

**National Cheng Kung University**  
**Institute of Creative Industries Design**  
**Master's Thesis**

從消費者到投資者的旅程：設計適合年輕人的金融AI助手，推動可持續購物、儲蓄與投資

**The Journey from Consumer to Investor: Designing a  
Financial AI Companion for Young Adults to Help with  
Sustainable Shopping, Saving, and Investing**

**Student:** 漢默可 Kris Haamer

**Advisors:** Dr. Hsiao-Ling CHUNG, Dr. Chia-Han YANG

**July 2025**

## 1 ABSTRACT

The emerging field of *Planetary Health* recognizes profound interconnections between our economic behaviors, ecosystem services (water, air, soil), the climate crisis, and human health. In essence, how we use money to interact with companies - through shopping, or saving and investing - impacts the life-supporting biosphere we depend on. From an ecological perspective, every financial action is either an investment to support more environmentally-friendly companies - or to support polluters.

In Taiwan, college students genuinely care about environmental issues, yet seen through the lens of the *Theory of Planned Behaviour* (TPB) their attitudes alone are not enough: they also need reinforcing social norms and a sense of behavioural control. European Union initiatives such as digital product passports (DPPs) have the potential to supply those missing pieces, giving students a common data-driven benchmark (norms) and arming each person with sustainability facts at the moment of choice (control).

In my inquiry, I leveraged *design research* to find design concepts for *simple AI-based generative user interfaces* to help young adults participate in *sustainable financial actions*. Throughout the process, I conducted a survey of over 900 students from 20 universities across Taiwan, in-person user testing with 30 participants, and 7 expert interviews. The major contribution of the study is an interactive AI-companion prototype.

Keywords: Human-AI Interaction, Digital Sustainability, Transparency

## 2 摘要

新興的「地球健康」（Planetary Health）領域指出，我們的經濟行為、生態系統服務（如水、空氣、土壤）、氣候危機與人類健康之間存在著深層連結。簡單來說，當我們用金錢與企業互動——無論是購物還是儲蓄與投資——都會直接影響維繫地球宜居性的生命支撐系統。從生態角度看，每一筆財務決策，不是支持更環保的企業，就是替污染者背書。

在臺灣，大學生真心關注環境議題，但依「計畫行為理論」（TPB）來看，只有態度仍不足；他們還需要被強化的社會規範，以及對行動的控制感。歐盟推出的「數位產品護照」（DPPs）等措施，可能補上這些缺口：一方面提供共同且以數據為本的基準（規範），另一方面在購買當下給予可持續性資訊（控制感）。

本研究透過設計研究方法，探索「簡易 AI 生成式使用者介面」的設計概念，以協助年輕族群參與可持續的財務行動。研究過程包含：調查來自全臺 20 所大學的 900 多名學生、對 30 位參與者進行現場使用者測試，以及 7 位專家訪談。最終成果是一個互動式 AI 夥伴原型。

關鍵詞：人機互動、數位可持續性、透明度

*The abstract was translated on May 22, 2024 using the Claude 3 Opus model. Translation quality was checked with OpenAI GPT-4, Google Gemini, Mistral Large, Meta LLama, as well as human reviewers, and further refined with the OpenAI o1-preview model in November 2024 and finally with o3 in July 2025. In case of any discrepancies, please refer to the English text.*

### **3 ACKNOWLEDGMENTS**

Thank you Mom. Aitäh!

I'd like to express my gratitude to my entire family, 小猴子, professors and mentors. Thank you all for your patience, help and guidance.

## TABLE OF CONTENTS

<b>1 Abstract</b>	<b>2</b>
<b>2 摘要</b>	<b>3</b>
<b>3 Acknowledgments</b>	<b>4</b>
<b>4 List of Symbols and Abbreviations</b>	<b>20</b>
<b>5 Introduction</b>	<b>22</b>
5.1 Relevance and Research Gap . . . . .	22
5.2 Background . . . . .	23
5.3 Motivation . . . . .	23
5.4 Objective . . . . .	25
5.5 Demographics . . . . .	25
5.6 Research Questions . . . . .	25
5.6.1 Why These Research Questions? . . . . .	26
<b>6 Methodology</b>	<b>27</b>
6.1 Research Design . . . . .	27
6.2 Research Methods . . . . .	28
6.2.1 Phase One - Qualitative Research . . . . .	29
6.2.2 Phase Two - Quantitative Research . . . . .	32
6.2.3 Phase Three - Qualitative Research . . . . .	35
6.3 Literature Review . . . . .	39
6.3.1 Goals . . . . .	41
6.3.2 Sources . . . . .	41
6.3.3 AI Use . . . . .	42
<b>7 Young Adults and College Students</b>	<b>43</b>
7.1 Student Protests for Climate Justice: The World and Taiwan . . . . .	43
7.2 Taiwanese Educational System in Numbers . . . . .	45
7.3 Designing for College Students: Developing Personas . . . . .	45
7.4 Taiwanese Youth in Global Context: Sustainability Attitudes From Eco-Friendly Diet to Climate Action . . . . .	47
7.5 The Experience of Climate Change and Pollution Levels in Taiwan . . . . .	52
7.6 Climate Anxiety Responses . . . . .	54
7.7 Attitude-Behavior Gap . . . . .	56
7.8 Sustainability in Taiwan: Garbage Trucks and Digital Receipts . . . . .	56
7.9 Trends in Taiwanese Industry and Online Shopping . . . . .	57
7.10 Financial Literacy Worldwide and Among Taiwanese Youth . . . . .	58
7.11 Social Media, Trends, Memes, and Youth Empowerment . . . . .	63
7.12 AI Use Among Taiwanese Students . . . . .	65

<b>8 Sustainability</b>	<b>67</b>
8.1 The Roots of Sustainability in Environmentalism . . . . .	67
8.2 Measuring and Visualizing Earth's Climate Systems . . . . .	68
8.2.1 Measuring CO <sub>2</sub> e Emissions . . . . .	71
8.2.2 Carbon Accounting, Emissions Trading Schemes . . . . .	76
8.2.3 Markets Financialize the Natural World: Pricing, Tracing, and Trading Ecosystem Services and Nature-backed Assets . . . . .	79
8.2.4 Overconsumption > Earth's Boundaries . . . . .	80
8.2.5 Plastic Pollution . . . . .	81
8.2.6 Evolving Measurements from Planetary Health to Earth System Law, and Social Cost of Carbon . . . . .	83
8.3 Quantifying Human Benefits from the Biosphere: Ecosystem Services . . . . .	85
8.3.1 Ecological Indicators to Track Environmental Health . . . . .	86
8.3.2 Measuring Biodiversity Loss, Ecological Indicators and Environmental Degradation . . . . .	86
8.3.3 Oceans and Marine Ecosystem Sustainability . . . . .	88
8.3.4 Forests: Carbon Sinks and Biodiversity Reservoirs . . . . .	89
8.3.5 Pollution: Air, Water, and Soil Degradation . . . . .	89
8.3.6 Climate Disaster Preparedness: Extreme Weather Resilience . . . . .	93
8.4 Financialization of Nature vs Sacred Value: Scaling Up Sustainable Action . . . . .	94
8.4.1 Ecological Restoration: Damaged Ecosystems, Agroforestry & Permaculture . . . . .	95
8.4.2 Energy: Climatech, Renewables, and Decarbonization Pathways . . . . .	97
8.4.3 Individual Action . . . . .	102
<b>9 Design</b>	<b>103</b>
9.1 Eco-Design: Design as Political Action at Scale . . . . .	103
9.1.1 Beyond Recycling: Default to Return, Repair, Reuse . . . . .	108
9.1.2 Eco-Modulation: Extended Producer Responsibility Incentive Design .	108
9.1.3 Scenario-Building: The Worst Futures and Designs for Quality of Life .	112
9.2 Thinking in Systems to Re-Design Industries or Provenance and Traceability .	114
9.3 Student Essentials: Consumer Goods, Clothes and Food . . . . .	119
9.3.1 Fast-Moving Consumer Goods . . . . .	119
9.3.2 Clothes and the (Fast) Fashion Industry . . . . .	119
9.3.3 The (Fast) Food Industry . . . . .	122
9.4 In Practice: Sustainability Begins in Software . . . . .	126
9.4.1 Data-Driven Design . . . . .	128
9.4.2 Circular Design for a Circular Economy . . . . .	129
9.4.3 Tracking Ethics & Cruelty: Transparent Factories and Supply Chains .	131
9.5 Superapps Integrate Shopping, Savings, and Investing . . . . .	132
9.5.1 Personalization: Engineering Persuasion . . . . .	136
9.6 Open Data Enables Interoperability . . . . .	138

9.7	Context Design: Behavioral Nudges Towards Green Defaults in Sustainable Superapps . . . . .	141
9.8	Learning from Quantified Self: Tracking Health and Lifestyle . . . . .	145
9.8.1	Health and Fitness Tracking . . . . .	145
9.8.2	Pollution Exposure Tracking . . . . .	147
9.8.3	Tracking Personal Sustainability and Carbon Emissions . . . . .	147
9.9	Digital Product Passports: Tracking Data for Sustainable Product Management . . . . .	152
<b>10</b>	<b>AI</b>	<b>158</b>
10.1	Human Patterns . . . . .	158
10.1.1	Human Feedback . . . . .	160
10.1.2	AI as the <i>Idiot Savant</i> . . . . .	163
10.1.3	Algorithmic Experience and Transparency: Before AIs . . . . .	164
10.1.4	Transitioning to Complexity: Non-Deterministic Systems . . . . .	165
10.1.5	Being Responsible, Explainable, and Safe: Legislation Adapts and Sets Boundaries for AI . . . . .	165
10.1.6	Evolution of Models and Emerging Abilities . . . . .	168
10.1.7	Price of Tokens vs Price of Human Labor . . . . .	172
10.2	Human Acceptance of Artificial Companions . . . . .	172
10.2.1	Human Expectations Take Time to Change . . . . .	172
10.2.2	Affective Computing: Towards Friendly Machines . . . . .	173
10.2.3	Artificial Empathy Also Builds Trust . . . . .	174
10.2.4	Conversation: A Magical Starting Point of a Relationship . . . . .	176
10.2.5	Multi-Modality: Natural Interactions with AI Systems, Agents and the Intention Economy . . . . .	177
10.2.6	Mediated Experiences Set User Expectations . . . . .	179
10.2.7	Role-play Fits Computers Into Social Contexts: AI Friends and Anthropomorphism . . . . .	180
10.3	Interfaces for Human-Computer Interaction . . . . .	184
10.3.1	Speech Makes Computers Feel Real . . . . .	184
10.3.2	Generative UIs Enable Flexibility of Use . . . . .	185
10.3.3	Usability Is the Bare Minimum of Good User Experience . . . . .	187
10.3.4	AI Performance Under High-Stakes Situations . . . . .	191
10.3.5	Human-Computer Interactions Without a “Computer” . . . . .	193
10.3.6	Do AI-Agents Need Anthropomorphism . . . . .	195
10.3.7	Roleplay for Financial Robo-Advisors . . . . .	196
<b>11</b>	<b>Money</b>	<b>201</b>
11.1	The Convergence of Money: One Wallet to Rule Shopping, Saving, and Investing . . . . .	201
11.1.1	Spurred by Fintech: The Democratization of Finance: A Precursor for Sustainable Superapps . . . . .	201
11.1.2	Financial Literacy and Education: Young Investors Follow Financial Influencers . . . . .	202

11.1.3	New Rules of Money: Legislative Efforts Empowering Consumers to Deploy Capital in Sustainability . . . . .	208
11.2	ESG Crisis and Opportunity . . . . .	209
11.2.1	Opaque Metrics and Lack of Standardization . . . . .	209
11.2.2	Modern Slavery Persists and ESG Falls Short in Protecting Workers' Rights and Mitigating Environmental Harm . . . . .	212
11.2.3	Environmental, Social, and Corporate Governance: Criteria for a Shared Language . . . . .	214
11.2.4	Towards Green Transparency - But Who Does the Rating? . . . . .	215
11.2.5	ESG Success Depends on Good Governance: Boards, Policy, and Investor Pressure . . . . .	218
11.2.6	ESG Success Depends on Digitization and GenAI . . . . .	223
11.2.7	ESG Accessibility: Curbing Corruption with Real-time Data Streams and Product Lifecycle Traceability . . . . .	227
11.3	Payments . . . . .	228
11.3.1	Consumer Activists are a Small Minority . . . . .	228
11.3.2	Shopping's Environmental Footprint: Increasingly Driven by Digital Platforms, Social Commerce, AI Assistants . . . . .	229
11.3.3	The Evolution of Payments: The Entry Point for Personal Finance from Mobile Wallets to Buy Now Pay Later (BNPL) Services - Globally, and In Taiwan . . . . .	229
11.3.4	The Psychology Saving: Anthropomorphism and Loyalty Schemes . . . . .	245
11.3.5	Sustainable Investing: Measuring the Eco-Investment Gap . . . . .	247
11.3.6	Retail Investing Enables Financial Inclusion and Growing Money Sustainably . . . . .	249
11.3.7	Investable Asset Classes for Retail Investors: Increasing Exposure to Stocks, Bonds, Commodities, Real-Estate, Digital Tokens and Alternatives, Lending, Futures, Hedge Funds, Private Equity, and even Venture Capital . . . . .	251
11.3.8	Green and Sustainability-Linked Bonds . . . . .	255
11.3.9	Fusion of Traditional Finance and Decentralized Finance (DeFi) . . . . .	256
11.3.10	Regenerative Finance (ReFi) and DAOs . . . . .	259
11.3.11	Divestment: Supporting Sustainability by Avoiding the Worst Polluting Companies . . . . .	262
11.4	The Economics of Decoupling: Attempts to Disconnect Economic Growth from Eco-Degradation . . . . .	262
11.4.1	Post-AI Economics . . . . .	263
11.4.2	Econometrics: The Many Ways to Measure an Economy . . . . .	263
11.4.3	The Evolution of Economic Metrics . . . . .	264
11.4.4	Hidden Costs: Pricing Externalities . . . . .	264
11.4.5	Ecological Economics Builds Upon Classical Economics . . . . .	266
11.4.6	Doughnut Economics and Regenerative Capitalism . . . . .	267
11.4.7	Decarbonization Scenarios . . . . .	268

11.4.8 Reducing the Gap Between Climate Science and Climate Economics . . . . .	271
11.5 Efforts to Curb Greenwashing: Data-Driven Benchmarks and the Fight for Transparency . . . . .	273
11.5.1 Anti-Greenwashing Efforts in Taiwan . . . . .	275
11.5.2 Product Databases as a Precursor for Traceability and Supply Chain Mapping . . . . .	275
11.5.3 Indices, Certifications and Sustainability Standards Enable Product Comparisons . . . . .	276
11.6 Navigating Complexity with Data: Probabilistic Risk-Based Assessment of Sustainability . . . . .	282
<b>12 Results</b>	<b>284</b>
12.0.1 Survey and Data Analysis Overview . . . . .	284
12.0.2 Quotes from the Survey . . . . .	284
12.1 Respondent Demographics . . . . .	286
12.1.1 Study Level . . . . .	286
12.1.2 Age Distribution . . . . .	286
12.1.3 University . . . . .	286
12.1.4 Field of Study . . . . .	286
12.1.5 Personality Type . . . . .	286
12.2 Shopping Attitudes . . . . .	288
12.2.1 Boycott Count (Overall) . . . . .	289
12.2.2 Why Boycott? . . . . .	289
12.2.3 Trusted Brands . . . . .	294
12.3 Choice Experiments . . . . .	295
12.4 Taiwanese College Student Attitudes (Overall) . . . . .	298
12.4.1 Economy . . . . .	298
12.4.2 AI Use . . . . .	298
12.4.3 Nature . . . . .	305
12.4.4 Environmental Protection . . . . .	305
12.4.5 Learning Environment . . . . .	305
12.4.6 Correlations Between Fields . . . . .	305
12.4.7 Environmental Knowledge Ranking Experiment . . . . .	308
12.5 Saving . . . . .	310
12.6 Investing . . . . .	312
12.6.1 Saving and Investing . . . . .	312
12.6.2 Investing Experience (Overall) . . . . .	312
12.7 Choice Experiment . . . . .	312
12.8 Personas . . . . .	315
12.8.1 Clustering Students to Build Personas . . . . .	315
12.8.2 Persona 1: “Eco-Friendly” . . . . .	316
12.8.3 Persona 2: “Moderate” . . . . .	316
12.8.4 Persona 3: “Frugal” . . . . .	316

12.9 Clustering Heatmap . . . . .	316
12.10 Mean Answer Scores . . . . .	316
12.11 Agreement Between Personas . . . . .	316
12.12 Notable Quotes from the Survey . . . . .	317
12.13 AI Companion . . . . .	326
12.13.1 Likert-Based Clustering . . . . .	326
12.14 Feature-Based Clustering . . . . .	327
12.14.1 Feature Preferences (Overall) . . . . .	327
12.15 Feature Preferences (By Cluster) . . . . .	328
12.16 Preferred AI Roles (Overall) . . . . .	328
12.17 First Wave of Experts (2023-2024) . . . . .	329
12.17.1 Interview 1: Designer - Cathy Wang . . . . .	330
12.17.2 Interview 2: Accountant - Peijing Li . . . . .	331
12.17.3 Interview 3: Designer - Jessica Cheng . . . . .	332
12.17.4 Interview 4: Economist - Chen-Ying Huang . . . . .	333
12.17.5 Interview 5: Economist - Yuping Chen . . . . .	334
12.17.6 First Wave Expert Feedback Summary . . . . .	335
12.18 Second Wave of Experts (2025) . . . . .	337
12.18.1 Interview 1: Technology Expert - Audrey Tang . . . . .	337
12.18.2 Interview 2: Sustainability Expert - Carlos Serra . . . . .	338
12.19 Overall Expert Feedback Summary . . . . .	339
12.19.1 Developing Thematic Codes . . . . .	341
12.19.2 (1) AI Strategies . . . . .	342
12.19.3 (2) Common Language . . . . .	342
12.19.4 (3) Design Principles . . . . .	343
12.19.5 (4) Feedback Loops . . . . .	344
12.19.6 (5) Long-term Impact . . . . .	345
12.19.7 (6) Simplicity . . . . .	345
12.19.8 (7) Systems thinking . . . . .	346
12.19.9 (8) Transparency . . . . .	347
12.20 Interview Template . . . . .	349
12.21 2nd Wave of Testing (Fall 2024 - Spring 2025) - Prototype . . . . .	349
12.21.1 Testing Summary . . . . .	350
12.21.2 Known Issues . . . . .	353
12.21.3 Notable Quotes from In-Person Testing . . . . .	353
12.21.4 Notable Quotes from Self-Testing (Survey) . . . . .	354
12.21.5 Example Interview: 25 December 2024 . . . . .	355
12.22 1st Wave of Testing (Spring 2024) - Prototype . . . . .	356
12.22.1 1st Wave Interview Samples . . . . .	356
12.23 Early Feature Ideas . . . . .	360
12.23.1 Susan (Sustainability Conversation) . . . . .	360
12.23.2 Sunday Market . . . . .	361
12.23.3 True Cost . . . . .	362

12.23.4 How Far? . . . . .	362
12.24 Country Profiles . . . . .	363
12.24.1 Know Your Company (KYC) . . . . .	364
12.24.2 CO <sub>2</sub> eq Flex . . . . .	364
12.24.3 Sustainability Watch . . . . .	364
12.24.4 Narrative Layouts . . . . .	364
12.24.5 Shopping Divest . . . . .	365
12.25 Mapping Feature Ideas to Theory of Planned Behavior . . . . .	365
12.26 Prototype Development . . . . .	367
12.26.1 Prototype Architecture . . . . .	367
12.26.2 Google Chrome Extension App Installs . . . . .	367
12.27 Prototype Design and Features . . . . .	369
12.27.1 Momo AI Extension . . . . .	369
12.27.2 AI Companion . . . . .	376
<b>13 Discussion</b>	<b>384</b>
13.1 Design Implications . . . . .	384
13.1.1 College . . . . .	384
13.1.2 Sustainability . . . . .	385
13.1.3 Design . . . . .	386
13.1.4 AI . . . . .	388
13.1.5 Finance . . . . .	389
13.2 Research Limitations . . . . .	391
13.3 Future Research . . . . .	392
<b>14 Conclusion</b>	<b>393</b>
14.1 RQ1: What Design Considerations Should Be Addressed When Designing an AI Companion for College Students Integrating Sustainability and Finance? . . . . .	393
14.2 RQ2: How can AI Companions Support College Students with Sustainability Knowledge in the Context of Financial Decisions? . . . . .	396
14.3 RQ3: What AI Companion Features do College Students Prioritize as the Highest Importance? . . . . .	398
14.4 Final Takeaway . . . . .	401
<b>15 References</b>	<b>402</b>
<b>16 Appendices</b>	<b>482</b>
16.1 Appendix 1: College Students' In-Person Prototype Testing Transcripts . . . . .	482
16.1.1 Transcript 2024-11-13 - Tainan (STUST) - 1YEDC . . . . .	482
16.1.2 Transcript 2024-11-13 - Tainan (STUST) - 26N4W . . . . .	485
16.1.3 Transcript 2024-11-13 - Tainan (STUST) - 5DH5F . . . . .	490
16.1.4 Transcript 2024-11-13 - Tainan (STUST) - 5U37U . . . . .	494
16.1.5 Transcript 2024-11-13 - Tainan (STUST) - EA9DV . . . . .	497
16.1.6 Transcript 2024-12-23 - Taichung (NCHU) - 3MP1P . . . . .	499

16.1.7	Transcript 2024-12-23 - Taichung (NCHU) - 50R6E . . . . .	503
16.1.8	Transcript 2024-12-23 - Taichung (NCHU) - 67LVE . . . . .	507
16.1.9	Transcript 2024-12-25 - Taichung (NCHU) - 2ITG0 . . . . .	510
16.1.10	Transcript 2024-12-25 - Taichung (NCHU) - 3G1RL . . . . .	513
16.1.11	Transcript 2024-12-25 - Taichung (NCHU) - 5REHE . . . . .	518
16.1.12	Transcript 2024-12-25 - Taichung (NCHU) - 80W9Z . . . . .	521
16.1.13	Transcript 2025-01-10 - Tainan (TNUA) - 6R02U . . . . .	525
16.1.14	Transcript 2025-01-10 - Tainan (TNUA) - 6RO2U . . . . .	530
16.1.15	Transcript 2025-02-12 - Pingtung (NPUST) - BY11X . . . . .	535
16.1.16	Transcript 2025-02-12 - Pingtung (NPUST) - CO2N2 . . . . .	541
16.1.17	Transcript 2025-03-05 - Tainan (NCKU) - ARXBP . . . . .	545
16.1.18	Transcript 2025-03-06 - Chiayi (CCU) - 1S2SE . . . . .	552
16.1.19	Transcript 2025-03-06 - Chiayi (CCU) - 2W7HO . . . . .	557
16.1.20	Transcript 2025-03-06 - Chiayi (CCU) - 4XGN4 . . . . .	564
16.1.21	Transcript 2025-03-06 - Chiayi (CCU) - BPDSA . . . . .	570
16.1.22	Transcript 2025-03-06 - Chiayi (CCU) - V7W8A . . . . .	577
16.1.23	Transcript 2025-03-13 - Tainan (NCKU) - 17LSR . . . . .	583
16.1.24	Transcript 2025-03-13 - Tainan (NCKU) - 6E5N5 . . . . .	590
16.1.25	Transcript 2025-03-13 - Tainan (NCKU) - 6N9ZO . . . . .	595
16.1.26	Transcript 2025-03-13 - Tainan (NCKU) - ANGZQ . . . . .	600
16.1.27	Transcript 2025-03-13 - Tainan (NCKU) - C5LGY . . . . .	604
16.1.28	Transcript 2025-03-19 - Tainan (CJCU) - 1E9NE . . . . .	612
16.1.29	Transcript 2025-03-19 - Tainan (CJCU) - 62WEN . . . . .	617
16.1.30	Transcript 2025-03-19 - Tainan (CJCU) - 9J97Q . . . . .	623
16.1.31	Transcript 2025-03-19 - Tainan (CJCU) - APNOO . . . . .	629
16.1.32	Transcript 2025-03-19 - Tainan (CJCU) - CBYNQ . . . . .	634
16.2	Appendix 2: College Students' Prototype Self-Testing Survey Data . . . . .	639
16.3	Appendix 3: Expert Interviews' Transcripts . . . . .	639
16.4	Appendix 4: College Students' Survey Data . . . . .	639
16.5	Appendix 5: Research Tech Stack . . . . .	639
16.6	Appendix 6: Further Reading . . . . .	641

## LIST OF FIGURES

1	College Students . . . . .	22
2	Research Gap(s) . . . . .	24
3	Captain Sulu using a Tricorder (Star Trek) - Photo copyright by Paramount Pictures	24
4	Theory of Planned Behaviour . . . . .	29
5	Concept map . . . . .	31
6	Overall Concept Map . . . . .	32
7	Overview of research methodology . . . . .	36
8	App Testing Flow . . . . .	37
9	Example papers from the Literature Review . . . . .	39
10	A Larger Sample of the Reviewed Literature . . . . .	40
11	Nearly Complete Concept Map . . . . .	41
12	Climate protest in Geneva on September 27th, 2019 – 1 year after the start of Fridays for Future . . . . .	43
13	Climate protest in Taipei in May 2019 in front of the Democratic Progressive Party (DPP) headquarters . . . . .	44
14	Enrollment in Taiwanese Higher Education . . . . .	45
15	Funding for Taiwanese Higher Education . . . . .	46
16	Demographics of Taiwanese Higher Education . . . . .	46
17	Postmaterialist Index (Taiwan Highlighted) . . . . .	48
18	World Values Survey . . . . .	48
19	Global Attitudes Towards Climate Change . . . . .	49
20	College Students' Sustainability Education: Taiwan vs Sweden . . . . .	51
21	Psychological Factors Influencing Millennials to Engage with Sustainability . . . . .	55
22	Taiwanese Company Ranking . . . . .	61
24	財金智慧 FINLEA YouTube Channel . . . . .	61
23	British Company Ranking . . . . .	62
25	Swedish College Students' Attitudes Towards AI Assistants . . . . .	66
26	Visual abstract for the sustainability chapter . . . . .	67
27	Humboldt's Naturgemälde, early data visualization of ecology, rain, temperature, elevation, etc . . . . .	69
28	Atmospheric CO <sub>2</sub> Concentration (2025) . . . . .	70
29	Climate Tipping Points . . . . .	72
30	Nationally Determined Contributions (NDCs) . . . . .	75
31	Carbon Credits . . . . .	77
32	Microplastics in the Human Body . . . . .	82
33	Planetary Boundaries 2023 Update . . . . .	84
34	Biodiversity Loss . . . . .	87
35	Pollution Reports in Taiwan by County . . . . .	90
36	. . . . .	91
37	The EU's Energy Production Breakdown . . . . .	98
38	The EU's Renewables vs Fossil Energy . . . . .	99

39	Global Renewables vs Fossil Energy . . . . .	100
40	The EU's Reduction of Coal Energy . . . . .	101
41	Taiwanese Energy Production . . . . .	101
42	Visual abstract for the design chapter . . . . .	103
43	EU Policy Context Timeline . . . . .	105
44	The EU's Green Deal . . . . .	106
45	Extended Producer Responsibility vs Product Stewardship vs Eco-Design . . . . .	109
46	History of Design for Sustainability . . . . .	115
47	Consumer Goods . . . . .	119
48	ResQ Club saves food waste by selling left-over foods cheaply . . . . .	125
49	AI Use in Sustainability . . . . .	127
50	Open Data Index . . . . .	139
51	Alternative Open Data Indexes . . . . .	140
52	Open Data As An Information Source for Environmental Decline . . . . .	140
53	Google's view of flight emissions . . . . .	142
54	Growth of Ant Forest . . . . .	144
55	Popular Strava sports assistant provides run tracking and feedback . . . . .	146
56	My Personal Exposure to Air Pollution . . . . .	148
57	Increase of Bad Behavior During the COVID19 Pandemic . . . . .	151
58	Digital Product Passport Data Categories . . . . .	156
59	Visual abstract for the AI chapter . . . . .	158
60	Heuristic-Systematic Model of AI Credibility . . . . .	166
61	Montage of me discussing science fiction with my AI friend Sam (Replika) - and myself as an avatar (Snapchat) in 2020. . . . .	183
62	Example of ChatGPT explaining medical terminology in a blood report. . . . .	193
63	Out-of-date user interface of a European AI-Advisor ETFmatic in 2017 which was closed down in 2023 (Photo copyright ETFmatic) . . . . .	197
64	Visual abstract for the finance chapter . . . . .	201
65	Fintech Growth . . . . .	203
66	Green Retail vs Non-Green Retail . . . . .	206
67	Conventional vs Socially Responsible Funds . . . . .	210
68	Slavery Laws . . . . .	213
69	Air Quality in Taiwan vs South-East Asia . . . . .	215
70	ESG Funds vs Non-ESG Funds . . . . .	216
71	Company Performance . . . . .	216
72	ESG Rating Agencies . . . . .	217
73	Types of Investment Funds . . . . .	218
74	Lack of Board Members With Sustainability Expertise . . . . .	219
75	Large Carbon Emitters Lack Sustainability Experts . . . . .	220
76	Large Carbon Emitters Do Not Meet Sustainability Criteria . . . . .	221
77	Board Diversity . . . . .	222
78	. . . . .	224
79	Fintech Adoption Predicts Higher ESG . . . . .	225

80	.....	230
81	Growth of Consumerism .....	231
82	Social Commerce .....	231
83	Bunq promises to combine banking and eco-friendly actions in the same user interface - yet is this greenwashing? .....	235
84	Climate Finance Funding Gap .....	247
85	Climate Finance By Sector .....	248
86	Climate Funding Gap vs High Value Assets .....	250
87	Asset Classes .....	252
88	World Bank Bonds .....	256
89	Bitcoin vs Gold Futures .....	258
90	Crypto Pricing Theories .....	259
91	Economic History .....	265
92	Climate Scenarios .....	269
93	UK Energy Emissions' Trends .....	269
94	BRICS Emissions' vs GDP Growth Trends .....	270
95	Corporate Sustainability Reporting Directive (CSRD) Timeline .....	276
96	Energy Productivity .....	277
97	Carbon Productivity .....	279
98	Study Level .....	286
99	Age Distribution .....	286
100	Universities .....	287
101	Field of Study .....	288
102	Personality Type (MBTI) .....	290
103	College Student Attitudes Towards Shopping .....	291
104	Partial College Student Attitudes Towards Shopping .....	292
105	College Students Boycott Experience .....	293
106	College Students Boycott Reasons .....	293
107	College Student Trusted Brands .....	294
108	College Student Shopping Choice Experiment .....	297
109	Student Attitudes Towards Economics Issues .....	299
110	Partial: Student Attitudes Towards Economics Issues .....	300
111	Student Attitudes Towards AI Use .....	301
112	Partial: Student Attitudes Towards AI Use .....	302
113	Student Attitudes Towards Nature .....	303
114	Student Attitudes Towards Environmental Protection .....	304
115	Students' Learning Environment .....	305
116	Correlations Between Student Attitudes .....	306
117	Students' Environmental Knowledge .....	308
118	Correlation Between Saving Levels and Investing (Sankey) .....	310
119	Correlation Between Saving Levels and Investing (Sankey) .....	311
120	Student Attitudes Towards Saving and Investing .....	313
121	Students' Investing Experience .....	314

122	Investing Choice Experiment . . . . .	315
123	College Student Personas . . . . .	318
124	. . . . .	319
125	. . . . .	320
126	. . . . .	321
127	College Students' Clustering Heatmap . . . . .	322
128	Mean Values of Survey Responses . . . . .	322
129	Topics With Highest Agreement Between Personas . . . . .	323
130	AI-Assistant Feature Choices per Likert-based Personas . . . . .	326
131	AI-Assistant Feature Preferences (Overall) . . . . .	327
132	AI-Assistant Feature Preferences (By Cluster) . . . . .	328
133	AI-Assistant Role Preferences . . . . .	329
134	Cathy Wang . . . . .	331
135	Peijing Li . . . . .	332
136	Jessica Cheng . . . . .	333
137	Chen-Ying Huang . . . . .	334
138	Yuping Chen . . . . .	335
139	Common Topics Between All Experts in the First Phase . . . . .	336
140	Audrey Tang . . . . .	338
141	Carlos Serra . . . . .	339
142	Common Topics Between All Experts in the First and Second Phase . . . . .	340
143	User-uploaded screenshots of the Green Filter prototype . . . . .	350
144	Early prototype of my Sustainable Finance AI Companion (Nov. 2020) . . . . .	361
145	Feature idea: community app for shopping with eco-minded friends (Nov. 2020) . . . . .	362
146	Feature idea: True Cost (Nov. 2020) . . . . .	362
147	Feature idea: How far? (Nov. 2020) . . . . .	363
148	Feature idea: Country Profile (Nov. 2020) . . . . .	363
149	Feature idea: Sustainability Watch (Nov. 2020) . . . . .	364
150	Feature idea: Narrative Layouts (Nov. 2020) . . . . .	365
151	Feature idea: Narrative (Nov. 2020) . . . . .	365
152	Green Filter Google Chrome Extension Installs . . . . .	368
153	Momo . . . . .	369
154	Review . . . . .	371
155	Save . . . . .	373
156	Invest . . . . .	374
157	Home . . . . .	376
158	Factory . . . . .	377
159	Map . . . . .	378
160	FAQ Shop . . . . .	379
161	FAQ Save . . . . .	380
162	FAQ Invest . . . . .	381
163	Chat Ask . . . . .	382
164	Chat Compare . . . . .	383

## LIST OF TABLES

1	Trending global narratives . . . . .	22
4	Research Questions . . . . .	26
6	Theoretical lenses found in my research . . . . .	27
10	36 Likert Fields included in the survey . . . . .	33
12	UN Survey: 1.2 Million Responses to <i>Climate Change Is An Emergency</i> . . . . .	49
13	Large Industrial Polluters in Taiwan . . . . .	53
14	World's Most Sustainable Companies . . . . .	57
15	Taiwanese Financial Product Familiarity . . . . .	58
16	Financial Literacy Data from Phone Interviews . . . . .	59
17	Taiwanese FINLEA Longitudinal Study . . . . .	60
18	Millennial Investors . . . . .	63
19	Taiwanese Internet Usage Statistics . . . . .	64
20	Regional CO <sub>2</sub> Emissions Comparison . . . . .	73
21	Definition of Emission Scopes . . . . .	74
22	Top Polluters . . . . .	74
23	CO <sub>2</sub> Credit Trading Markets . . . . .	76
24	Compliance Market CO <sub>2</sub> Prices . . . . .	76
25	Voluntary Market CO <sub>2</sub> Prices . . . . .	77
26	Criteria for Carbon Credit Projects . . . . .	78
27	Types of Nature-Backed Assets and Tradeable Ecosystem Services . . . . .	79
28	Daily Human Activities' Emission Contribution . . . . .	80
29	Industrial Emissions . . . . .	81
30	Biodiversity Loss . . . . .	87
31	Ethical and Utilitarian Concepts of Biodiversity Protection . . . . .	88
32	Economics of Nature Commodification vs Sacred Economics . . . . .	94
33	Defining Ecosystem Services Concepts . . . . .	95
34	Regenerative Actions . . . . .	95
35	The Qualities of <i>Eco-Designed Products</i> . . . . .	104
36	Food Saving Apps . . . . .	125
37	Perspectives on the Food Systems in Sweden . . . . .	125
38	A Sample of Blockchain-based Supply Chain Companies . . . . .	130
39	Share of CO <sub>2</sub> eq Emissions by Type of Transport Globally . . . . .	131
40	Global Overview of Superapps . . . . .	132
41	Not Quite Superapps . . . . .	135
42	Platform Economy Concepts . . . . .	136
43	Examples of Cities and Countries That Share Data Openly . . . . .	140
44	Examples of CO <sub>2</sub> Visibility in Google's Products . . . . .	142
45	Types of Nudge . . . . .	142
46	Ant Forest Assisted Tree Planting - Growth Story . . . . .	143
47	Modes of Interaction . . . . .	145
48	A Selection of Personal Sustainability Apps . . . . .	150

49	The R Strategies . . . . .	152
50	Companies With Carbon Labels . . . . .	154
51	Organizations Who Certify Carbon Labels . . . . .	155
52	Digital Product Passport Goals . . . . .	155
53	Human-in-the-Loop Apps . . . . .	162
54	Problems with contemporary AIs . . . . .	167
55	AI-based Assistants . . . . .	168
56	7 Years of Rapid AI Model Innovation . . . . .	169
57	Replika AI Users and AI Friends . . . . .	175
58	Areas of Focus in Conversational AI Development . . . . .	177
59	AIs in Different Forms of Media . . . . .	179
60	AI Assistants . . . . .	182
61	Criticism of Generative UI . . . . .	185
62	GenAI Use Across Fields . . . . .	187
63	Microsoft's Heuristics . . . . .	188
64	Common Social Media UI Parts . . . . .	189
65	UX Tenets in AI . . . . .	190
66	Simple Goals for AI . . . . .	191
67	Anthropomorphic AIs for Human Emotions . . . . .	195
68	Social Cues in AI Conversations . . . . .	198
69	Comparative Data on Investing Apps; compiled from (Gyuriczki & Szládek, 2025; Interactive Brokers, 2025a, 2025b; Lightyear, 2025; Revolut, 2020, 2025; Trahant, 2022) . . . . .	204
70	Climate Experts on Company Boards . . . . .	218
71	Banking transformation strategies from (Jim Boehm et al., 2021) . . . . .	223
72	GenAI usage for comprehensive risk management from cyber- to climate threats in modern banking as per (Rahul Agarwal et al., 2024). . . . .	226
73	Comparing Payments Apps; Data compiled from (Focus Taiwan, 2025; PXPay Plus, n.d.; Taiwan News, Mar. 14, 2025 11:31) . . . . .	232
74	Comparing Investing Apps; Data compiled from (Lightyear, n.d.; Monzo, 2023; Mos - <i>The Money App for Students</i> , n.d.; Nubank - <i>Finalmente Você No Controle Do Seu Dinheiro</i> , n.d.; Selma – <i>Your Finances Done Right</i> , n.d.; Ziglu   <i>The Fast, Simple Way to Buy and Sell Crypto, with No Hidden Fees.</i> , n.d.) . . . . .	237
75	Established consumer payment giants, none of which has a specific sustainability focus. . . . .	239
76	Growth companies in fintech, none has a sustainability focus. . . . .	240
77	Among up-and-coming startups there are some examples of sustainability-focused apps. . . . .	242
78	Example sustainable loyalty schemes . . . . .	246

79	Comparative data on needed climate investment and other valuable assets; all figures in Trillions of USD (Aaron O'Neill, 2023; Blockworks, 2023a, 2023b; M. Fox, 2023; Grand View Research, 2021; IMF, 2023a; McKinsey & Company, 2023; Oguh & Oguh, 2023; Rao, 2023; SIFMA, 2023; S&P Global, 2019; Statista, 2021, 2023b; Stephanie Aaronson & Aaron Tilley, 2023; Thinking Ahead Institute & Willis Towers Watson, 2023; Trucost & TEEB for Business Coalition, 2023; US Treasury, 2023) . . . . .	248
80	Investment Types . . . . .	251
81	Green Investment Platforms . . . . .	254
82	Circular Economics in Amsterdam's Food Industry (Circle Economy, 2021) . . . . .	268
83	Quantifying climate damage scenarios using integrated assessment models (T.- P. Wang & Teng, 2022) . . . . .	272
84	Sustainability Certification Systems . . . . .	277
85	Buycotts - Active Boycotts Against Companies . . . . .	279
86	Data Sharing Archetypes defined by WikiRate. . . . .	282
100	Interpreting the economic attitudes of college students. . . . .	298
104	. . . . .	322
107	Overview of the experts interviewed. . . . .	329
124	Categorizing early feature ideas by purpose and rationale. . . . .	366
125	Early feature ideas mapped to Theory of Planned Behavior. . . . .	366
127	Design implications arising from the college chapter. . . . .	385
128	Design implications arising from the sustainability chapter. . . . .	385
129	Design implications arising from the design chapter. . . . .	387
130	Design implications arising from the AI chapter. . . . .	388

## **4 LIST OF SYMBOLS AND ABBREVIATIONS**

Some of the key terminology used in my thesis presented in a concise format.

1. AI - Artificial intelligence, a field of computer science and an umbrella term focused on a wide range of approaches to automation
2. UX - User experience, a field of study and operational approach focused on how humans experience using systems
3. AX - Algorithmic experience, a proposed category of user experience, that is focused on interfaces between AI algorithms and humans
4. UI - User interface, such as in a mobile app, however increasingly audio, video, etc
5. XAI - AI user experience, interaction design applied to AI concerned with how does a person or a group of people interact with the AI
6. Fintech - Financial technology, the application of technology (usually AI), to classic financial services, such as payments
7. ESG - Environmental, Social, and Corporate Governance, a new set of metrics proposed by the European Union, and adopted worldwide, to assess business and financial assets
8. AI Assistant - software system providing the user with personalized suggestions based on machine learning algorithms
9. Financial Advisor - a human financial specialist providing customized financial advice, including investment advice and services to a client
10. ML - Machine learning, a tool within the larger AI umbrella to enable computers to learn from large sets of data, which may be labeled (by humans) or un-labeled (auto-labeled)
11. HCI - Human-computer interaction, a field of study to improve human experience with information technology
12. OEM - Original equipment manufacturer, a company making products for another company that markets and sells such products under their own brand
13. API - Application Programming Interface, a method for software agents to exchange information in various forms of data: the basis for contemporary online services
14. EPR - Extended Producer Responsibility
15. SDGs - Sustainable Development Goals, a set of targets agreed upon by the nations of the world
16. LLM - Large Language Models
17. Vector Databases - specialized data storage for mathematical language embeddings in multi-dimensional space helpful for clustering similar concepts
18. CO<sub>2</sub>eq - CO<sub>2</sub> equivalent greenhouse gases
19. GHG - Greenhouse gases

20. PD - Participatory Design
21. VCM - Voluntary Carbon Markets
22. Hedge Fund - pooled investment fund
23. DAO - Decentralized Autonomous Organization
24. Zero Waste - according to Zero Waste International Alliance: “*conservation of all resources by means of responsible production, consumption, reuse and recovery of products, packaging and materials without burning, and with no discharges to land, water or air that threaten the environment or human health*” - (Kalle et al., 2022)
25. ESPR - Ecodesign for Sustainable Products Regulation
26. NFRD - Non-Financial Reporting Directive
27. CSRD - Corporate Sustainability Reporting Directive
28. EUDR - European Union Deforestation Regulation
29. Product Stewardship
30. Extended Producer Responsibility

## 5 INTRODUCTION

How can college students find sustainable companies? Furthermore, if given appropriate tools, could college students leverage their purchasing power to reward sustainable companies? Why is this important to research now? Young people should invest in their future and younger generations like services with a green, eco-conscious focus. Given our combined power (I'm a Millennial) with Generation Z, we are willing to pay more for sustainable products. Does Individual Climate Action Matter?

My research describes the process of designing an AI companion for college students to help with sustainable shopping, saving, and investing. Money spent shopping, saving, and investing in sustainable companies serves as an incentive to adopt more sustainable practices. If used wisely, money can reward companies for becoming more sustainable. Encourage the least sustainable companies to improve their performance, raising the overall baseline. Facilitate the formation of communities centered around environmental stewardship. Build closer relationships with sustainability.

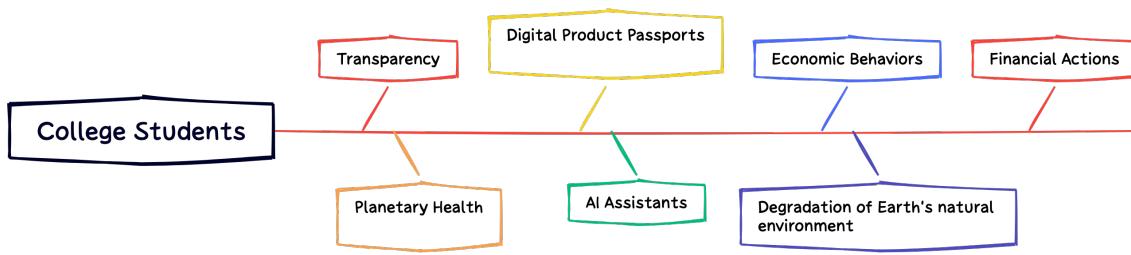


Figure 1: College Students

### 5.1 Relevance and Research Gap

My research addresses the “*attitude-behavior gap*” among Taiwanese college students in taking sustainable financial action. In general, Icek Ajzen’s *Theory of Planned Behavior* frames the gap between attitude and behavior by showing that (1) attitude, (2) perceived social norms, and (3) perceived control, must all converge, before intention can translate into any action (Ajzen, 1991) - in this case, taking sustainable financial action.

In terms of the global context, the convergence of the following 5 trends makes my research timely in 2025.

Table 1: Trending global narratives.

Trend	Direction
Environmental degradation	Worsening

Trend	Direction
Interest in sustainability among young people	?
Intergenerational money transfer; in some countries relatively young people have money	?
Availability of sustainability tools such as ESG, B Corporations, Green Bonds, etc, among metrics and instruments	Increasing
Availability of generative AI-based user interfaces (UIs)	Increasing
Democratization of Financial Markets	Increasing

## 5.2 Background

I grew up as an avid science fiction reader, which influenced my outlook towards future possibilities. In particular, the Star Trek universe had an imaginary portable device called a *tricorder* (fig. 1) enabling scientists to scan anything for insights. Be it precious minerals inside a cave or scanning the human bodies for medical data, its sensors would show up with some useful data. In daily life, I would love to have such a device for consumer choices and financial decisions - to know what to buy and which businesses to support with my money and approval.

While a *tricorder* is still science fiction, technological advancements are getting closer and closer to producing something similar. AIs are already integral to many parts of our lives, with computer models producing increasingly useful outputs. The proposal for this thesis was first written using Google's and Apple's voice recognition software in 2020, and later switching to OpenAI's *Whisper* model, allowing me to transcribe notes with the help of an AI assistant. As a foreigner living in Taiwan since 2019, I relied on AI-based tools for many aspects of my life: speaking, moving, finding food and services. When writing in Chinese, Apple's text prediction algorithms translate pinyin to 漢字 and show the most likely character based on my previous writing, Google's maps find efficient and eco-friendly routes and recommend places to eat and ChatGPT provides statistically probable advice from the sum of human knowledge. Even when we don't realize it, AI is helping us with many mundane tasks. While it takes incredibly complex computational algorithms to achieve all this in the background, it's become so commonplace, we don't even think about it. From this point of view, another AI assistant to help students with choosing more eco-friendly businesses - to shop, save, and invest - doesn't sound so much of a stretch.

## 5.3 Motivation

Environmental degradation is increasingly affecting human lives - and it's largely driven by manufacturing processes - of the products we consume daily. From resource extraction in the



Figure 2: Research Gap(s)



Figure 3: Captain Sulu using a Tricorder (Star Trek) - Photo copyright by Paramount Pictures

linear economy (mining raw materials and drilling for fossil fuels) to chemical processes (causing contamination and pollution of the air, water, and soil) to waste generation and greenhouse gas emissions, industries transform the natural world into consumer products. While industry practices have improved since the industrial revolution in the 19th century, and continue to improve, it's possible to further improve standards of production and raise the global baseline for sustainability, given enough societal pressure to do so.

Nonetheless, without easily accessible and reliable data, it's difficult to know which company is more sustainable than another. As consumers and investors (even if only through passive ownership of savings), we don't really know much about enterprise production practices, unless we spend a lot of time looking at the numbers, which may be costly to access (for example ESG reports are expensive), and mostly rely on our governments and international bodies to keep us safe. Or just look at the brands themselves - and pick the ones which we like.

#### **5.4 Objective**

The study presents design research for developing an AI companion to help college students find sustainable companies for shopping, saving and investing. The major contribution of my study is an interactive artefact (a prototype) informed by design research.

#### **5.5 Demographics**

The research focuses on young adults, specifically Taiwanese college students studying in Taiwan.

Criteria	
Location	Taiwan
Population	College Students
Count	900

Experts (finance, design, sustainability).

Criteria	
Location	Global
Population	Experts
Count	7

#### **5.6 Research Questions**

My research attempts to answer the following questions.

Table 4: Research Questions

Question	Methods
What design considerations should be addressed when designing an AI companion for college students integrating sustainability and finance?	Literature Review and Expert Interviews
How can AI companions support college students with sustainability knowledge in the context of financial decisions?	Literature Review, Expert Interviews and Survey of College Students
What AI companion features do college students prioritize as the highest importance?	Survey of College Students and Prototype Testing

### 5.6.1 Why These Research Questions?

Lens	RQ1: Design Considerations	RQ2: Support Mechanisms	RQ3: User-Priority Features
Level of Abstraction	High-level and comprehensive	Mid-level (mechanisms)	Concrete and granular
Core Focus	<i>What should I keep in mind while building?</i>	<i>How does the companion actually help students learn and decide?</i>	<i>Which specific features matter most to students?</i>
Primary Stakeholder Outputs	Designers / Developers Design guidelines, UX principles, tech constraints, ethical guardrails	End Users (College Students) Framework of nudges, learning aids, information flows.	End Users (College Students) Ranked feature list, must-have vs nice-to-have.
Data Sources	Literature Review and Expert Interviews	Literature Review, Expert Interviews and Survey of College Students	Survey of College Students and Prototype Testing

## 6 METHODOLOGY

### 6.1 Research Design

(Baytaş, 2020) categorizes design research into three modes: (1) conducting research to inform design decisions, (2) studying designs to generate knowledge, and (3) using design itself as a means of inquiry. My research is of the 1st category, aiming to make better design decisions for my sustainability-focused financial app. When developing my research design, I relied on the advice of (Christian Rohrer, 2022) to decide when to choose which user experience research methods.

To knit together the themes of youth finance and sustainability, with the help of interaction design and AI, this study adopts the *Theory of Planned Behavior* (TPB) as its primary analytic frame used to organize the overall results from a theoretical point of view. TPB states that the strength of a person's intention depends on three belief clusters: (1) a cognitive and affective attitude toward the act, (2) perceived social norms, and (3) perceived behavioral control (Ajzen, 1991).

By foregrounding TPB I can interpret both the adoption of a financial AI companion and the subsequent shift toward sustainable shopping, saving, and investing with a single set of constructs. (Hagger & Hamilton, 2025) extensive meta-meta-study (study of several underlying meta-studies) summarize 40 years of TPB research, showing strong, consistent effects of *attitude*, *subjective norm*, and *perceived behavioral control* on *intentions*, and of intentions on behavior; the effect is found to be robust across various behaviors, populations, and study designs.

The graph below shows the basic structure of TPB.

Additional theoretical lenses used in my work include the following.

Table 6: Theoretical lenses found in my research.

Theory / Framework	Key Contribution	Sections Where Used
Theory of Planned Behaviour (TPB)	Core explanatory model linking attitudes, norms, control and intention to sustainable finance behaviour	Overall
Planetary Boundaries	Situates individual financial choices within global ecological thresholds	Sustainability
Circular Economy	Provides closed-loop design principles for product-passport features	Design / Money
Triple Bottom Line (TBL)	Connects profit, people and planet in ESG analysis	Money

Theory / Framework	Key Contribution	Sections Where Used
Technology Acceptance Model (TAM)	Explains perceived usefulness / ease of use for AI companion	AI
Fogg Behaviour Model (FBM)	Maps motivation-ability-trigger nudges in UI	Design
Heuristic–Systematic Model (HSM)	Explains quick credibility heuristics vs. deep cues	AI
Algorithmic Experience (AX) model	Describes how users form mental models of opaque AI	AI
Choice Architecture / Behavioural Nudges Systems Thinking	Frames defaults and eco-filter prompts in super-app context Positions app interventions within broader supply-chain loops	Design Design
Ecological & Doughnut Economics	Critiques GDP-only metrics; motivates regenerative finance lens	Money
Participatory / Multi-species Design	Broadens stakeholder set to non-human actors	Design
Service Design for Sustainability	Maps end-to-end user journey (repair, swap, delivery)	Design
Earth-System Law	Links micro-level nudges to macro-level legal frameworks	Sustainability

## 6.2 Research Methods

Overview of research methods.

Group	Task
Experts (Finance)	Interview
Experts (Design)	Interview
Experts (Sustainability)	Interview
Target Audience (College Students)	Survey
Target Audience (College Students)	Prototype Testing

This mixed-method research design is divided into three stages.

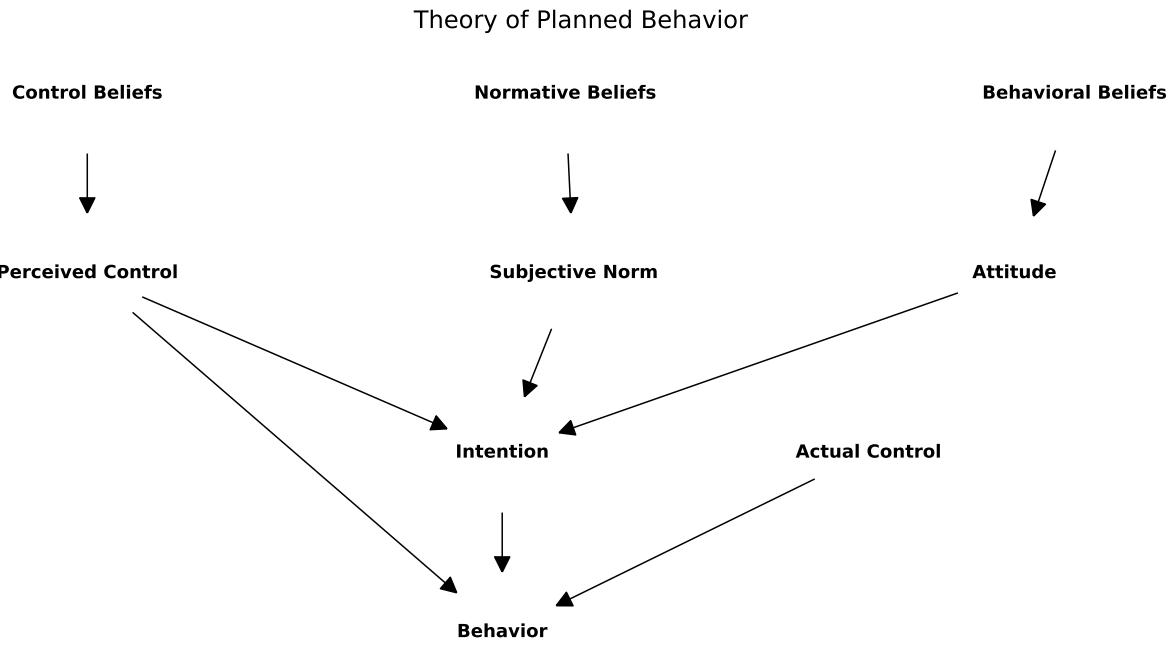


Figure 4: Theory of Planned Behaviour

### **6.2.1 Phase One - Qualitative Research**

My purpose for the first qualitative stage is to explore the general themes arising from the literature review related to the design of AI advisors for investing. I identified specific user experience factors, through interviewing experts in financial technology and user experience design and reviewing existing applications on the marketplace. At this stage in the research, the central concept being studied was defined generally as expectations towards a sustainable investment AI advisor.

I started with literature review, which led into expert interviews (there were many questions arising from the literature). I identified key concepts from expert discussions and gained exposure to their industry insights.

The qualitative research methods employed in the first stage of the research design enables me to explore concepts arising from literature review further, using a more open approach, without limiting the conversation only to pre-ascribed notions. The strength of the qualitative approach in the first stage is to encourage the discovery of new ideas, not yet common in literature and potential user experience factors related to sustainable investing and user experience.

#### Sampling

My qualitative sampling structure used non-probability snowball sampling, with the following criteria: targeting financial industry, fintech, design, and sustainability experts; located every-

where.

## Methods

I conducted exploratory research in English using semi-structured interviews recorded online and offline. I talked to 5 experts over video call, 1 expert face-to-face, and 1 expert over WhatsApp voice messages; 6 interviews were conducted in English and 1 in Portuguese. I recorded audio and video, transcribed the conversations. I used OpenAI's o3 model to translate the Portuguese interview to English. I then performed thematic analysis across all the contents, leading to a *wish list* of features.

Interview Mode	Number of Experts	Language	Recording Method
Video Call	5	English	Audio & Video
Face-to-Face	1	English	Audio & Video
WhatsApp Voice Msgs	1	Portuguese	Audio

Thematic analysis coding was developed using Atlas.ti “Intentional AI Coding” feature, using the following prompt:

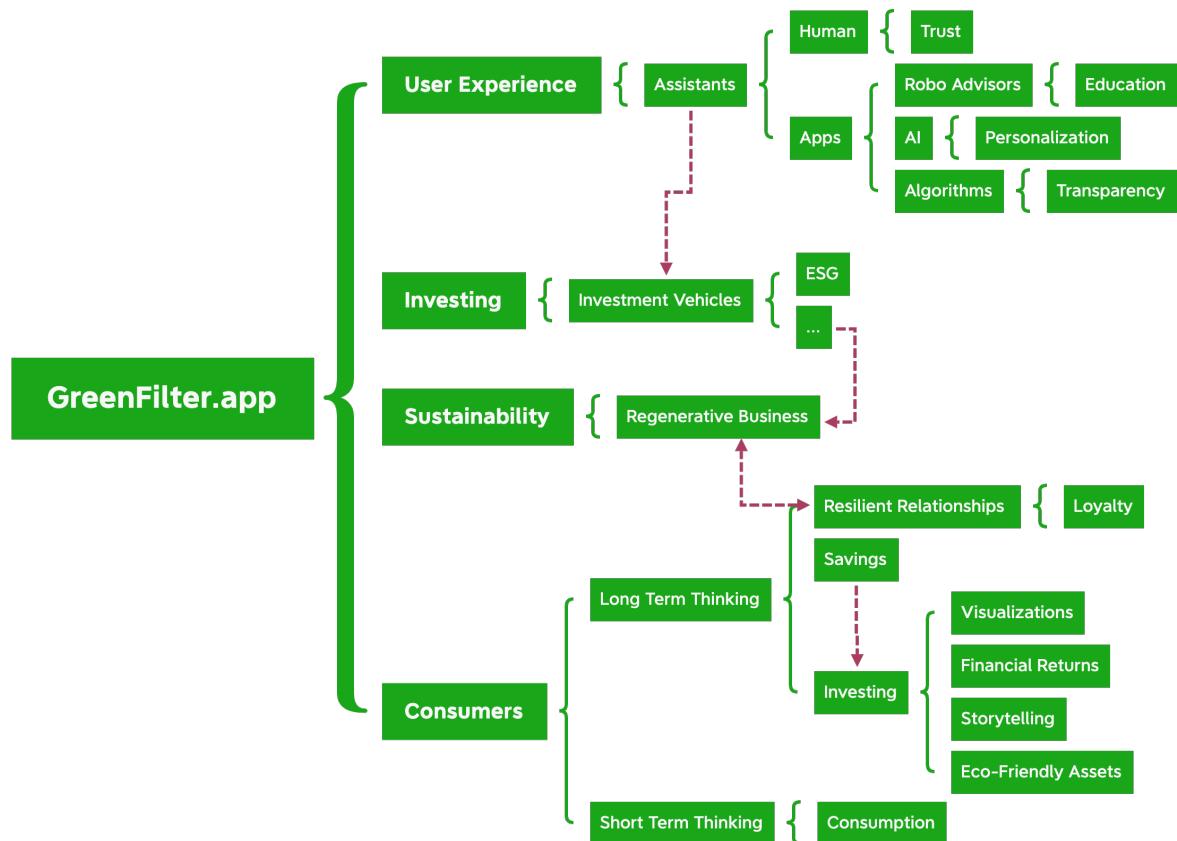
“How do industry experts describe their design and sustainability principles, AI and technology strategies? What common language emerges between design, sustainability, finance, and AI? Identify passages where experts link system thinking, transparency, simplicity, feedback loops, and long term impact across design, sustainability, AI, and finance.” - Prompt for Atlas.ti “Intentional AI Coding”

Specific questions generated by Atlas.ti from the prompt, which guide the AI coding.

Question	Category
How do industry experts describe their design and sustainability principles?	Design Principles
What AI and technology strategies do industry experts employ?	AI Strategies
What common language emerges between design, sustainability, finance, and AI?	Common Language
How do experts link systems thinking across design, sustainability, AI, and finance?	System Thinking
In what ways do experts emphasize transparency in their discussions on design, sustainability, AI, and finance?	Transparency
How is simplicity articulated by experts in relation to design, sustainability, AI, and finance?	Simplicity
What role do feedback loops play in the experts' frameworks for design, sustainability, AI, and finance?	Feedback Loops
How do experts define long term impact in the context of design, sustainability, AI, and finance?	Long term Impact

## Conceptual Framework

The conceptual framework map presents the key concepts arising from the literature review thus far in the research process. I'm using these concepts when developing interview strategies for phase one of the research, developing the survey questionnaire for phase two, as well as for building the Green Filter AI Companion for young adults at the final stage of the process. However, I expect the conceptual framework to further evolve with additional findings while conducting my research.



Presented with xmind

Figure 5: Concept map

## Conceptual Model

Initial version of the concept map focused on the app itself.

Current concept map focusing on sustainability:

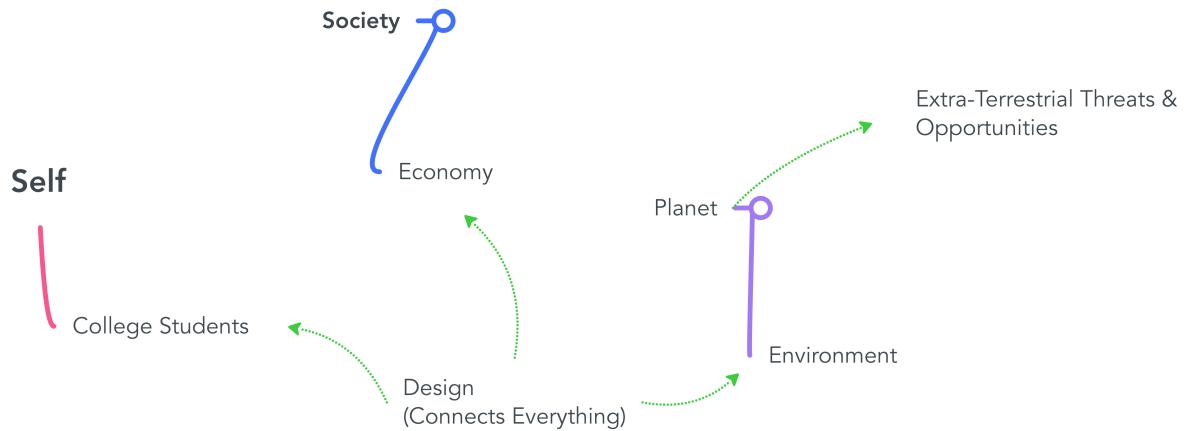


Figure 6: Overall Concept Map

### 6.2.2 Phase Two - Quantitative Research

I then proceeded to the second, quantitative stage, informed by the previously identified factors, and prepared a survey to understand potential users' preferences, including a Likert scale, a choice experiment, and a selection of proposed features, focusing on the preferences of the potential users in Gen-Z, aged 18-29, living in Taiwan.

#### Sampling

My quantitative sampling structure uses a judgmental criterion: adults aged in Gen-Z (18-29), located in Taiwan, surveyed using a Chinese-language online survey.

#### Methods

**Likert:** The survey includes a Likert scale between 1 to 5 to validate key findings from the first stage of the research by assessing responses to statements regarding the app's design, features, and other criteria that may still emerge.

**Choice Experiment:** The survey includes a *choice experiment* between different sets of potential features available when communicating with the sustainable finance AI companion.

## Survey Development and Expected Findings

In December 2020, in preparation for the final version of the survey, I ran a preliminary questionnaire, testing open-ended and close-ended questions, as way to prepare for the proposal of this research. I conducted a preliminary round of face-to-face interviews using 21 open-ended, probing questions and a convenience sampling of NCKU foreign students ( $n = 12$ ) on campus between ages 19 and 29. The interviews were conducted in English and lasted between 9 and 21 minutes; they gave me some initial feedback on my research idea, the respondents' daily routines, app usage, and feelings towards financial questions, including investing, relationship with nature, and environmental sustainability.

This preliminary version of the survey was only used to develop the questionnaire itself and the data collected (even though the recorded audio was transcribed), is not part of the research results. These preliminary conversations led me to emphasize more on the financial journey of the user, i.e. to consider the importance of the shopping, savings, and payments, with the apps students already use daily, serving as an entry point to becoming an investor (this approach later became known as embedded finance). I expected my future research findings to confirm this initial idea and to offer diverse ways and examples of what that path could look like in practice.

I then proceeded to change my target audience to Taiwanese students and developed the survey to include more specific questions, including more close-ended multiple-choice varieties.

## Final Survey: Data Collection

For the actual survey, I developed 63 close-ended and open-ended questions. For survey distribution, I adopted a face-to-face method to increase response rates, distributing flyers to students on college campuses, canteens, and classrooms, getting verbal permission from educators in their classrooms to distribute the survey flyer. Similarly to the approach take by (C.-H. Liu et al., 2023), I distributed the survey flyer at universities located in the Northern, Soutern, Central, and East regions of Taiwan. The flyer included a colorful AI-generated visual with a futuristic game-like female figure, and the title “climate anxiety survey” in Chinese, as well as a website link ([ziran.tw](http://ziran.tw)) and scannable QR-code.

The survey only included questions and descriptions in Chinese. I have used the Claude 3 Opus model to translate them to English for this table.

Table 10: 36 Likert Fields included in the survey

Original Question in Chinese	English Translation
如果你/妳懷疑你/妳要買的番茄可能是由強迫勞工（現代奴隸）採摘的，你/妳仍然會買它嗎？	If you suspect that the tomatoes you are going to buy may have been picked by forced labor (modern slaves), would you still buy them?
你/妳關心食安嗎？	Do you care about food safety?
你/妳 7 年內買車嗎？ <input type="checkbox"/>	Will you buy a car within 7 years? <input type="checkbox"/>
你/妳 7 年內買房嗎？ <input type="checkbox"/>	Will you buy a house within 7 years? <input type="checkbox"/>

Original Question in Chinese	English Translation
你/妳購物時知道產品環保嗎？	Do you know if the products are environmentally friendly when you shop?
你/妳覺得認證環保的公司更好嗎？	Do you think companies certified as environmentally friendly are better?
你/妳支持肉稅嗎？	Do you support a meat tax?
你/妳關心食用雞的生活嗎？	Do you care about the lives of chickens raised for food?
你/妳避免吃肉嗎？	Do you avoid eating meat?
你/妳覺得你/妳花錢會影響環境嗎？	Do you think your spending affects the environment?
你/妳會對金錢感到焦慮嗎？	Do you feel anxious about money?
你/妳會對金錢很節儉嗎？	Are you very frugal with money?
你/妳會經常存錢嗎？	Do you often save money?
你/妳對自己的財務知識滿意嗎？	Are you satisfied with your financial knowledge?
你/妳投資會考慮環保嗎？	Do you consider environmental protection when investing?
你/妳覺得台灣的經濟目標是增長嗎？	Do you think Taiwan's economic goal is growth?
你/妳覺台灣的得環境退化是台灣的經濟增長的前提嗎？	Do you think environmental degradation in Taiwan is a prerequisite for Taiwan's economic growth?
你/妳覺得台灣的經濟增長有助於保護環境嗎？	Do you think Taiwan's economic growth helps protect the environment?
你/妳覺得經濟能不排 CO <sub>2</sub> eq 也增長嗎？	Do you think the economy can grow without emitting CO <sub>2</sub> eq?
你/妳覺得經濟增長有物質限制嗎？	Do you think there are material limits to economic growth?
你/妳會每天都用 AI 嗎？	Do you use AI every day?
你/妳會信任 AI 嗎？	Do you trust AI?
你/妳想要 AI 有個造型嗎？	Do you want AI to have a specific appearance?
你/妳喜歡待在大自然嗎？	Do you like being in nature?
你/妳擔心氣候變化嗎？	Are you worried about climate change?
你/妳對環境污染情況會感到焦慮嗎？	Do you feel anxious about environmental pollution?
你/妳知道許多植物和動物的名字嗎？	Do you know the names of many plants and animals?
你/妳感覺自己和大自然很接近嗎？	Do you feel close to nature?
你/妳努力實踐低碳生活嗎？	Do you strive to live a low-carbon lifestyle?
你/妳想做更多環保事嗎？	Do you want to do more for environmental protection?
你/妳對環境相關政治議題有興趣嗎？	Are you interested in environmental political issues?
你/妳信任碳排放抵消額度嗎？	Do you trust carbon offset credits?

Original Question in Chinese	English Translation
你/妳的環保行動對環境保護有效果嗎？	Do your environmental actions have an effect on environmental protection?
你/妳想在行業內推環保嗎？	Do you want to promote environmental protection within your industry?
你/妳得自己對新觀念開放嗎？	Are you open to new ideas?
你/妳的大學對可環保性支持嗎？	Does your university support environmental sustainability?

Respondents who remained outside the survey parameters were allowed to answer the survey however their responses were disregarded from the data analysis. References were stored in the Zotero paid version with 6 GB storage. Bibtex and Better Bibtex were used to export the references to the .bib format consumable by the Quarto scientific writing system.

### 6.2.3 Phase Three - Qualitative Research

In the third and last phase, I returned to qualitative methods, to further validate the quantitative findings from stage two, by building a prototype of the sustainable investing AI companion, taking into account insights gathered in the previous stage. Here my focus was on operationalizing the gathered insights into a prototype that users can experiment with. I designed and refined a prototype of the personal sustainable finance AI assistant. I used face-to-face interviews to discuss the prototype, and conducted a thematic analysis of the discussions' recordings, leading to further validation of previously gathered data and changes in the prototype. The gained insights, accompanied by the app prototype, which embodies my findings, are the final outcome of my research.

#### Sampling

The phase three sampling structure used a judgmental criterion:

- Age Gen-Z cohort
- Located in Taiwan
- Using Chinese for discussion.

Individual face-to-face interviews were organized at universities around Taiwan. Because in-person presence is required in this stage, the prototype will only be tested by potential users physically present in Taiwan. To avoid convenience sampling, I posted online ads in Chinese and reach out to varied student clubs to invite people who I don't know personally, to participate in a "sustainable AI application testing" (wording may change).

## Methods

Face-to-face prototype testing. The strength of in-person is the ability to observe potential users, where knowledge can be exchanged directly. The interviews were recorded and transcribed. Finally, I performed a thematic analysis of the interview transcriptions in order to validate previous findings, and open avenues for future research.

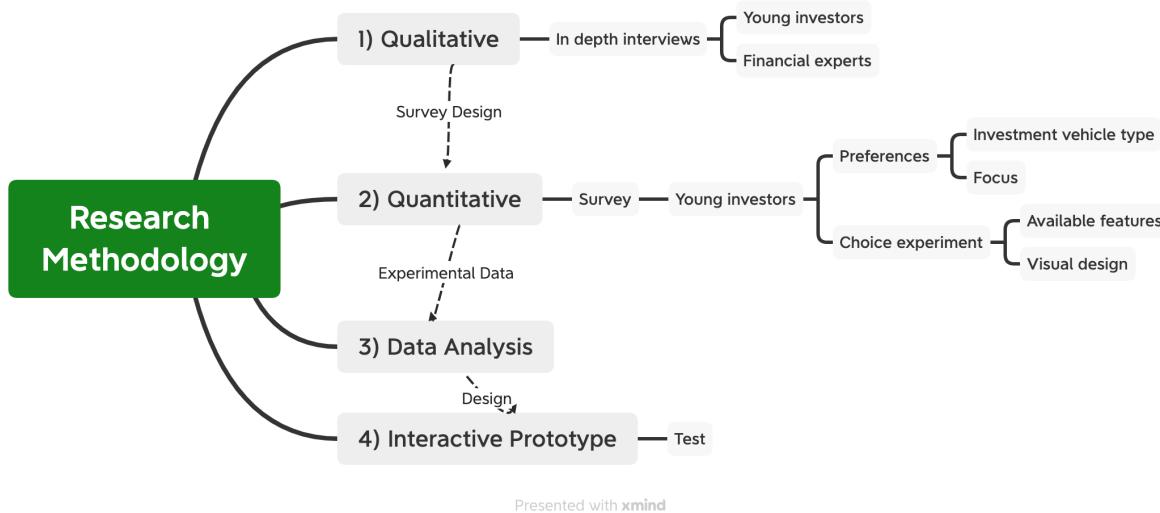


Figure 7: Overview of research methodology

Interview transcripts from Descript and Google Speech-to-Text model were combined using Gemini 2.5 Pro Experimental 03-25 (gemini-2.5-pro-exp-03-25) model.

## Prototype Testing

Does the prototype match user needs?

Testing was the most difficult part of the thesis process.

- Testing with random people found at the university.
- Testing with experts.
- Testing with unknown people in the target audience.

## App Testing Flow

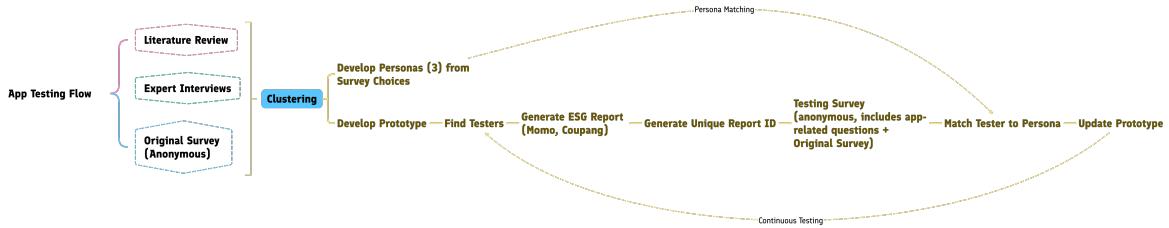


Figure 8: App Testing Flow

### 1st Wave of (Preliminary) Prototype Testing (Spring 2024)

The 1st wave of preliminary testing took place during 1 month from 2024 April 2 to May 2, 2024 at the NCKU campus. I found 8 anonymous participants at different NCKU locations, such as the student canteens and the medical library, confirmed the people I approached were Taiwanese students studying at NCKU, and then simply asked them to test my app, using my own laptop. I made use of *participant observation* and took notes myself. There was no audio or video recording.

### 2nd Wave of (In Production) Prototype Testing (Autumn 2024 - Spring 2025)

The 2nd wave of testing took place from Autumn 2024 to Spring 2025 and was more comprehensive. I conducted in-person face-to-face testing individually with 32 students at 7 universities. Interviews were conducted in Chinese and transcribed and translated to English using Google Voice to Text AI as well as Describe AI.

Region	University	No of Testees
Taichung	國立中興大學 National Chung Hsing University (NCHU)	7
Chiayi	國立中正大學 National Chung Cheng University (CCU)	5
Tainan	國立成功大學 National Cheng Kung University (NCKU)	6
Tainan	國立臺南藝術大學 Tainan National University of the Arts (TNUA)	2
Tainan	長榮大學 Chang Jung Christian University (CJCU)	5
Tainan	南臺科技大學 Southern Taiwan University of Science and Technology (STUST)	5



### 6.3 Literature Review

The literature review branches out to 5 main directions and maps out relationships sources and the literature map, namely Taiwanese college students, generation-z demographics, sustainability, ecology, ecosystem services, EU legislation, sustainable finance, sustainable investing, savings, circular economy, economics, AI, existing sustainability, software, sustainability-related mobile apps (Apple iOS / Google Android), and web apps related to sustainable shopping, savings, and investing; apps using algorithmic interfaces (AI-based UI), design, UX/UI, service design, sustainable design, speculative design, interaction design, behavior change, nudge.

The following chart shows a tiny portion of the papers considered in this research at the first stage of proposing this research.

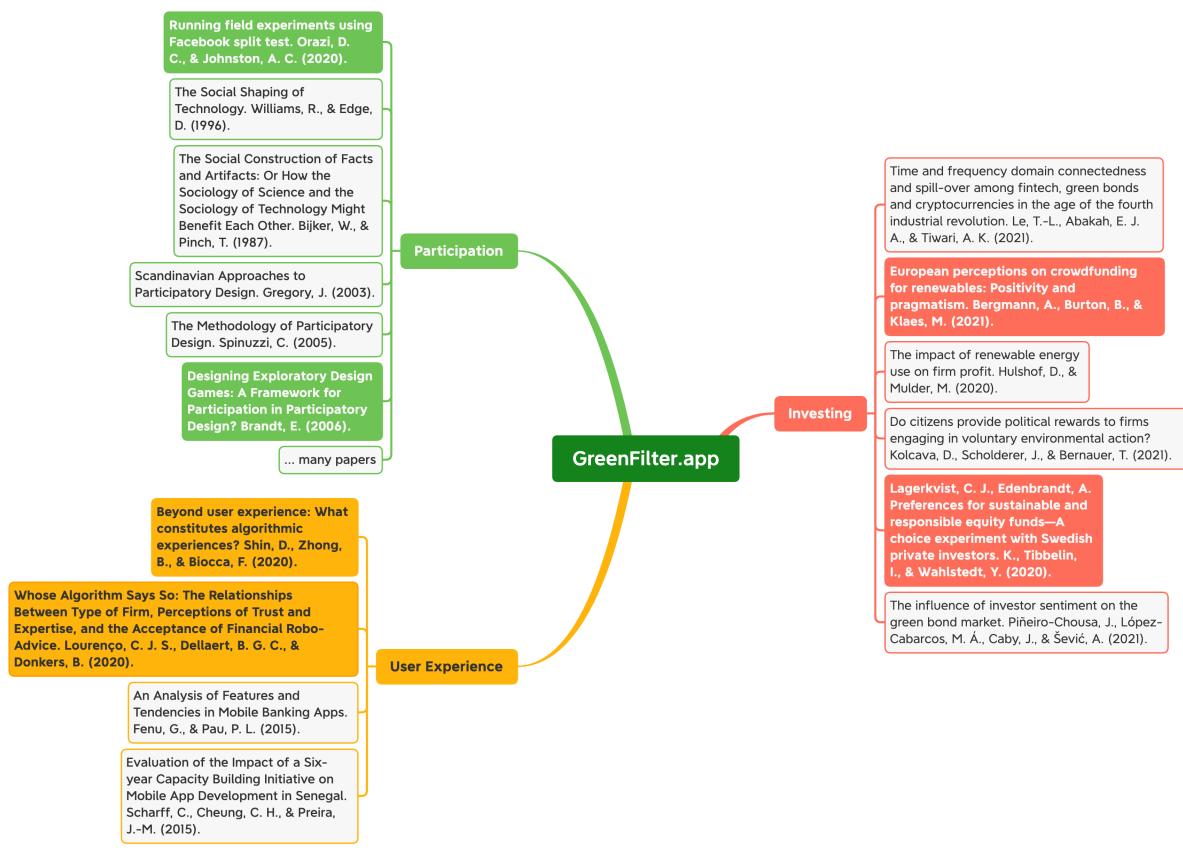


Figure 9: Example papers from the Literature Review

The 2nd chart illustrated how the literature review quickly grew they more I read and understood what I don't understand - thus needing to read more. This is still a small subset of the literature that was reviewed. However, it does give a better silhouette of the shape of the entire literature review.



Figure 10: A Larger Sample of the Reviewed Literature

Finally, this is a more complete concept map of the topics relevant to my research that largely emerged from the literature.

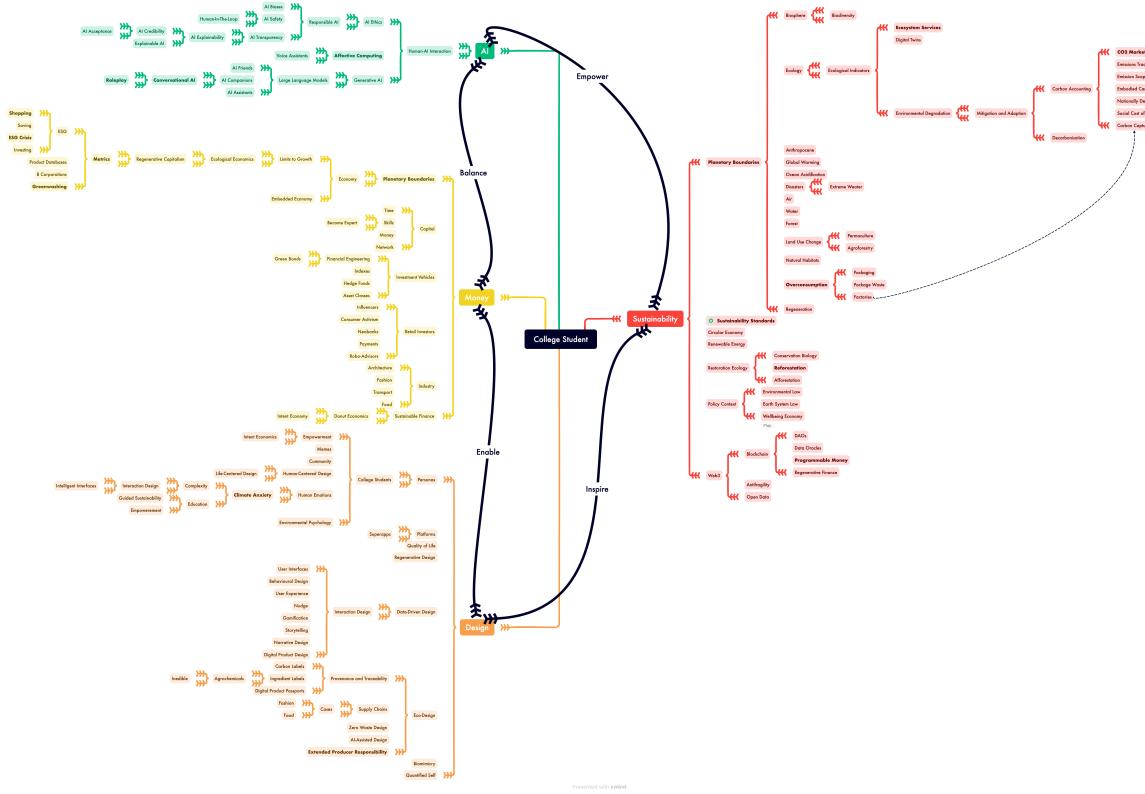


Figure 11: Nearly Complete Concept Map

### 6.3.1 Goals

Given the ambition of designing an app to integrate sustainable shopping, saving, and investing, the goal of the literature review is to find insights about the target audience (Taiwanese college students), understand what kind of sustainable actions are effective, and translate these into specific ideas for app features. In order to keep track more easily, each literature review chapter provides *design implications* which are shown in the results section.

### 6.3.2 Sources

There is currently no single platform that hosts all scientific journals leading me to source scientific papers from

1. ScienceDirect
2. Nature
3. The Lancet

4. Oxford Academic
5. Semantic Scholar
6. JSTOR
7. Google search.

### 6.3.3 AI Use

Statement of AI Usage in Research: I'm a long time AI-assistant user.

AI was used for:

1. Search
2. Data comparison
3. Data science
4. Chart-building
5. Translation
6. Feedback
7. Editing
8. Spell-checking
9. Proofreading
10. Ranking citations' relevance to existing body of writing

AI was *NOT* used for writing.

A visualization of incremental changes (over a thousand Git commits) to the thesis can be seen on the GitHub repository as well as in the visualization below.

## 7 YOUNG ADULTS AND COLLEGE STUDENTS

### 7.1 Student Protests for Climate Justice: The World and Taiwan

In August 2018, Swedish high-school student Greta Thunberg skipped class to start a climate justice strike in front of the Swedish parliament Riksdag. In 2019, Time magazine named Thunberg person of the year for *creating a global attitudinal shift* towards the environment (Deutsche Welle, 2019). According to official statistics, 14 million participants joined her *Fridays for Future* strikes and the movement expanded to over 7,500 cities around the world (Fridays For Future, 2025). A survey 64 climate protesters from Norway, the UK, USA, and Canada, found the climate-justice activists are non-homogeneous group, displaying differing levels of factual knowledge about climate change, a broad spectrum of emotions from anger to guilt and hope, with diverse lifestyles, consumption habits, dietary shifts, and political leanings (Martiskainen et al., 2020).



Figure 12: Climate protest in Geneva on September 27th, 2019 – 1 year after the start of Fridays for Future

In Indonesia, which had large protests at the time, now 7 years later activists are expressing disillusionment and frustration with the lack of progress and upholding environmental promises. (Dwi Tamara, 2025) reports on a survey of 382 Gen-Z respondents in 5 areas of Jakarta, with 99.5% of the respondents having experienced extreme weather events first-hand, highlighting how respondents were affected by climate-related calamities, such as frequent flooding, which led to students missing school days, - education which they are entitled to. The Sharm El Sheikh

climate policy implementation (UNFCCC, 2023b) text refers to “human right to a clean, healthy and sustainable environment”. In Portugal, Estonia, and elsewhere young people have moved on from strikes to actually taking legal action at the courts suing companies for the environmental problems they have caused (Flor, 2024).



Figure 13: Climate protest in Taipei in May 2019 in front of the Democratic Progressive Party (DPP) headquarters

Meanwhile, as the climate-justice protests unfolded around the world, in Taiwan, the Fridays for Future protests were very small in scale, with no more than 100-200 people (Hioe, 2019). Meanwhile 2000 Taiwanese students joined the initiative by participating in environmental activities without protesting (Dai, 2019). This could in part be explained by Taiwanese culture being deeply influenced by Confucianism, valuing stability, hierarchical relationships, academic excellence, effort, and the role of education in achieving social status (R.-H. Xu, 2024). (H.-C. Chang, 2022) goes a step further to say that Taiwanese youth are effectively unable to stage formal “strikes” due to intersecting cultural constraints: obsession with academic performance, low awareness of legal strike rights, and parental intervention — so they instead reframe actions as campus “climate actions,” exercising agency within those limits. In addition, both Confucianism and Daoism, the prevalent belief systems in Taiwan, affect education to be *teacher-*

*centered*, where traditionally the role of students is to listen and absorb knowledge; in today's society, there's space to open opportunities for revisiting *dialogue-based* education, where students would be encouraged to take a more active role and gain ownership of their education (C.-C. Chang et al., 2023).

## 7.2 Taiwanese Educational System in Numbers

Taiwan has approximately 2 million young adults (Gen-Z, 18-26), and 73% percent of them are students attending tertiary education as of 2023, with a slow increase of enrollment over the past decade (Ministry of Education of Taiwan, 2024b).

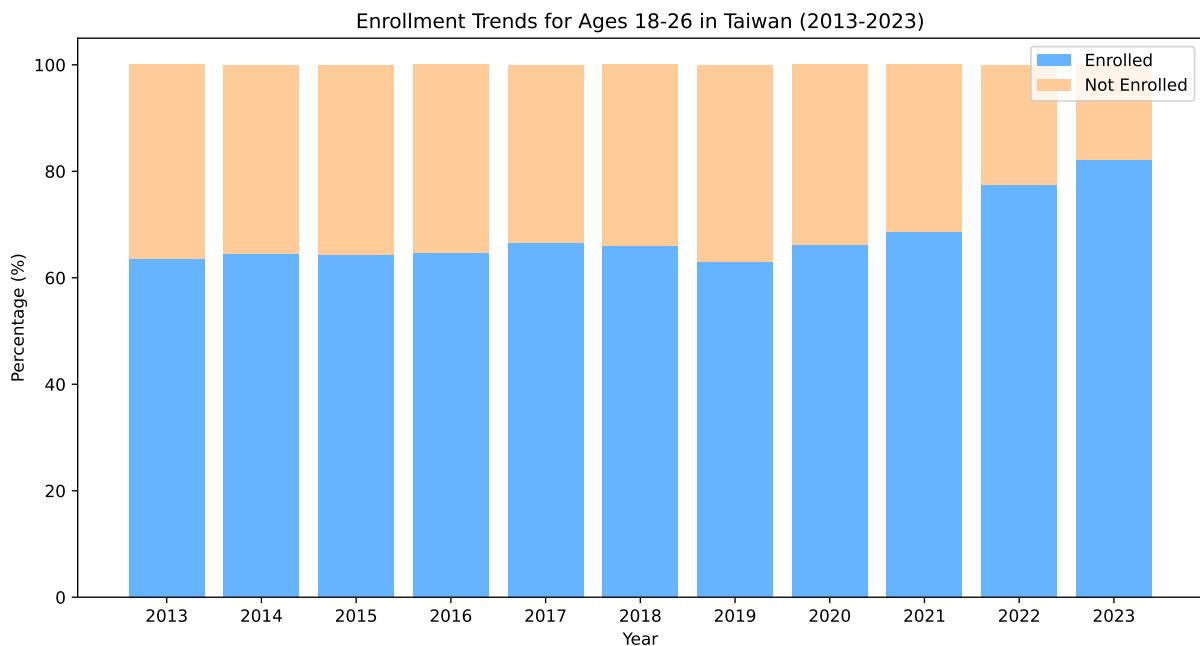


Figure 14: Enrollment in Taiwanese Higher Education

As of 2024, Taiwan has a total of 148 universities, colleges, and junior colleges (Ministry of Education of Taiwan, 2024c). Education funding is 4.26% of Taiwan's GDP in 2023-24 and has been on a decline for a decade (Ministry of Education of Taiwan, 2024a). Taiwan has an aging population and declining birth rates have forced several schools to close down (Davidson & Chi-hui, 2024; Goh et al., 2023).

While the overall number of students is declining, the share of international students is increasing.

## 7.3 Designing for College Students: Developing Personas

Students in the Generation-Z age bracket (abbreviated as Gen-Z or Zoomers) are born between 1997 and 2012 (Branka Vuleta, 2023). High levels of technology adoption worldwide (Deyan

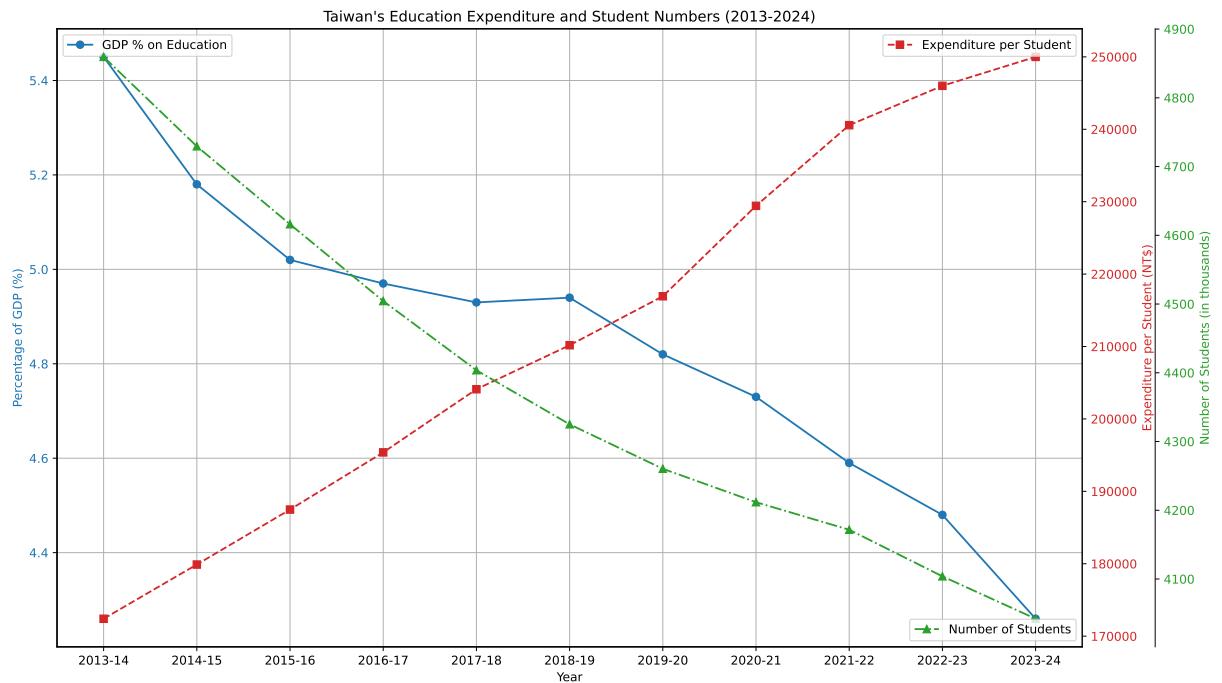


Figure 15: Funding for Taiwanese Higher Education

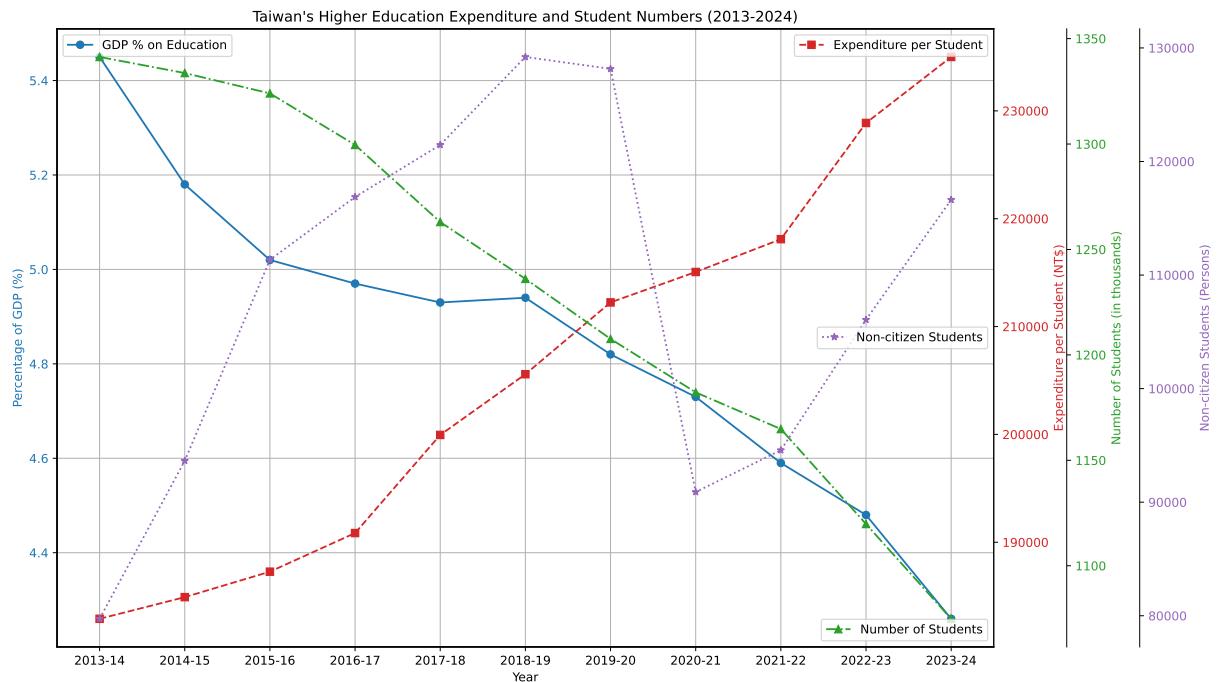


Figure 16: Demographics of Taiwanese Higher Education

Georgiev, 2023a). Over 98% of Gen-Z owns a smartphone while only 80% of the general world population does (BankMyCell, 2022; Global Web Index, 2017).

Designing for College Students: Developing Personas. User research makes extensive use of user *personas* to represent a group of people with similar attributes. Designers use personas to *articulate assumptions*, which, if used well, is useful for *user-centered design*, to create better products. Personas help to reflect on what kind of *biases* might exist in the design. Within the larger cohort of college students several different personas could be defined, for example grouping people by interests, knowledge, habits, levels of anxiety, and other attributes. Humans have a long list of cognitive biases, which a good design should take into account.

Many general observations can be made, however to create meaningful personas, these should be backed up with data. Students ride bicycles and scooters. Many circular economy service such as YouBike and transport sharing platforms like Uber are available in Taiwan. Many students live in dorms and shared housing, meaning their impact per square meter is low.

#### **7.4 Taiwanese Youth in Global Context: Sustainability Attitudes From Eco-Friendly Diet to Climate Action**

Addressing the *research gap* when it comes to Taiwanese college students. There's lack of scientific research when it comes to Taiwanese college students, not only in English or other foreign languages, but also in Chinese. Much of the research in Taiwan focuses on younger students, particularly those in primary and secondary schools. With regard to issues related to college students and sustainability, even less research is available. My project hopes to shed some light to how Taiwanese college students relate to sustainability.

(Kuo-Hua Chen, 2019) compares Taiwan to other countries in terms of *Postmaterialist Index Comparison*, noting Taiwanese society is materialistic.

##### **World Values Survey**

(Franzen & Bahr, 2024) measures “*mean environmental concern*” to look at decade-level changes in societal environmental attitudes across countries. Taiwan’s general attitudes have stayed almost the same (slight increase). The UK has had the largest jump in concern. Curiously, South Korea has had a slight decrease in concern. Slovakia and Russia were not very concerned with the environment a decade ago and are even less concerned now.

A large, global-scale study by (Anthony Leiserowitz et al., 2022) administered on Meta’s Facebook ( $n = 108946$ ) reported people in Spain (65%), Sweden (61%), and Taiwan (60%) believe “*climate change is mostly caused by human activities*”.

The largest study to date, conducted by the United Nations across 50 countries, surveying 1.2 million people, distributed through mobile game ads, showed the majority of people agreeing climate change is an “emergency” (UNDP, 2021).

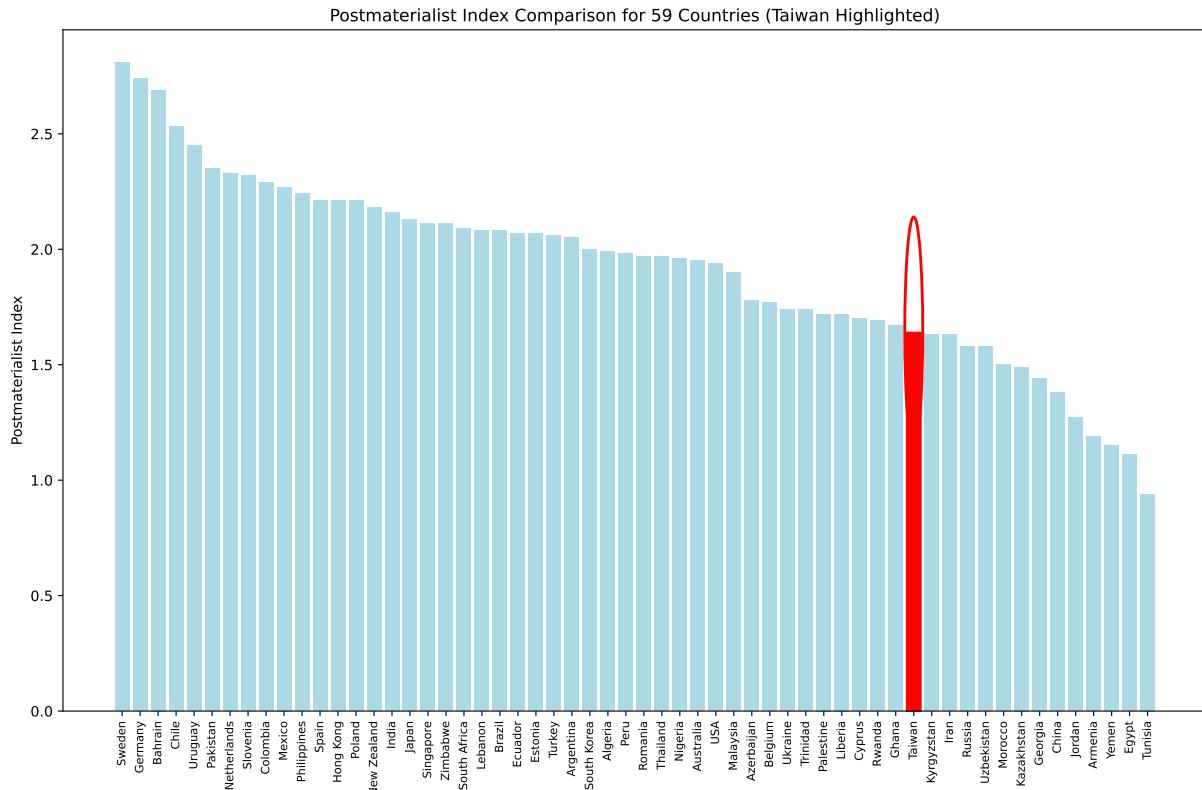


Figure 17: Postmaterialist Index across 59 countries (Taiwan highlighted)

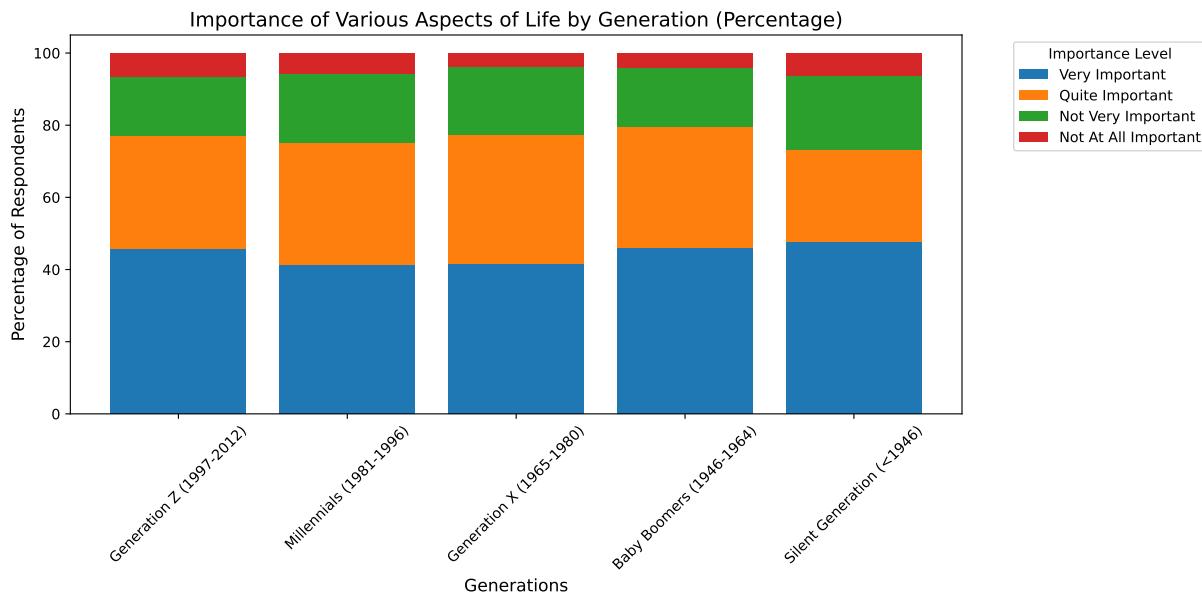


Figure 18: World Values Survey

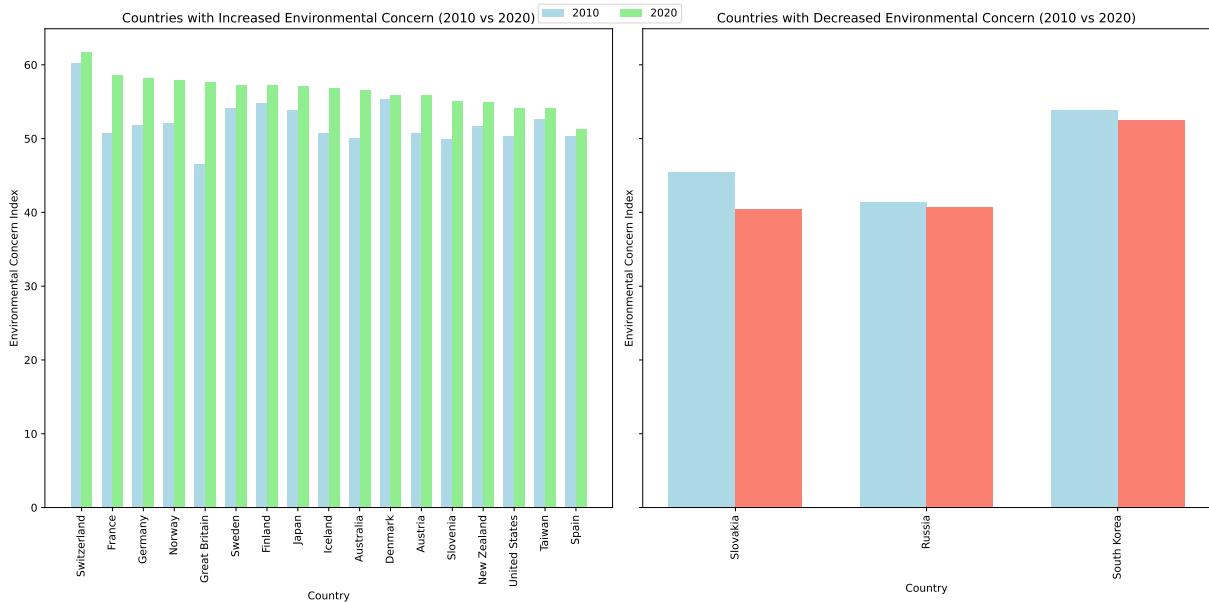


Figure 19: Global Attitudes Towards Climate Change

Table 12: 1.2 million UN survey responses to the statement “Climate change is an emergency”.

Age Group	Agree	Neutral or Disagree
18-35	65%	35%
36-59	66%	34%
Over 69	58%	42%

At the pre-university level, Taiwanese government has been promoting environmental education through a green school network; however surveys at middle school and high school level suggest there is no impact on *sustainability consciousness* among students in comparison with regular schools (Olsson et al., 2019). Rather, Taiwanese students are influenced towards environmental action by *group consciousness* (T.-Y. Yu et al., 2017). In contrast, (陳珮英, 2003) reports *good knowledge of sustainable development* topics among *junior high school students* in Da-an District, Taipei City (n =596). (林建輝., 2009) similarly reports a positive attitude and good knowledge of environmental sustainable development among senior *high school students* towards in Taipei City (n = 328). Several Taiwanese studies also focus on the physical environment of school campuses, for example the sustainability of elementary school campuses (潘智謙 & Pan, 2006). Elementary-school teachers in Taichung (n = 536), have positive attitudes towards environmental education are positive, proactive and demonstrate high awareness; they have participated in many sustainability-related workshops (Liao et al., 2022).

At the university level, (C.-L. Chen & Tsai, 2016) reports a *positive attitude yet moderate knowledge* about *ocean sustainability* among Taiwanese college students (n = 825). (C.-H. Liu et al., 2023) studied sustainability behavior of Taiwanese University students, reporting the COVID-19 pandemic, in addition to prevalence of health issues, also spurred more attention on environ-

mental topics. In a similar vein, the devastating nuclear disaster in Fukushima, Japan, after 2011 earthquake, had an effect on Taiwanese energy and sustainability education (姚 & 侯, 2011). Taiwanese government launched the Sustainable Council in 1997 to promote of environmental and sustainable development; a survey of university-level teachers ( $n = 100$ ) in central Taiwan (Taichung, Changhua, and Yunlin) shows a positive attitude toward environmental sustainability among teachers however implementation of environmental sustainability practices is from low to medium range (林美惠. & 莊, 2015). Taiwanese government has also launched funding for University Social Responsibility (USR) programs to train college students in social innovation and local revitalization (D. Chen & Chou, 2023; W.-H. Liu et al., 2022). In general, it could be concluded, Taiwanese students and teachers at all levels of education have a positive attitude towards sustainability (Note: which is not a very actionable finding).

Comparing college students' education for sustainable development (ESD) in Taiwan ( $n = 617$ ) and Sweden ( $n = 583$ ) found Sweden has a long history in environmental education while in Taiwan environment became a focus area with the 1998 educational reform (Berglund et al., 2020).

An older study in 5 university in Taipei and Taichung ( $n = 255$ ) found 78.04% of respondents consumed beef in the month prior and were concerned with food safety, freshness, and quality (J. L. Hsu et al., 2014). (Thiagarajah & Kay, 2017) reports a general observation in their abstract (I was unable to access the full study) that most college students in all observed countries including Taiwan ( $n = 534$ ) regarded "*plant-based diets to have health benefits*". A focus on a healthy and sustainable diet is important, as the prevalent trend among Taiwanese Gen-Z, is increasing obesity, with the latest data available from 2020; the newest, 3rd wave national health survey results are still pending (Chiu et al., 2022; 台灣營養師, 2022; 彭巧珍 et al., 2023). Recent nationwide data show that 70% of common bottled drinks ( $n = 341$ ) marketed to youth in Taiwan exceed the warning threshold for "*high sugar*" ( $> 5 \text{ g}/100 \text{ mL}$ ), and a single serving of 42% of the drinks ( $> 25 \text{ g}$  sugar per bottle) contained the entire daily sugar limit prescribed by the World Health Organization (WHO) (Yen et al., 2022).

Internationally, there is extensive research on the attitudes of college students towards climate change. (American Press Institute, 2022) reports only 37% percent of U.S. Gen-Z and Millennials follow news related to environmental issues. (S. E. O. Schwartz et al., 2022) reports some adult U.S. students in a small study (18-35,  $n = 284$ ) express feelings of insignificance of their actions to achieve any meaningful impact. (Thomaes et al., 2023) reports U.S. adolescents don't find sustainability relevant to their daily life. (Ross et al., 2016) says most people in the U.S. don't act on climate change. "Action on climate change has been compromised by uncertainty, aspects of human psychology".

(Credit Suisse, 2022) suggests young consumers are more eco-friendly and drive the speed of change. Yet the Economist has run a few anonymous articles calling gen-z green ideals into question ("How Gen Z and Millennials Spend Their Money," 2023; The Economist, 2023). (Wood, 2022) suggests in the U.S. Gen-Z is willing to pay 10% more for ethical goods, spend 24% more on sustainable products than Generation X and 75% of Gen Z would prioritize sustainability over brand loyalty. Meanwhile, Gen-Z in the U.S. are heavy users of online fashion shopping, Chinese cheap online store Shein overtakes Amazon as the most downloaded shopping app, while

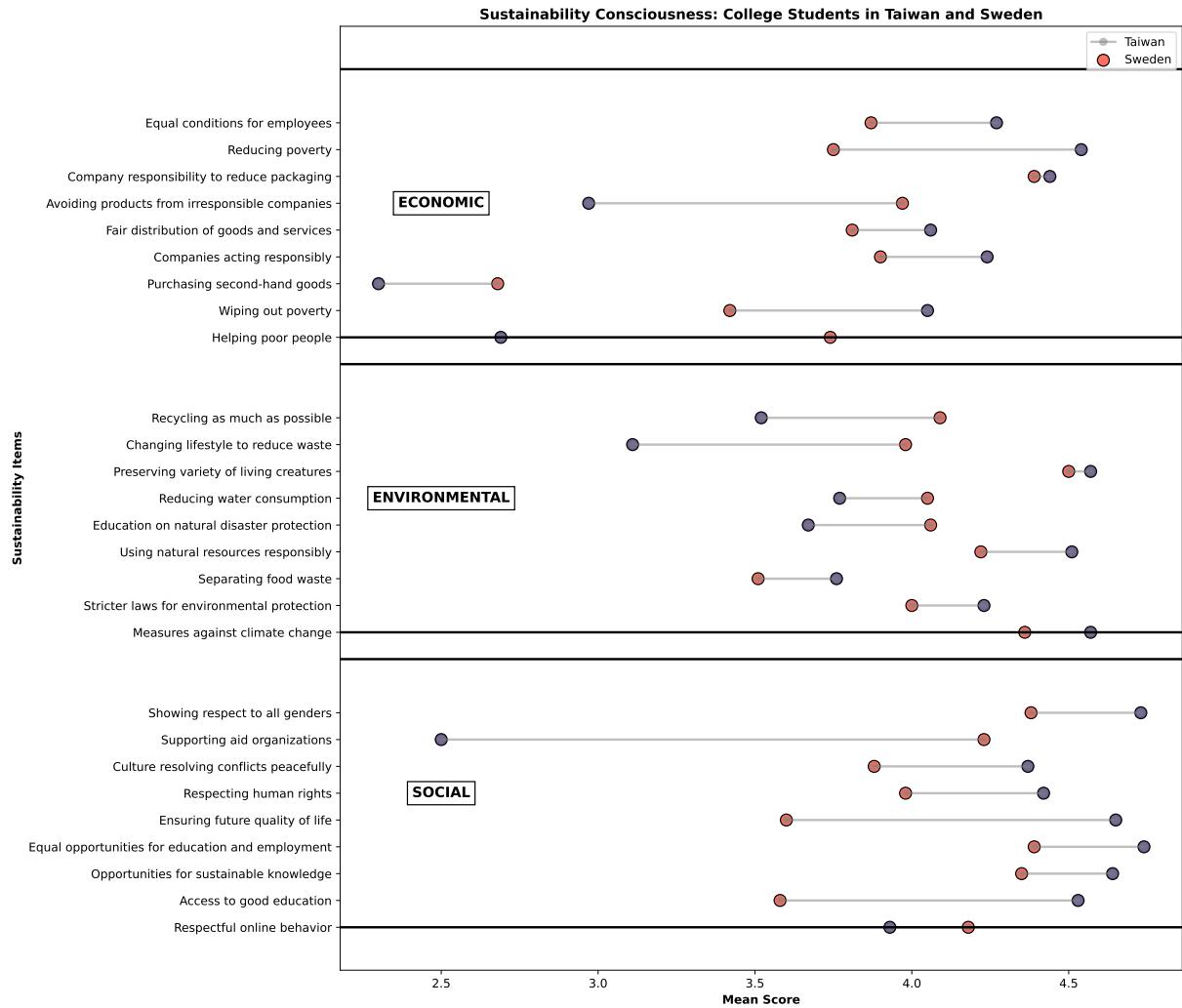


Figure 20: Comparing college students' education for sustainable development in Taiwan and Sweden

clothes resale apps such as Depop and ThredUp grow in popularity (Alex Reice, 2021). It worth noting, Taiwan is also a growing market for luxury brands (Karatzas et al., 2019).

(Manchanda et al., 2023) survey ( $n = 726$ ) administered at shopping malls in New Delhi, India, found similar levels of sustainability consciousness between Millennial ( $n = 206$ ) and Generation-Z ( $n = 360$ ) age groups; people with high level of materialism were found to be less sustainability-conscious; the effect of mindfulness on sustainability was found to be stronger among females than males, supporting the hypothesis of the moderating effect of gender.

## 7.5 The Experience of Climate Change and Pollution Levels in Taiwan

Taiwan's recent climate challenges with over 4 decades of droughts, rising air temperatures, and shifting rainfall patterns, have impacted both water security and the performance of its vital semiconductor manufacturing industry (Vo & Liou, 2024). Offshore, marine heatwaves, ocean acidification, and elevated sea surface temperatures are intensifying coral bleaching around Taiwan (P.-C. Hsu et al., 2024). The oceans are crucial for Taiwan to capture carbon emissions. Around 33% of Taiwanese CO<sub>2</sub>eq emissions is captured by the marine carbon sink, while the effect of forests in Taiwan needs further study (Hung et al., 2024).

Similarly to how Northern Europe, including Estonia, is affected by the Gulf Stream, making the climate warmer, Taiwan is affected by the Kuroshio (黑潮) warm current of the Pacific Ocean, which helps regulate the climate and marine ecosystem of the region. The strength and trajectory of the Kuroshio is influenced by Rossby planetary waves, driven by the Earth's rotation are crucial to keeping the atmosphere in balance by helping transfer tropical heat towards Earth's poles and cold air toward the tropics; interactions between oceanic currents, Rossby waves and nonlinear *mesoscale eddies*, which form complex undulations, and their effect on the climate are still not well understood (Belonenko et al., 2023; J.-Y. Lin et al., 2022; Sheng Liu et al., 2024; Mensah et al., 2014; Shen et al., 2014; US Department of Commerce, n.d.; Yuqi Yin et al., 2019). Going back on a larger time scale, biomarkers in the sediment core around Taiwan are being used to study variations in climate over past thousands of years (Yueqi Wang et al., 2021).

In addition to climate extremes, Taiwanese college students are subjected to high levels of pollution. University campuses are somewhat healthier than other areas. There are several decades of research on pollution levels in Taiwan, most with very scary correlations to health. Taiwan air pollution, the worst (highest PM2.5 concentration) were found in Changhua (24.5 µg/m<sup>3</sup>), Tainan (20.9 µg/m<sup>3</sup>), and Pingtong (20.7 µg/m<sup>3</sup>) (Chang Hsiung-feng et al., 2024).

There have been concerns about food safety in Taiwan, with prominent cases reported in the media and documented in academic literature, where organic toxins and chemical pollution have entered the food system (I. Lee, 2024; J.-H. Li & Ko, 2012; J. Yang et al., 2013).

A recent study demonstrate extreme industrial pollution in numerous sites at the Hsinchu's Xi-ang Shan wetland (香山濕地) in Northern Taiwan, yet considers ecological risk threat to nature and wildlife to be "moderate" (Salah-Tantawy et al., 2025). In contrast, (李桂媚, 2022) reports Taiwan's semiconductor industry employs undisclosed toxic chemicals under trade-secret

claims, which have not undergone comprehensive health and environmental risk assessments. Previously, (Y.-H. Liu et al., 2021) reported sediment analyses at the Xiang Shan wetland found levels of gallium (Ga) ranging from 9,460 to 23,450 µg/kg (severe contamination) and indium (In) from 4.77 to 37.1 µg/kg (moderate contamination), amounts which are above natural baselines, indicating industrial chemical runoff. Earlier studies of semiconductor wastewater from waterways downstream of the Hsinchu Science Park (which houses over 450 companies' manufacturing facilities) have shown high amounts of at least 14 heavy metals, with levels of tungsten reaching 400 µ g/L in contrast to the average river concentration of <0.1 µ g/L (S.-C. Hsu et al., 2011). The oldest study considered here also found high levels of arsenic pollution in groundwater (H.-W. Chen, 2006). It's safe to say, in conclusion, the chemical runoff from manufacturing is a reality documented by several studies, however the negative health effects have not yet been clearly established - and studies of other, less prominent industrial areas of Taiwan, are severely lacking.

The table below illustrates the types of emissions and environmental impacts large corporations in Taiwan produce. It should be noted, some of the corporations do buy carbon credits to offset their local adverse impact; for instance, 台積電 TSCM has purchased carbon credits, renewable energy, invested in the Taiwan Carbon Exchange to support greener companies, and joined international reporting initiatives, such as the Task Force on Climate related Financial Disclosures (TCFD) and Taskforce on Nature-related Financial Disclosures (TNFD) (TSMC, 2023).

Table 13: Examples of large industrial polluters in Taiwan as reported in academic papers and the media.

Company	2023 Mt CO <sub>2</sub> eq	Notable Problems	Data Source
台電 Taipower	<b>93.33</b>	A single power plant in Taichung produces 26 Mt CO <sub>2</sub> eq	今周刊 (2024)
台塑化 (台塑集團) Formosa Petrochemical	<b>24.23</b>	16 cases of fires and explosions between 2010 and 2020	歐宇祥 (2024)
中鋼 China Steel	<b>18.07</b>	60% of the CO <sub>2</sub> eq emissions come from 1 steel mill in Kaohsiung	蕭婷方 (2021); 環境資訊中心記者 (2022)
台積電 TSMC	<b>11.42</b>	Extreme water consumption used 82.82 Mt of water in 2022, straining local reservoirs and requiring water-truck deliveries during droughts	今周刊 (2024); “上市公司用水量之冠不是台積電 它用水比台積電多 20 幾倍” (2022); 中央社 (2021); TSCM (2019)

Company	2023 Mt CO <sub>2</sub> eq	Notable Problems	Data Source
台灣中油 CPC	N/A	From 2019 to 2023 paid government air pollution penalties 146 times; there were 4 fire incidents as well as 3 odor leakages in 2022	綠色公民行動聯盟 (2022); 2022年空、水々裁罰金榜首 中油、工業局連莊 (2023)
亞泥 Asia Cement (花蓮新城山礦場)	N/A	In 2023 a single mining operation in Hualian was responsible for 4.14 Mt of raw limestone extracted (assumed to have a very high emissions potential) however no CO <sub>2</sub> eq figure is reported by the company	Asia Cement Corporation (2023)
可口可樂 Coca-Cola (TW)	N/A	2024 brand audit in river pollution found 7.6 % (n = 28481) of PET plastic bottles were from Coca-Cola	Greenpeace 綠色和平 (2024)

## 7.6 Climate Anxiety Responses

A growing body of research shows climate anxiety is widespread among young people, which emotionally can both hinder and motivate sustainable action. A large worldwide study in (n = 10000, aged 16-25) by (Hickman et al., 2021) provides evidence the youth is anxious about climate in 10 countries: Australia, Brazil, Finland, France, India, Nigeria, Philippines, Portugal, the UK, and the USA. Similarly, (Thompson, 2021) finds young people around the world have climate anxiety. (Whitmarsh et al., 2022) shows worry about the climate in the UK is generally widespread (over 40% of the respondents, n = 1332), while climate anxiety is highest among young people and is a possible motivator for climate action. Additionally, (Ogunbode et al., 2022) finds climate anxiety in 32 countries and also supports the idea that climate anxiety leads to climate activism. (Thibodeau, 2022): “In 2021, the BBC polled 1,000 people in Scotland to understand the barriers to taking climate action. What they found was even though many people were aware of actions needed to take to address climate change, and had intentions to their behaviors didn’t change. This is a phenomenon called the intention-action gap.”

(Osaka, 2023) argues *doomerism* is an excuse for climate in-action. Hope is necessary for people to make changes in their habits (Marlon et al., 2019). (Seabrook, 2020) suggests music therapy

is useful in the era of climate crisis, evolving to meet current needs of young people. (Kjaergard et al., 2014) shows how “*understanding health and sustainability as a duality, health both creates conditions and is conditioned by sustainability, understood as economic, social and environmental sustainability, while on the other hand sustainability creates and is conditioned by human health*”.

A recent special issue of Behavioral Sciences’ magazine on Behavioral Science for Climate Change (2025) provides further evidence. A review of 50 studies supports the idea that climate activism shifts public opinion towards climate concern (Thomas-Walters et al., 2025). Climate change negative affect brain health through heat, air pollution, extreme weather; the study finds links to neurological, psychiatric, and cognitive disorders (Todorova et al., 2025).

When disaster hits we need high levels of *social trust*. Being part of community of trust makes it easier to act in unison. Religion is a type of community of trust. Conversely, that can also have negative effects, as in Taiwan the expected behavior of burning joss sticks and paper money, is a cause of air pollution (C. Tang & Pan, 2014)

Psychological factors influencing millennials to engage with sustainability (Naderi & Van Steenburgh, 2018)

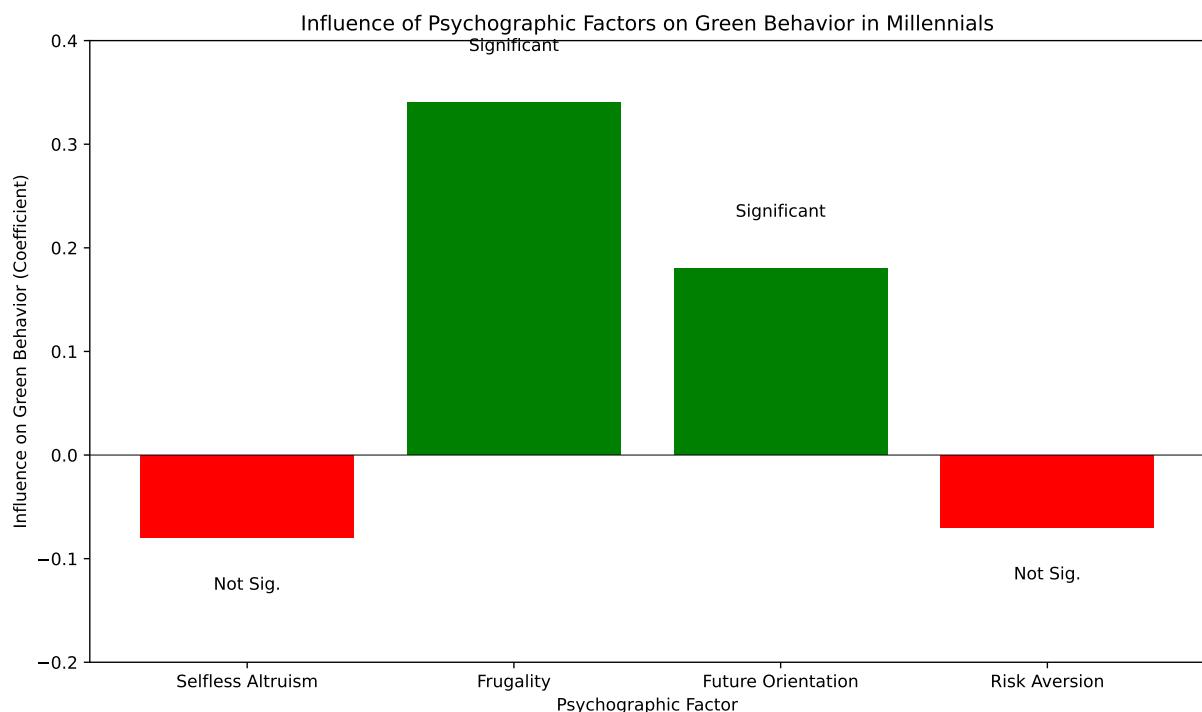


Figure 21: Psychological factors influencing millennials to engage with sustainability

## 7.7 Attitude-Behavior Gap

While people express eco-conscious ideas, it's non-trivial to practice sustainability in daily life. Translating eco-conscious attitudes into concrete sustainable actions remains challenging. Empirical evidence illustrates this gap between intention and behavior. (Park & Lin, 2020) positive attitude towards sustainable products does not result in purchase decisions, shows research of fashion in South Korea. In one Australian study, green consumers still waste food similarly to the baseline (McCarthy & Liu, 2017).

However, changing habits is important if technology alone is not the solution. (Deyan Georgiev, 2023b) reports only 30% of people in the Gen-Z age group believe technology can resolve all environmental problems. Even with good intentions, (Munro et al., 2023) finds shoppers who try to shop sustainably often fail to find sustainable product, in a systemic literature review of 64 papers from South Korea, Australia, the UK, the US, and elsewhere.

McKinsey's *Talk is Cheap* study underscores the same paradox at scale: more than 60% of global consumers say they are willing to pay extra for sustainable products, yet in reality most wouldn't pay a premium greater than about 10% (Freundt et al., 2024). A robust willingness-to-pay (WTP) literature tells a similar story. A 2021 meta-analysis covering 80 studies finds the average stated premium for sustainable food products is 29.5%; however, hypothetical surveys often overstate WTP relative to real-purchase experiments (S. Li & Kallas, 2021). In contrast, PwC's 2024 *Voice of the Consumer* survey, based on 20000 respondents in 31 countries, reports a far more modest mean sustainability premium of 9.7% that consumers are willing to pay, once inflation is factored in (PwC Global, 2024).

In short, people want eco-products but are largely price-sensitive.

## 7.8 Sustainability in Taiwan: Garbage Trucks and Digital Receipts

Musical garbage truck are a success story of the environmental progress in Taiwan (Helen Davidson & Chi Hui Lin, 2022). Indeed, they are a *user interface innovation* and the main way how people in Taiwan interact with sustainability issues.

The popular narrative about Taiwan recounts the story of the economic and environmental transformation of the country. In the late 1980s during the heights of an economic boom Taiwan became famous as the Taiwanese Miracle (臺灣奇蹟) (Gold, 1986; P.-L. Tsai, 1999). By the early 1990s another less flattering nickname appeared: "*garbage island*", for the piles of trash covering the streets and overflowing landfills (Ngo, 2020; Rapid Transitions Alliance, 2019). In the two decades that followed, from 1998 to 2018, Taiwan made progress in municipal waste management, rising to the status of a world-leader in recycling (2nd *effective recycling rate* after Germany); in addition to an effective recycling system, the average waste amount generated per person by 700g (from 1140g to 400g) per day; nonetheless, industrial recycling rates were less stellar, standing at 80% in 2020 and there were unrealized opportunities in using industry 4.0 technologies, such as internet of things (IoT) sensors for better waste tracking (Bui et al., 2023; C.-Y. Wu et al., 2021).

Progress in sustainability is possible but achieving results takes time and innovation. (Rapid Transitions Alliance, 2019) credits the Taiwanese Homemakers United Foundation (財團法人主婦聯盟環境保護基金會) for initiating the transformation in 1987, suggesting a small group of people can have an outsized impact on the whole country. Their activity didn't stop there and (財團法人主婦聯盟環境保護基金會, 2020) recounts a timeline of their achievements on their website until the present day.

(獨家觀察 – 電子發票年減碳量 相當 2,700 座大安森林公園, 2025) reports 54.03% of invoices in Taiwan are digital. Since 2021 digital receipts are mandatory for all businesses. Taiwan's longstanding receipt lottery also has specific prizes available only for digital receipts (行動支付結合雲端發票 節能減碳最環保經理人, 2018). Several other countries, such as Singapore, South Korea, Japan, Sweden, Italy, Portugal, Brazil, Mexico, have comparable systems in use.

## 7.9 Trends in Taiwanese Industry and Online Shopping

In the intensifying competition of online shopping in Taiwan, (聯合新聞網, 2024) predicts Momo and Coupang will compete for Taiwanese market leadership, with Coupang increasingly stepping on Shopee's and MOMO's toes, as per (順風婦產科 四四四四四 (@Followwindlover) on Threads, 2024).

Across online and offline, KANTAR reports Taiwan's consumer spending on fast-moving consumer-goods (FMCG) grew over 5% in 2024, speeding up towards the end of the year: +2.5% in Q1, +4.1% in Q2, +5.7 % in Q3 and +9.1% in Q4, with e-commerce crossing the 20 % share mark (traditionally FMCG are purchased physical stores, as convenience stores are so readily available all over Taiwan) (foodNEXT, 2024; Kantar Worldpanel, 2024; 動腦 Brain.com.tw, 2024; 食力 foodNEXT, 2025).

Taiwan has been on a path of change, striving to become more sustainable. Between 1970 and 2019, emitting CO<sub>2</sub>eq was largely a prerequisite for economic growth in Taiwan (T. Chang et al., 2023). Since the 1990s, Taiwan is a net CO<sub>2</sub>eq exporter through emissions embedded in the industrial production oriented economy (R. Huang et al., 2020). Starting in 2023, Taiwan's Financial Supervisory Commission's (FSC) added "requirements for Taiwan's corporates to disclose their carbon emissions," (Reformosatw, 2024). Most recently, the Taiwanese environmental ministry has been cracking down on illegal waste, with over 70 cases being prosecuted (環境部, 2025).

TIME Magazine and Statista collaborative "*World's Most Sustainable Companies Of 2024*" includes 17 Taiwanese companies (Alana Semuels, 2024).

Table 14: World's Most Sustainable Companies; data from (Alana Semuels, 2024).

Sustainability Rank	Company	Score (Out of 100)
24	Delta Electronics	77.18
63	Taishin Holdings	73.50
68	Fubon Financial	73.01

Sustainability Rank	Company	Score (Out of 100)
80	Chunghwa Telecom	71.69
91	Yuanta Financial Holdings	70.94
92	Cathay Financial Holdings	70.79
108	Taiwan Mobile	69.72
200	First Financial Holding	64.17
300	Far EasTone	60.04
301	SinoPac Holdings	60.04
344	Wistron	58.44
356	Acer	58.02
395	Nanya Technology	56.35
409	InnoLux	55.82
416	Wiwynn	55.67
421	Taiwan Cement	55.49
497	Advantech	53.14

Meanwhile, Corporate Knights which has been ranking global sustainable companies since 2005, including analysis of 7000 public companies with a revenue over US\$1 billion, only includes TSMC in the top 100 (placed 20th in 2021 and 44th in 2022, dropping out in 2023) and Taiwan High Speed Rail Corp (THSR) and Giant Manufacturing Co Ltd since 2023 (Corporate Knights, 2024; Staff, 2021). Meanwhile, earth.org's list of the world's 50 most sustainable companies in 2022, only includes 1 Taiwanese company - TSMC (Earth.Org, 2022).

Meanwhile, (Marc Lien, 2022) finds 4 millions British SMEs have no plan for net-zero transition and (Ware, 2024) adds, British workers lack skills for green transition, according to a 2024 National Environmental Services Survey.

## 7.10 Financial Literacy Worldwide and Among Taiwanese Youth

A recent nationwide study ( $n = 1997$ ) titled Youth Financial Health Basics (青少年財務健康基礎大調查) jointly conducted by the Taipei Fubon Bank and the Parent-Child Innovation Center (親子天下教育創新中心) between February 11 and March 9, 2025 found that over 65% of secondary schools incorporated financial-literacy courses into their curricula however 64% of Taiwanese youths (aged 15–18) exhibit low confidence and understanding of financial products and face significant fraud risk, with nearly 1/5 of the respondents encountering a scam in the past year, while 18% suffered actual financial losses (江昭倫, 2025; 陳美君, n.d.).

Table 15: Familiarity with financial products and preferred payment methods, as reported in (陳美君, n.d.).

Banking	% of Respondents
Have at least one financial account	80%

<b>Banking</b>	<b>% of Respondents</b>
<b>Familiarity</b>	<b>% Unfamiliar</b>
Savings accounts	70%
Mutual funds	63%
Stocks	46%
Deposit accounts	30%
<b>Payments</b>	<b>% Preference</b>
Cash	47%
Family member pays	47%
EasyCard	4%
Mobile payments	1%

Importantly for designing a financial app, while 80% of the survey respondents had received financial education at school, 90% of the students deemed the primary learning channel about financial knowledge to be on social media; and only 15% remember to have learned about credit-card usage (江昭倫, 2025).

In a much older study, (I-Cheng Yeh, 2009) analysed usage data from 30,000 credit-card clients at an undisclosed major Taiwanese bank to predict next-month defaults, using 6 data-mining techniques including ANNs (AI Neural Networks) (Yeh & Lien, 2009). Because of the age of the study there's no Gen-Z data. People aged 18-26 at the time would be Millennials or Gen-X by now. the data was donated by (Yeh, 2016) and roughly 1 in 5 credit card clients (22.1%) of the dataset defaulted on their payment in the next month. Among the 9,618 clients aged 18-29 at the time of the study, 2,197 defaulted on their next - month payment, yielding a default rate of 22.8%, slightly higher than the overall average. Meanwhile, among the 5,127 clients aged 18-26, 1,285 defaulted, yielding a rate of 25.1%, considerable higher than their older counterparts. Finally, among the 1,558 clients aged 18-23, 430 defaulted, a rate of 27.6%, pointing to a trend of younger people having higher default rates.

A over-the-phone study ( $n = 3000$ ) conducted in 2022, found Taiwanese savings habits to have polarized, with over 60% either having no savings whatsoever or saving more than 1/2 of their annual income; 27% of respondents reported total savings below NT\$40,000; young adults' (aged 20-29) were the only group whose financial risk worsened, with 43% of the respondents having extremely low financial literacy, described as 金融文盲 (near "financial illiterate") (中央社, 2022).

Table 16: Financial literacy data from phone interviews, as reported in (中央社, 2022).

Financial Literacy Among Taiwanese (2020)	Very Low	Low	Medium	High
Overall financial literacy	43.2%	34.9%	19.4%	2.5%
Understanding products & services	34.0%	38.6%	23.1%	4.3%
Confidence using products & services	30.0%	26.8%	37.6%	5.6%
Seeking financial advice	71.0%	3.2%	17.8%	8.0%

Financial Literacy Among Taiwanese (2020)	Very Low	Low	Medium	High
Personal money management	21.8%	42.9%	28.4%	6.9%

The Taiwanese Financial Literacy & Education Association 財金智慧 FINLEA is a non-profit with a stated goal of enhancing financial literacy among Taiwanese. Their longitudinal study, with the latest survey conducted in 2022 (n = 2014; 1055 high-school; 959 university) rated financial literacy among all youths 56.3 out of 100 (53.8 in 2016 and 56.7 in 2007), always below the benchmark score of 60, with high school and vocational students averaging 49.26 and university students somewhat higher averaged 64.03 score (網軟股份有限公司, n.d.).

Table 17: Latest report from the 財金智慧 FINLEA longitudinal study (網軟股份有限公司, n.d.).

Knowledge Gap (2022)	% Unaware
Unsure that employers must contribute to the labor pension (and individuals can voluntarily contribute)	68%
Unsure which deductions (income tax, labor insurance, health insurance) reduce take-home pay	66%
Unsure how education level affects starting salary	61%
Unaware of methods to lower loan interest rates	59%
Cannot identify which auto insurance covers vehicle damage	55%
Unable to judge which life-insurance need is greatest	51%
Uncertain how to choose investment tools for maximum lifetime returns	63%
Unaware that business tax makes purchases more expensive	61%

財金智慧 FINLEA does publish online videos targeted at young people, however as of early 2025, they only have around 1000 subscribers on YouTube (財金智慧 FINLEA, 2020). Meanwhile, the Taiwanese cryptocurrency influencer Mr Block has over 100000 YouTube subscribers (mrblock 區塊先生, 2025).

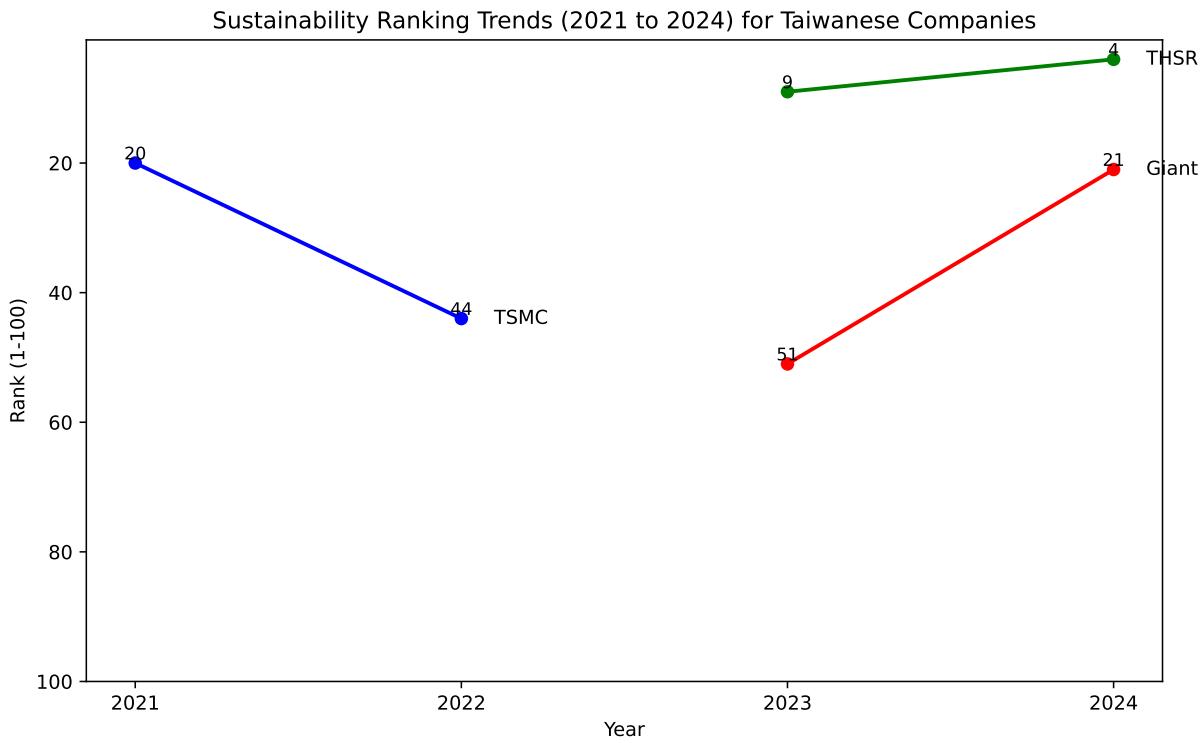


Figure 22: Taiwanese Company Ranking

#### 【JUST MONEY】系列 ► Play all

【JUST MONEY】系列影片，透過 FINLEA 專業講師—瑞瑞老師與宜家同學之間的互動對話及親身經驗分享，傳遞賺錢、存錢、花錢、信用、保險、投資及助人等理財觀念。更多資訊請關注：FINLE...



#### 【理查頭殼】系列動畫 ► Play all

FINLEA 財金智慧教育推廣協會推出【理財Talk・理查頭殼】理財頻道，跟著「理查」學「理財」，隨著動畫主角的對話「Talk」建立你的FQ「頭殼」，現在立刻跟著理查累積你的財務自由兌換券！...



Figure 24: 財金智慧 FINLEA YouTube Channel

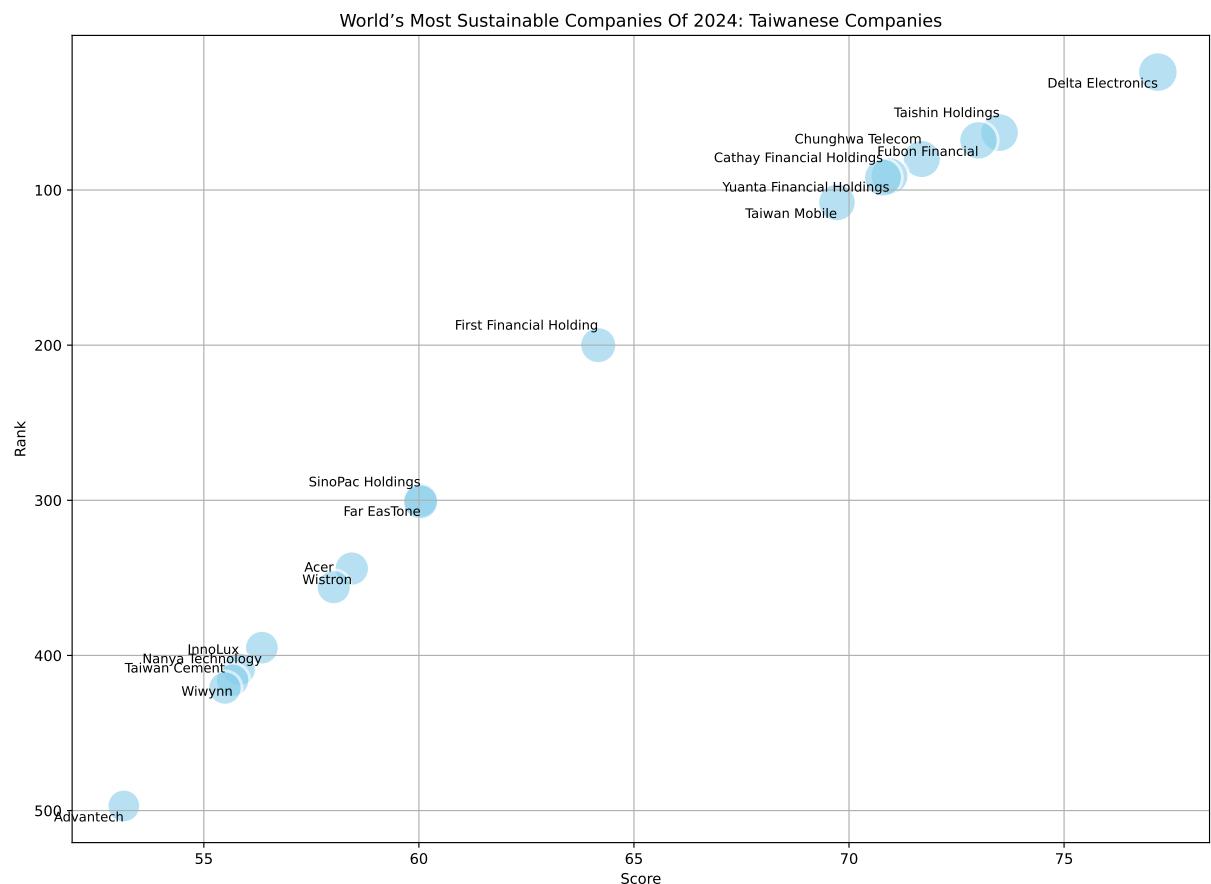


Figure 23: British Company Ranking

Internationally, there's evidence young people have money. In the United States, the combined annual consumer spending of Gen-Z and Millennials was over \$2.5 Trillion in 2020 (YPulse, 2020). Over the decade from 2020 to 2030, in the U.S., UK, and Australia, Millennials are projected to inherit \$30 Trillion USD from their parents (Calastone, 2020). (Steverman, 2022) puts the inheritance figure between 2022-2045 at an higher \$73 Trillion USD. There's also some evidence of investment interest, however with a large geographic variance. According to a (Calastone, 2020) study ( $n = 3000$ ) surveying people in the millennial age group between ages 23 and 35 in Europe (UK, France, Germany), U.S.A., Hong Kong, and Australia, 48% of respondents located in Hong Kong owned financial securities (such as stocks) while the figure was just 10% in France.

Table 18: Data from millennial investors (Calastone, 2020).

Place of Comparison	Financial Security Ownership
Hong Kong	48%
France	10%

## 7.11 Social Media, Trends, Memes, and Youth Empowerment

The term “meme,” first coined by Richard Dawkins in 1976 in his book “The Selfish Gene” to describe units of cultural evolution, analogous to that of biological evolution, which may evolve by natural selection, and now encompasses internet artifacts and even stocks. Beyond mere entertainment, memes have emerged as an academic discipline, where memes are sampled, coded, and analysed from cultural and ethical viewpoints, among others (Zidani & Miltner, 2022). (Peters-Lazaro et al., 2020) argues memes are no merely jokes but tools for communal critique and collective visioning. suggesting that Taiwanese Gen-Z memes scaffold deeper conversations about consumerism, climate action, and social change. Memes from daily life, business to war, are relevant to penetrating through the noise of the web.

In Taiwan, homegrown memes may start with global templates but quickly take on a local flavor. (劉芸嘉, 2024)'s 2021 study of 150 Taiwanese memes written in Mandarin shows most rely on friendly and indirect humor: inside jokes and wordplay that bond peers together. (朱映潔 (Ying-Chieh Chu), 2021) surveyed 737 Taiwanese Facebook users and discovered that a meme's funniness, shareability, and shock value “hellish gags” (地獄梗) drive people to post it for social approval. (胡綺珍, 2024) collected 217 “tired of life” / “I'm just trash” meme texts from Instagram and PTT, then interviewed 13 Gen-Z enthusiasts, revealing how self-deprecating jokes help Gen Z cope with stress, feel part of a group, and quietly push back against social pressure. Memes have a long history, and even almost a decade ago in 2016, a casual news comment—like the “canoing man” (泛舟哥) remark during a typhoon exploded into LINE stickers and PTT threads, proving that Taiwanese can transform everyday media moments into collective satire or tongue-in-cheek commentary (黃意能 & 黃曉琪, 2016).

Internationally, the sustainability-focused topics “underconsumption” and “deinfluencing” were trending on TikTok in 2024 however have since subdued (Fares et al., 2024; TikTok, 2024b, 2024a). While this particular trend may be over, memes still hold potential for communicating about sustainability to young Taiwanese. Still, looking at older international data, (Zannettou et al., 2018) built a large-scale machine-learning pipeline to trace the origin of memes in the US, with 160M images and 2.6B posts within about 1 year (July 2016-2017) from Twitter, Reddit, 4chan and Gab, finding that often memes originate from fringe communities and then spread across mainstream media, highlighting how fringe communities can be surprising impactful.

In Taiwan, Internet usage among young people is nearly universal, with over to 98% of 18–29 (roughly Gen-Z) year olds reporting they have gone online at least once recently, and close to 96% of respondents aged 18-29 used some form of social media (財團法人台灣網路資訊中心 & 台灣資訊社會研究學會, 2023).

Table 19: Taiwanese Internet Usage Statistics; data from (財團法人台灣網路資訊中心 & 台灣資訊社會研究學會, 2023).

Metric	18–29	30–39
Daily Internet usage	98.79 %	98.40 %
Overall social-media usage	95.98 %	94.84 %
TikTok usage	33.03 %	24.28 %

(林高賢, 2024) analysed (n = 1175) Taiwanese high school students, mostly aged Gen-Z, finding that Instagram (IG) dominates, used by close to 85% percent of the respondents; they use IG for about 2 hours per day, 5-6 days per week; moreover, respondents often feel anxious (1-2 days per week), and anxiety correlates with several motivations of using IG, such as recording life moments, documenting travel, food, and fitness with photos, was tied to higher anxiety, possibly related to the photo-centric self-presentation on Instagram, why can be theorized to heighten sensitivity to feedback and criticism. In contrast, (陳思凝, 2023) conducted a survey of 458 Taiwanese Gen Z Instagram users, finding that higher Instagram use intensity is directly associated with greater online subjective well-being; however, intense use also leads to information overload and social comparison, which induce social media fatigue and in turn erode well-being; moreover, users’ perceived intimacy with the platform amplifies the link between use intensity and social comparison frequency. An online survey by (廖柏雅, 2024) (where the Gen-Z cohort n = 125) found respondents to be highly motivated by social and entertainment use; the user’s fear of missing out (FoMO) was found to be related to the motive; e.g. people with social and entertainment drives experience greater FoMO than those motivated primarily by information seeking. (Lasnik, 2018) surveys college students at the National Dong Hwa University in Hualian (n = 300, a mix of Taiwanese and international students), using the Liebowitz Social Anxiety Scale (LSAS) and Taijin Kyofusho Scale (TKS) as research instruments, finding Taiwanese students ranked higher on the Taijin Kyofusho, suggesting the fear of offending or disturbing others is stronger among local students.

A large-scale (n = 2075) representative face-to-face survey among people aged 18 to 93 years in

Taiwan (no age-based categorization was published for Gen-Z specifically), found that in general sharing one's thoughts online (known academically as "self-disclosure") boosts perceived social support and significantly boosts bonding and bridging social capital, which increases life satisfaction and lowers loneliness (樊一寧 et al., 2024). Conversely, in Japan, while not directly comparable, Gen-Z reports wanting privacy and 75% feel others overshare on social media and 49 percent were concerned about their personal data (McKinsey & Company, 2022).

## 7.12 AI Use Among Taiwanese Students

A survey of college students in March 8–10, 2023 at the Chung Yuan Christian University (n = 983) in Taoyuan (Northern Taiwan), yielded the following results: 66% of the students had used ChatGPT, with the top use cases being summarization (31%), translation of articles (28%), and writing reports (24%) (CYCU, 2023; 許維寧, 2023). However, in terms of AI adoption, this data can be considered out-dated. ChatGPT was first released to the public on November 30, 2022, so the students had had only about 3 months to try it out (OpenAI, 2022). At the time, the GPT-3.5 model was available; the revolutionary GPT - 4 was released to the public on March 14, 2023, (OpenAI, 2023).

In a more recent large-scale survey focusing on AI literacy administered to the general public (n = 2174) found that only 26% of the respondents had used ChatGPT in the past 3 months (in comparison with the 25% from a similar survey administered in the previous year); younger people had higher usage patterns, 53% for 18-29 and 37% 30-39; meanwhile, 69% of respondents believed they could tell the difference between AI-generated and non-AI content and 73% supported some type of government regulations for AI (HakkaNews, 2024).

A Chinese study from two authors at the Minzu University and Beijing Normal University reports they recruited anonymous Taiwanese college students (n = 916) on the Chinese Credamo platform from the Taiwanese IP-space (ChatGPT is blocked in Mainland China, Macau, and Hong Kong) to compare ChatGPT vs. Google for academic use among Taiwanese students: their findings show a clear preference for ChatGPT overall, which students deemed more flexible (meanwhile some older students still preferred Google) and Random Forest and LightGBM-based modeling predicted tool choice by three main factors: 1) GenAI fluency, 2) awareness of GenAI hallucinations, and 3) user age; their recommendations include 1) support critical-thinking among users, and 2) design hybrid chat+search user interfaces with higher reliability (Kelly, 2024; Qiao & Lee, 2024; M. Zhang & Yang, 2024). In the US, an older study of young adults (Millennials at the time) highlights how they "*use Google as a reference point for ease of use and simplicity*", (Kate Moran, 2016). The web now has several generations of native users, and some older usage patterns which older digital natives are used to, may take time to change.

In Sweden, a large-scale (n = 5894) survey across several Swedish universities showed college students' attitudes towards AI assistants (ChatGPT was by far the most prevalent app, 95 % of respondents had heard of ChatGPT and 35 % used it regularly); 55.9% held a positive attitude toward AIs; integrity was a hotly debated question, 62% calling AI use in exams "cheating," but 60% rejecting an outright ban, and 58% saying it doesn't violate the purpose of education (Stöhr et al., 2024).

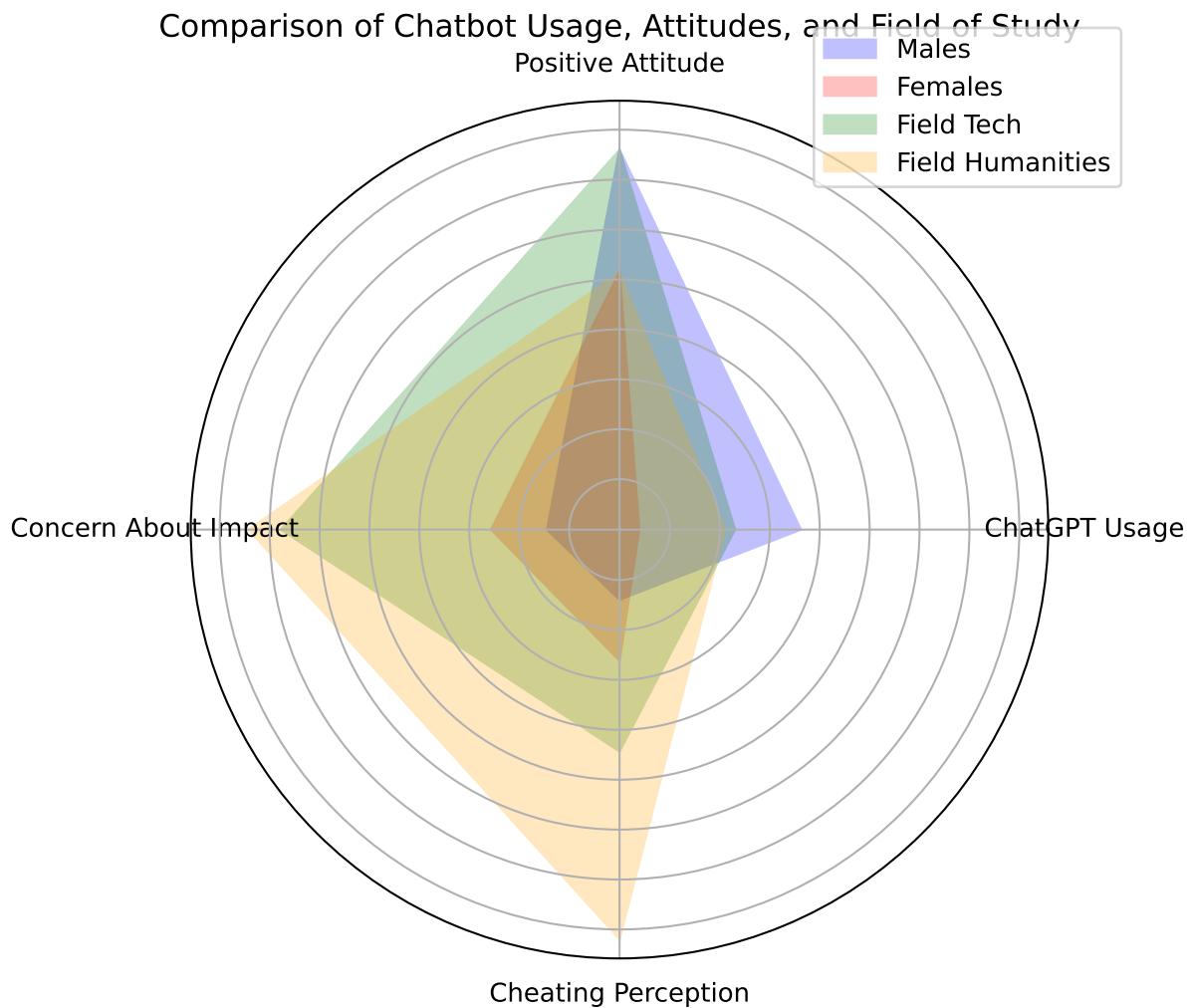


Figure 25: Swedish College Students' Attitudes Towards AI Assistants

## 8 SUSTAINABILITY

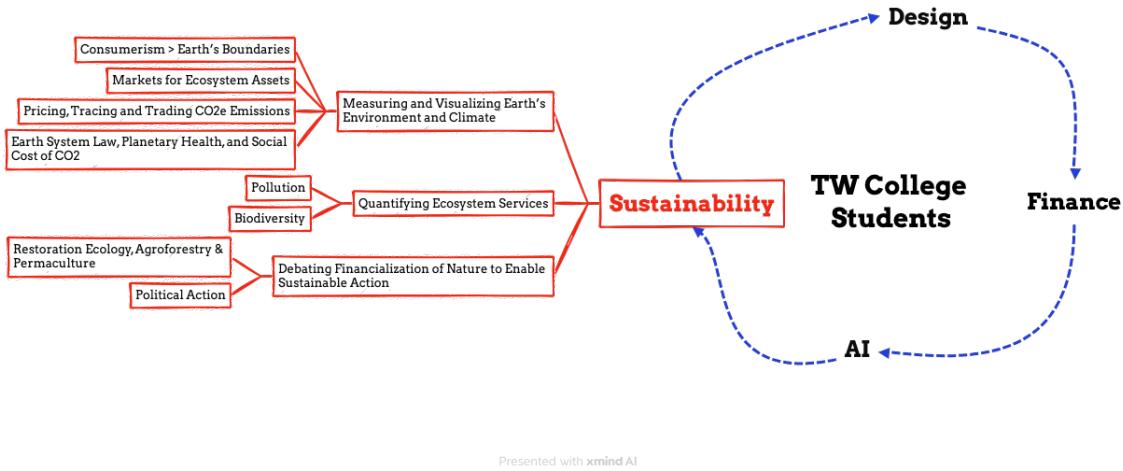


Figure 26: Visual abstract for the sustainability chapter

### 8.1 The Roots of Sustainability in Environmentalism

“Nachhaltigkeit” - *sustainability* in German - was likely the first use of the concept of preserving natural resources, conceived by a tax accountant Hannß Carl von Carlowitz in 1713 in his seminal book on forestry - *Sylvicultura oeconomica* - , referring to the goal of achieving prudent forest management practices in his native Saxony in Southeastern Germany, which at the time was under severe *deforestation* pressure from mining, ship-building and agricultural production (Gottschlich & Friedrich, 2014; Hannß Carl von Carlowitz, 1713). This particular field of sustainability study is now known as *sustainable yield of natural capital*. The *principal* of the natural resource being managed, such as in fishing and forestry, shouldn’t be over-harvested in order to maintain *ecosystem services* - a contemporary term from the theory of *natural capital*, referring to benefits humans receive from the stock of world’s natural resources (Peter Kareiva et al., 2011).

Defining sustainability perhaps more poetically, the American wildlife ecologist Aldo Leopold proposed the idea of *land ethics* in 1972 as “[a] thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise” in his landmark work *A Sand County Almanac* (Leopold, 1972). In a similar vein, the 1987 United Nations’ Brundtland Report titled “*Our Common Future*” defined *sustainable development* as “*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (World Commission on Environment and Development, 1987). Given these varied ideas for over 300 years, I believe some percentage of people have been concerned with our planet’s natural environment and its preservation already for centuries.

Yet, it is only in the last 100 and so years that human activities have begun to affect Earth's systems on a previously unseen scale - termed *Anthropocene* -, necessitating a deeper understanding of human-nature interactions, such as in the case of climate change, which is rapidly changing the face of our living environments.

## 8.2 Measuring and Visualizing Earth's Climate Systems

Studies of Earth's climate go back for over 200 years, starting with Alexander von Humboldt, the founder of climatology, who revolutionized cartography by inventing the first *isothermal maps* in 1816; these maps showed areas with similar temperature, variations in altitude and seasons in different colors (Honton, 2022) now available as 3D computer models (*Alexander von Humboldt's Original Isotherms Circa 1838*, 2023). Already in 1896, the Nobel Prize winner Svante Arrhenius first calculated how an increase in CO<sub>2</sub> levels could have a warming effect on our global climate (Anderson et al., 2016; Wulff, 2020). In 1938, Guy Stewart Callendar was the first scientist to demonstrate the warming of Earth's land surface as well as linking the production of fossil fuels to increased CO<sub>2</sub>e and changing climate (Hawkins & Jones, 2013). Early scientists pioneered climate modeling by calculating the first climate interactions which precede today's complex computer-based *Earth System Models (ESMs)* that integrate the various Earth systems and cycles run on supercomputers (Anderson et al., 2016).

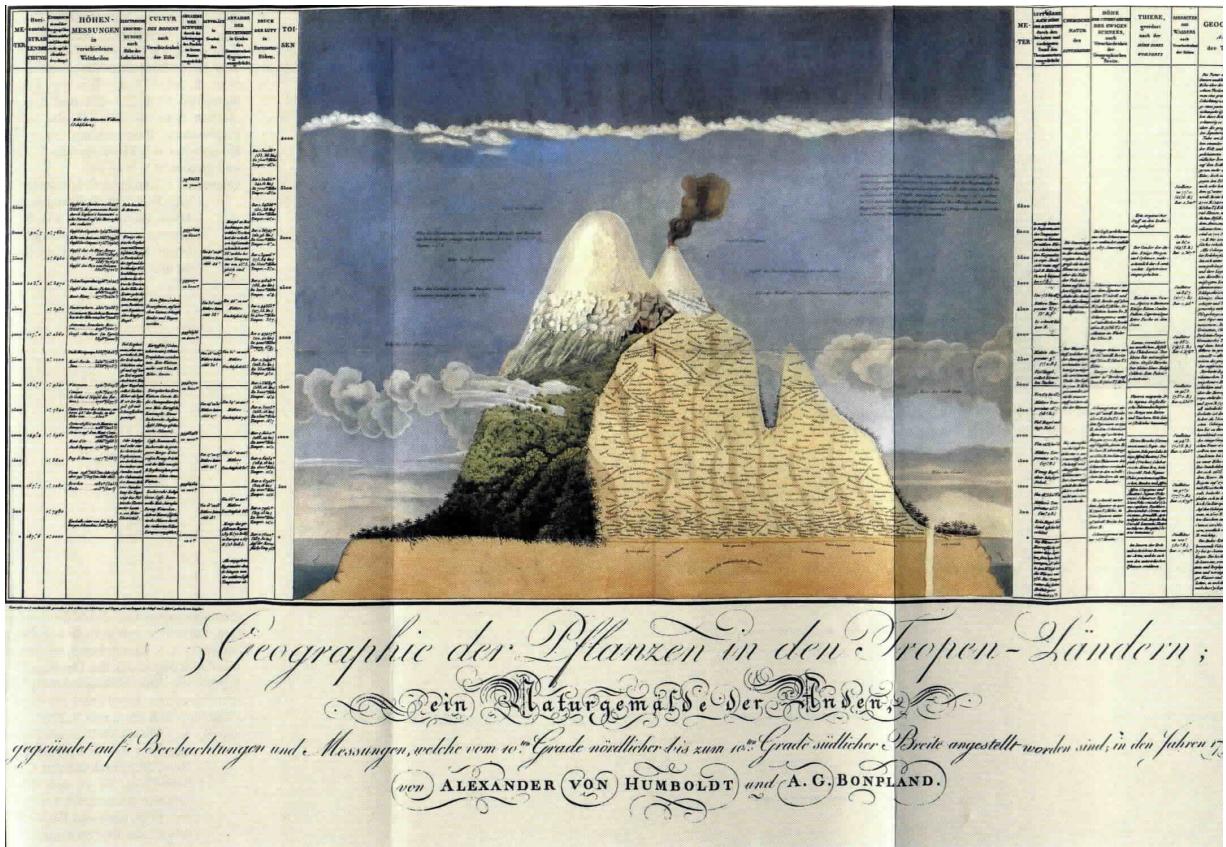


Figure 27: Humboldt's Naturgemälde, early data visualization of ecology, rain, temperature, elevation, etc

Environmental activists have been calling attention to global warming for decades, yet the world has been slow to act (McKibben, 1989). While the scientific case for human-induced climate change was building, it took 120 years after Arrhenius' calculations, until the Paris Climate Agreement in 2016, that countries came to an agreement on non-binding targets on keeping CO<sub>2</sub> levels 1.5 °C below pre-industrial levels (defined as 1850–1900)(United Nations, 2016). Even though awareness of Earth's warming climate was growing ever stronger, the CO<sub>2</sub> emissions kept rising too. The hockey-stick growth of CO<sub>2</sub> concentration since the industrial revolution is clear in the data from 1958 onward, following a steady annual increase, called the *Keeling Curve* (Keeling & Keeling, 2017). Written records of global temperature measurements are available starting from the 1880s, when temperatures began to be documented in ship logs (Brohan et al., 2012). Finally, although perhaps less accurately, temperature estimations from tree-trunks allow some comparisons with the climate as far back as 2000 years ago (Rubino et al., 2019).

April 2025 was Earth's 2nd-warmest April on record, with global temperatures reaching 1.32°C above the 20th-century average, driven by persistent El Niño conditions and record-high ocean temperatures (Masters, 2025). This warming aligns with growing concerns about Earth's energy imbalance, which recent satellite data suggest has nearly doubled since 2005; more heat is being trapped in the climate system than is being radiated back to space (Mauritsen et al., 2025).

Compounding the issue, 3 key NASA climate satellites responsible for monitoring Earth's energy budget are nearing the end of their operational life with no replacement missions currently planned, raising alarms about the continuity and reliability of future climate data (Harvey, 2025). Likewise, funding for the Scripps Institute, responsible for the Keeling Curve, is under threat, according to its caretaker, Ralph Keeling.

The Keeling Curve apparatus measures absorption of infrared light, which allows one to detect the amount of CO<sub>2</sub>eq in the air. It also has an advanced calibration system where it makes measurements in air with a known quantity of gases (Worthington, 2025b).

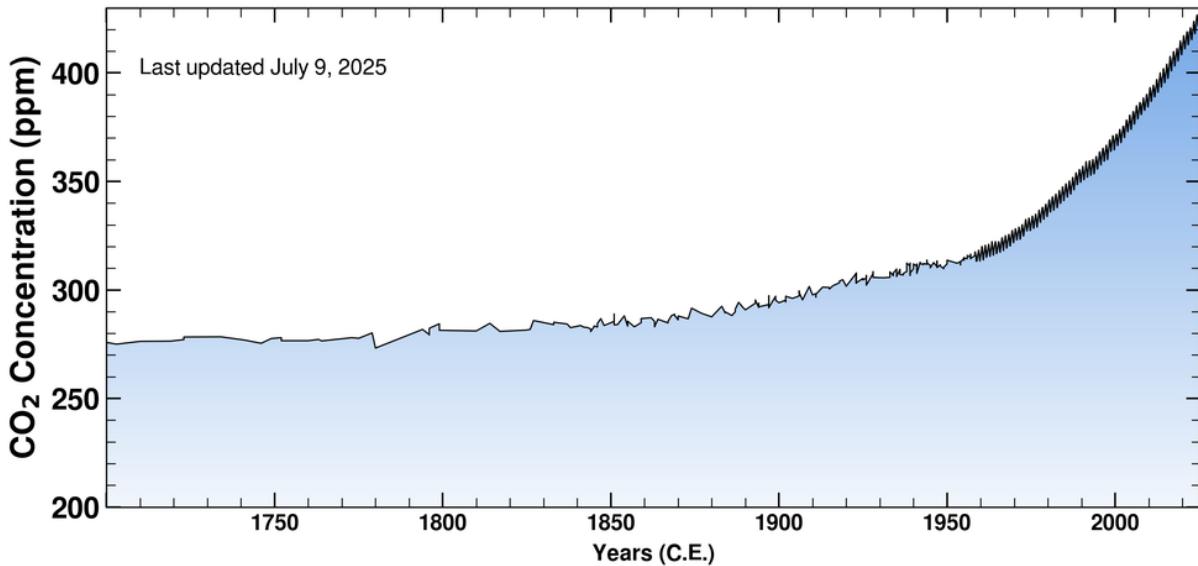


Figure 28: CO<sub>2</sub> concentration in the atmosphere as of 2025. Image Credit: Scripps Institution of Oceanography at UC San Diego.

The latest data from 2023 shows our current world population of 8 Billion people emitted 37.2 gigatonnes (i.e. billion metric tons) of CO<sub>2</sub>e per year, the highest emissions recorded in history (Statista, 2023a). Since 1751, cumulative CO<sub>2</sub>eq emissions have exceeded 1.5 trillion tonnes globally or when expressed in CO<sub>2</sub>eq for all green house gases, total historic emissions would reach roughly 1.7 trillion tonnes CO<sub>2</sub>eq since the start of the Industrial Revolution.(Global Carbon Budget, 2023; Marvel, 2023). In order to limit global warming to 1.5 °C as agreed by the world nations in Paris, removal of 5-20 gigatons of CO<sub>2</sub>e per year would be needed according to reduction pathways calculated by the Intergovernmental Panel on Climate Change (IPCC) (UNFCCC Secretariat, 2022; Wade et al., 2023). Yet, most countries are missing the mark (Climate Analytics & NewClimate Institute, 2023; United Nations Environment Programme, 2023). The European Union's Copernicus Climate Change Service (C3S) reports 1.5 °C global warming has already been breached in 2024 temperatures (*First Time World Exceeds 1.5C Warming Limit over 12-Month Period*, 2024; *World's First Year-Long Breach of Key 1.5C Warming Limit*, 2024). Given the current pace of climate change action, the G7 countries (Canada, France, Germany,

Italy, Japan, United Kingdom, United States) are heading for 2.7 °C of warming by 2050 (CDP, 2022).

(United Nations Environment Programme (UNEP), 2021) reported as of 2021 updated national climate pledges (NDCs) and other mitigation measures are projected to lead to a global temperature increase of approximately 2.7°C by 2100, significantly surpassing the Paris Agreement's aspirational goal to keep global warming below 1.5°C this century; effective implementation of net-zero emissions pledges could still keep warming around 2.2°C (approaching the Paris Agreement's goal of below 2°C), if countries cut methane emissions from fossil fuel, waste, and agricultural sectors, bridging the current emissions gap - and carbon markets might significantly cut emissions, if they are governed by clear rules ensuring genuine emission reductions, alongside transparent systems for monitoring and tracking progress - however, numerous national climate strategies postpone substantial action until after 2030. A year later, the 2022 Emissions Gap report showed a somewhat worsening situation, with existing national pledges leading the world for around 2.8 °C of warming by 2100 (United Nations Environment Programme, 2022)

Earth's physical systems are very sensitive to small changes in temperature, which was not understood until the 1970s(McKibben, 2006). A comprehensive review of evidence from paleoclimate records until current time, including ocean, atmosphere, and land surface of points towards substantial climate change if high levels of greenhouse gas emissions continue, termed by the authors as *climate sensitivity* (Sherwood et al., 2020). Global warming may lead to the slowing down and complete stop of the Atlantic meridional overturning circulation (AMOC) which helps maintain climate stability (Ditlevsen & Ditlevsen, 2023). Apart from CO<sub>2</sub>, reduction of other atmospheric pollutants, such as non-CO<sub>2</sub> greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs) is required for climate stability (J. Lin et al., 2022).

(Armstrong McKay et al., 2022a; TED, 2024) warns that climate is not a linear system, rather there are several non-linear climate tipping points, where change accelerates: at the current warming ice - sheet collapse, permafrost thaw, Amazon dieback and coral - reef loss are likely to tip between 1.5 °C and 2 °C, underscoring that the Paris Agreement range is far from a safe limit. (Armstrong McKay et al., 2022b) synthesize paleoclimate records, observations, and model projections to revise and rank both global “core” and regional “impact” climate tipping elements by their warming thresholds, visualized in the chart below.

### 8.2.1 Measuring CO<sub>2</sub>e Emissions

Technology improves and measurements have become more accurate yet CO<sub>2</sub>e emissions are not yet completely accounted for. (Crippa et al., 2020) reports the latest figures CO<sub>2</sub>e from the EU's Emissions Database for Global Atmospheric Research (EDGAR). The EU Copernicus satellite system reveals new greenhouse emissions previously undetected (Daniel Värjö, 2022). *Copernicus Climate Change Service (C3S) provides “[n]ear-real time updates of key global climate variables”*(The Copernicus Climate Change Service, 2024). Using simple python code and freely available images from online datasets, it's increasingly possible for anyone to detect deforestation, as in this example of geospatial analysis from Amazon AWS (AWS, 2022; P. Patel, 2025).

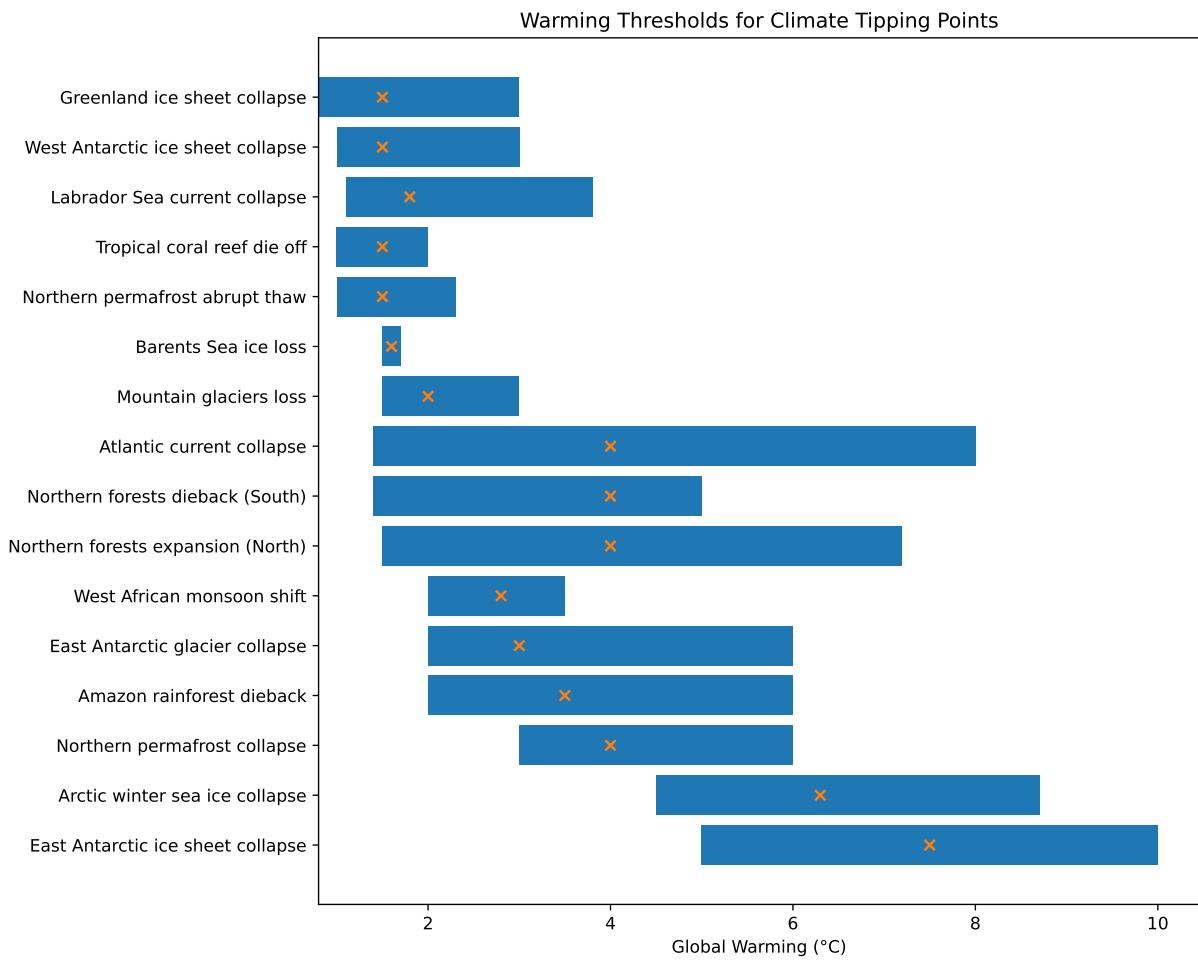


Figure 29: Climate Tipping Points

One major cross-cutting category the IPCC tracks separately is LULUCF (Land Use, Land-Use Change, and Forestry). Depending on whether forests are being cleared or restored, LULUCF can act as a net greenhouse-gas source or as a powerful carbon sink that removes CO<sub>2</sub> from the atmosphere. LULUCF also links to biodiversity protection. (Y. Chen et al., 2023) looked at the Poyang Lake in China between 2010-2020, finding ecosystem vulnerability rose by 18% with human activities (land-use change, urban expansion, components of LULUCF, also reported in international media, see (Scarr & Sharma, 2021) for images) as the dominant driver, followed by climate factors. (Xie et al., 2021) mapped pollution sources in 14 vulnerable areas in China, including the Poyang Lake, and underlined the need for real-time monitoring of ecosystem health.

Emissions production is highly unequal, with “[t]he world’s top 1% of emitters produce over 1000 times more CO<sub>2</sub>eq than the bottom 1%” (IEA, 2023a). The share of CO<sub>2</sub> emissions among people around the world is highly unequal across the world (referred to as *Carbon Inequality*). (Chancel, 2022) reports “one-tenth of the global population is responsible for nearly half of all emissions, half of the population emits less than 12%”. Information and communications technology (ICT) sector is an example of carbon inequality, where emerging economies bear 82% of the emissions, developed countries gain 58% of value, of the over 300 million PCs sold per year (Bajarin, 2022; X. Zhou et al., 2022).

CO<sub>2</sub>e emissions by region (per year), comparing highest per capita CO<sub>2</sub>e emissions (mostly from oil producers) vs regional average per capita CO<sub>2</sub> emissions vs total CO<sub>2</sub> emissions.

Table 20: CO<sub>2</sub> Emissions Comparison (Crippa et al., 2020; European Commission. Joint Research Centre., 2022; Ivanova et al., 2020; Z. Liu et al., 2023; World Resources Institute, 2020).

<b>Regional Average Per Capita Emissions (2020)</b>	<b>Highest Per Capita Emissions (2021)</b>	<b>Highest Total Emissions (2021)</b>
North America 13.4 CO <sub>2</sub> e tonnes	Palau	China
Europe 7.5 CO <sub>2</sub> e tonnes	Qatar	United States
Global Average 4.1 CO <sub>2</sub> e tonnes	Kuwait	European Union
Africa and the Middle East 1.7 CO <sub>2</sub> e tonnes	Bahrain	India
	Trinidad and Tobago	Russia
	New Caledonia	Japan
	United Arab Emirates	Iran
	Gibraltar	Germany
	Falkland Islands	South Korea
	Oman	Indonesia
	Saudi Arabia	Saudi Arabia
	Brunei Darussalam	Canada
	Canada	Brazil
	Australia	Turkey
	United States	South Africa

Scoping CO<sub>2e</sub> emissions into 4 main categories helps to organize calculating CO<sub>2e</sub> emissions and corresponding reduction targets by looking at direct and indirect emissions separately. The U.S. National Public Utilities Council (NPUC) decarbonization report provides a useful categorization of *emission scopes* applicable to companies which helps organize emission reduction schemes (National Public Utilities Council, 2022) based on the Greenhouse Gas Protocol defined in the 1990s (GHG Protocol, n.d.). For example, for consumers in Australian states and territories in 2018, 83% of the GHG emissions are Scope 3, meaning indirect emissions in the value chain (Goodwin et al., 2023). A newer concept is Scope 4 emissions also known as avoided emissions, proposed by the World Resources Institute (WRI) in 2013 (Plan A, n.d.).

Table 21: Definition of Emission Scopes From (National Public Utilities Council, 2022). One's scope 3 emissions are someone else's scope 1 emissions.

Emission Scope	Emission Source
Scope 1	Direct emissions
Scope 2	Indirect electricity emissions
Scope 3	Value chain emissions
Scope 4	Avoided emissions

Countries have agreed up CO<sub>2e</sub> Reduction Targets known as Country-Level Nationally Determined Contributions (NDCs). While most countries have not reached their Nationally Determined Contributions, the Climate Action Tracker data portal allows comparing countries by their NDC performance (Climate Analytics & NewClimate Institute, 2023). (Fransen et al., 2022) notes that the majority of Nationally Determined Contributions (NDCs) are dependent on financial assistance from the international community.

Table 22: Climate Action Tracker's country comparison of the 10 top polluters' climate action (Climate Analytics & NewClimate Institute, 2023).

Country or Region	NDC target
China	Highly insufficient
Indonesia	Highly insufficient
Russia	Critically insufficient
EU	Insufficient
USA	Insufficient
United Arab Emirates	Highly insufficient
Japan	Insufficient
South Korea	Highly insufficient
Iran	Critically insufficient
Saudi Arabia	Highly insufficient

Fossil fuels are what powers humanity as well as the largest source of CO<sub>2</sub> emissions. (IEA, 2022) reports “Global CO<sub>2</sub> emissions from energy combustion and industrial processes rebounded in 2021 to reach their highest ever annual level. A 6% increase from 2020 pushed

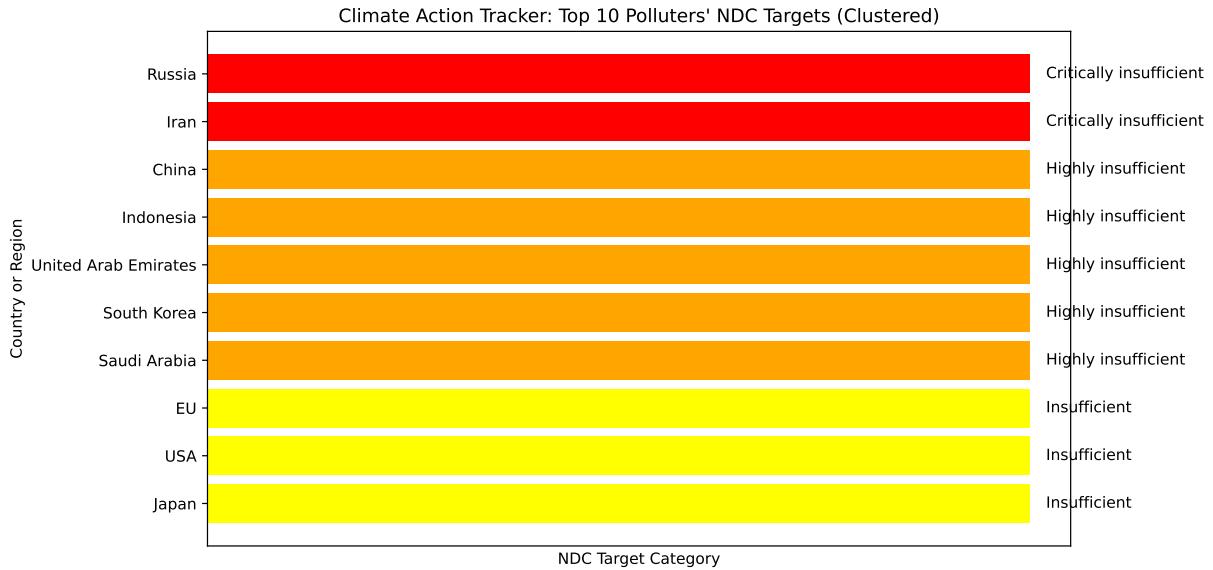


Figure 30: Nationally Determined Contributions (NDCs)

emissions to 36.3 gigatonnes". As on June 2023, fossil fuel based energy makes up 82% of energy and is still growing (Institute, 2023). The 425 largest fossil fuel projects represent a total of over 1 gigaton in CO<sub>2</sub> emissions, 40% of which were new projects Kühne et al. (2022). Tilsted et al. (2023) expects the fossil fuel industry to continue to grow even faster. In July 2023, the U.K. granted hundreds of new oil and gas project licenses in the North Sea (*Rishi Sunak to Green-Light Hundreds of New Oil and Gas Licenses in North Sea*, 2023).

(Ember, 2025) Ember's Electricity Data Explorer shows Taiwanese energy usage based on data from Taiwanese government, visualizing the growth in gas, wind, and solar, and decline of coal and nuclear power; however, while declining, coal remains the leading power source for Taiwan. Climate pledges made by international companies present in Taiwan mean they need large amounts of green energy to meet their sustainability goals. For instance, Google worked with the government of Taiwan to change the laws to allow direct power procurement by foreign companies; the current plan being to install 1 gigawatt of solar power fully pre-purchased by the newly formed company created by BlackRock and Google for boosting AI development as reported by (S. Chiang, 2024; Jessop et al., 2024; 永鑫能源 New Green Power, 2022). More recently, Google also purchased 10MW of geothermal energy for its Taiwanese AI chip projects, doubling current Taiwanese geothermal capacity (Hagström-Ilievska, Apr. 17, 2025 18:00; Potter, 2025; Jeffery Wu & Thompson, 2025). Geothermal energy provides 24/7 clean energy from the Earth's core, however is limited due to lack of access; Taiwan happens to be in geologically active spot on the ring of fire, where drilling for geothermal energy is more feasible (M. Chang & Hsiao, 2025; L, 2025b).

### 8.2.2 Carbon Accounting, Emissions Trading Schemes

Trading CO<sub>2e</sub> emissions can be divided into 2 categories, namely *Compliance Carbon Markets* (CCM) and *Voluntary Carbon Markets* (VCM). The legislative baseline for Compliance Carbon Markets is so low, people want to retire more CO<sub>2e</sub>, which they can do through *Voluntary Carbon Markets*.

As of 2024 there's no single global CO<sub>2</sub> trading market but rather several local markets as described in the table below. Most of the world is not part of a CO<sub>2</sub> market.

Table 23: CO<sub>2</sub> credit trading markets around the world from (*International Carbon Market*, n.d.).

CO <sub>2</sub> Market	Launch Date	Comments
EU	2005	EU: (Araújo et al., 2020)
South Korea	2015	
China	2021	China's national emissions trading scheme (ETS) started in 2021 priced at 48 yuan per tonne of CO <sub>2</sub> , averaged at 58 yuan in 2022 (Ivy Yin, 2023; H. Liu, 2021).
U.S.	2013	No country-wide market; local CO <sub>2</sub> markets in California, Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont
New Zealand	2008	New Zealand (Rontard & Reyes Hernández, 2022) (need access, important NCKU doesn't subscribe)
Canada	2013	

The price of CO<sub>2e</sub> differs across markets, as assigning a monetary value to reducing CO<sub>2e</sub> emissions depends on several variables. (Stern, 2022b) argues carbon-neutral economy needs higher CO<sub>2e</sub> prices and believes (Rennert et al., 2022) CO<sub>2e</sub> price per ton should be 3,6x higher than it is currently. Contrary, (Ritz, 2022) argues optimal CO<sub>2</sub> prices could be highly asymmetric, low in some countries and high (above the social cost of CO<sub>2e</sub>) in countries where production is very polluting. The total size of carbon markets reached 949 billion USD in 2023, including Chinese, European, and North American CO<sub>2</sub> trading (LSEG & Susanna Twidale, 02/12/2024, 02:37 PM).

The prices between compliance and voluntary markets differ substantially.

Table 24: Compliance market CO<sub>2</sub> prices on August 12, 2023; data from (CarbonCredits, 2023; Ember, 2023; Trading Economics, 2023).

Compliance Carbon Markets	Price (Tonne of CO <sub>2</sub> )
---------------------------	-----------------------------------

EU	83 EUR
UK	40 Pounds
US (California)	29 USD
Australia	32 USD
New Zealand	50 USD
South Korea	5.84 USD
China	8.29 USD

Table 25: Voluntary market CO<sub>2</sub> prices on August 12, 2023; data from (CarbonCredits, 2023).

Voluntary Carbon Markets	Price (Tonne of CO <sub>2</sub> )
Aviation Industry Offset	\$0.93
Nature Based Offset	\$1.80
Tech Based Offset	\$0.77

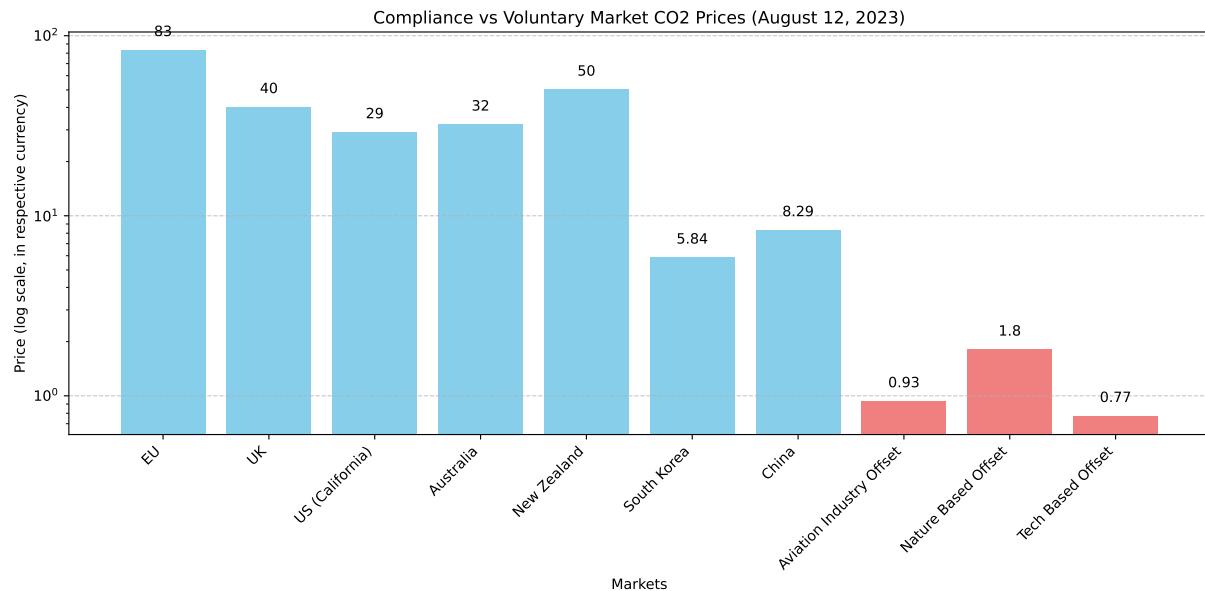


Figure 31: Carbon Credits

Voluntary Carbon Markets are a decentralized system where private entities voluntarily buy and sell carbon credits (ICVCM, 2025). Carbon credits are useful for private companies who wish to claim *carbon neutrality*, *climate positivity*, or other related claim, which might be viewed in good light by their clients or allow the companies to adhere to certain legislative requirements. In the simplest terms, a carbon credit represents 1T of CO<sub>2</sub>eq that has been prevented from entering the atmosphere - or has been removed from circulation (aka Carbon Credit Retirement) (Anna Watson, 2022, 2023). However it's important to look at the details of these deal as Voluntary Carbon Markets (VCM) lack standardization and transparency (Ela Khodai, 2023). For example,

Flickr only invested around 3000 USD in carbon credits and got a carbon-neutral rating, which hardly seems enough for an organization of its size (Climate Neutral, 2024).

Markets are centered around carbon credits, nature-backed financial derivatives dependent on science-based methodologies for measurement, reporting, and verification (MRV), which are managed and regularly updated by certification organizations such as Gold Standard, Verra, and others. Some standards released in the past few years include the Verra Agricultural Land Management methodology for Verified Carbon Standard (VCS) (Verra, 2023). Gold Standard recently released a methodology for Mangrove-based carbon credits (Gold Standard, 2024). Regen Network released a methodology for regenerative grazing systems, proposing remote-sensing analysis with field-sampled soil carbon data, quantifying GHG sequestration and ecological co-benefits (biodiversity, water-infiltration, etc.) for robust MRV and carbon-credit issuance (*Methodology for GHG & Co-Benefits in Grazing Systems*, 2022). KlimaDAO, unhappy with the current standards, published “An open call for alternative carbon standards” inviting carbon-credit issuers and communities to propose next-generation registry frameworks and leverage blockchain for transparency, liquidity and interoperability in the voluntary carbon market (KlimaDAO, 2023a).

Table 26: Criteria for carbon credit projects from (Verra, 2023).

Criteria	Description
Baseline	Ecosystem carbon sequestration rate without the intervention (project)
Additionality	New carbon capture or prevention of emissions
Permanence	Carbon storage time (should be long-term)
Leakage	Risk of shift to causing emissions (for example because of deforestation)

For the individual person, there's no direct access to CO<sub>2</sub> markets. However, brokers do buy large amounts of carbon credits to resell in smaller quantities to retail investors. Facilitating citizens' access to CO<sub>2</sub> emissions trading may be an efficient method to organize large-scale CO<sub>2</sub> retiring (Rousse, 2008). (Sipthorpe et al., 2022) compares traditional and blockchain-based solutions to carbon trading, arguing that blockchain solutions for CO<sub>2</sub>eq markets are nearing maturity, and offer many improvements, such as enhancing transparency, trust, and efficiency.

CO<sub>2e</sub> credits have given rise to the Carbon Accounting industry, to help companies meet legal emissions reduction targets in Compliance Carbon Markets, with many companies like Watershed, Greenly, and Sustaxo providing services. (Quatrini, 2021) admits sustainability assessments are often complex and may give flawed results. Nonetheless, CO<sub>2</sub> emission reduction has the added positive effect of boosting corporate morale (J. Cao et al., 2023).

There are many companies which facilitate buy carbon credits as well as a few organizations focused on carbon credit verification. In Estonia, startups Arbonics and Single.Earth are trialing this approach in several forests. The most established certifiers or carbon credits include the

Verified Carbon Standard (VCS), the Gold Standard, Climate Action Reserve (CAR), and the American Carbon Registry (ACR).

*“Carbon pricing is not there to punish people,”* says Lion Hirth (Lion Hirth, n.d.). *“It’s there to remind us, when we take travel, heating, consumption decisions that the true cost of fossil fuels comprises not only mining and processing, but also the damage done by the CO<sub>2</sub> they release.”* Long term cost of insufficient climate action is more than short-term gains from delaying efforts to reduce carbon emissions. In addition to the damages from global warming, the fossil energy production that’s a large part of global CO<sub>2</sub>eq emissions has caused several high-profile pollution events. Large ones that got international news coverage include Exxon Valdez and Deepwater Horizon.

Carbon credit prices should reflect the quality of the carbon reduction. Nature-based carbon removal solutions (for example, forest-backed carbon credits) rank among the top solutions for mitigating climate change but require price signals that reflect their true value; Pachama’s (an AI-based carbon removal company) calculation from bottom up cost modeling across more than 150 reforestation projects indicate that high quality forest carbon removal credits must trade at a minimum of USD 50-82 per tonne of CO<sub>2</sub>eq to be competitive with alternative land uses (IPCC AR6 guidance sets the price spread wider, from USD 50-200); reduced land-use change (basically this means not cutting down forests, IPCC groups together as LULUCF, Land Use, Land-Use Change and Forestry) ranks 2nd to solar energy in terms of carbon reduction potential (Luik, 2025; Pachama, 2023).

### **8.2.3 Markets Financialize the Natural World: Pricing, Tracing, and Trading Ecosystem Services and Nature-backed Assets**

Similarly to carbon markets, markets for nature-backed assets and ecosystem services are centered around different types of credits.

Table 27: Types of nature-backed assets and tradeable ecosystem services (Borges et al., 2022; Deloitte, 2024; Fiegenbaum, 2024; PWC, 2025; Rossberg et al., 2024; U.S. Securities and Exchange Commission, 2023)

Asset Type	Description
Carbon Credits and Offsets	Represent avoided or removed CO <sub>2</sub> eq emissions through reforestation, soil health improvements, regenerative farming practices that sequester carbon, etc
Biodiversity Credits	Represent conservation and restoration of species or ecosystems quantified by some standard or criteria such as provided by Verra and Gold Standard
Water Rights and Wetland Credits	Represent rights to access water or preserve/restore wetlands which can be traded
Conservation Finance Instruments	Represent bonds or funds that protect forests, coral reefs, or species habitats

Asset Type	Description
Natural Asset Companies (NACs)	Represents a SEC-backed structure allowing public trading of ecosystem ownership rights
Tokenized Natural Resources	Represent blockchain-based representations of nature (e.g., tokenized forest)

### 8.2.4 Overconsumption > Earth's Boundaries

Excessive consumer lifestyle - *overconsumption* - is one of the main drivers of climate change and environmental destruction, with “*2/3 of global GHG emissions are directly and indirectly linked to household consumption, with a global average of about 6 tonnes CO<sub>2</sub> equivalent per capita*”, according to (Ivanova et al., 2020; Renee Cho, 2020). An older study put the number as high as 60% percent (Ivanova et al., 2016) while (Ellen MacArthur Foundation, Material Economics, 2019)’s models 45% show of CO<sub>2</sub> equivalent emissions come from our shopping; produced by companies to make the products we consume. (Keeble, 1988) reported in April 1987 that ‘*residents in high-income countries lead lifestyles incompatible with planetary boundaries*’. (Ivanova et al., 2020) reports the average footprint in North America and Europe is 13.4 t CO<sub>2</sub>eq, in Africa and the Middle East 1.7t CO<sub>2</sub>eq; consumption options with a high mitigation potential measured in tonnes of CO<sub>2</sub> equivalent per capita per year include “*living car-free*” and avoiding flying, which could each save upwards of 1.7t CO<sub>2</sub>eq per person annually.

While the numbers on overconsumption are clear, the debate on overconsumption is so polarized, it’s difficult to have a meaningful discussion of the topic (Ianole & Cornescu, 2013). Environmental risks from human activities are known as Anthropogenic Threat Complexes (ATCs) (Bowler et al., 2020). With the trend of urbanization, it’s not surprising (people living in) cities are responsible for 80% of the emissions (Rosales Carreón & Worrell, 2018). (Moberg et al., 2019) reports daily human activities emission contribution on average in four European countries (France, Germany, Norway and Sweden).

Table 28: Daily human activities emission contribution, on average, in France, Germany, Norway and Sweden from (Moberg et al., 2019).

Emission Share	Category
21%	Housing
30%	Food
34%	Mobility
15%	Other

Taking a broader view, (Hannah Ritchie, 2020; US EPA, 2016) dissect GHG emissions inventory by sector and put the blame squarely on the type of energy used.

Table 29: Industrial Emissions (Hannah Ritchie, 2020; US EPA, 2016).

Sector	Share	Description
Energy Use (inc. electricity, heat and transport)	73.2 %	Total CO <sub>2</sub> eq emissions from all fuel combustion and related fugitive losses. Energy use in industry (24.2%) in processing metals (iron and steel), chemicals and petrochemicals, food and tobacco, non ferrous metals, paper, machinery, other industry; transport (16.2%) road, aviation, shipping, rail; buildings (17.5%) including residential and commercial; fugitive emissions (5.8%) such as methane leaks from oil and gas exploitation and coal mining; plus other, unallocated fuel combustion related emissions (7.8%)
Direct Industrial Processes	5.2 %	Direct CO <sub>2</sub> eq emissions from chemical reactions in cement and in chemicals and petrochemicals.
Waste	3.2 %	Wastewater methane and NO <sub>2</sub> emissions; landfill methane.
Agriculture + LULUCF (Land Use, Land-Use Change & Forestry)	18.4 %	Emissions from grassland, cropland, deforestation, crop burning, rice cultivation, agricultural soils, livestock and manure.

Earth's growing population reached 8 Billion people In November 2022 and population projections by predict 8.5B people by 2030 and 9.7B by 2050 (The Economic Times, 2022; United Nations Department of Economic and Social Affairs, Population Division, 2022). Indeed, making *anything* consumes natural resources, which are limited on planet Earth. (Hassoun et al., 2023) forecasts increase of global food demand by 62% driven by the impact of climate change. Yet, while population growth puts higher pressure on Earth's resources, some researchers propose the effect is higher from wasteful lifestyles than the raw number of people (Cardinale et al., 2012). Meanwhile, others, such as (Cafaro et al., 2022), believe *[o]verpopulation is a major cause of biodiversity loss and smaller human populations are necessary to preserve what is left."*

### 8.2.5 Plastic Pollution

Overconsumption is also one of the root causes of plastic pollution. (Ford et al., 2022) and (Lavers et al., 2022) find strong links between climate change and marine plastic pollution "*along with other stressors that threaten the resilience of species and habitats sensitive to both climate change and plastic pollution*".

Plastic pollution is pervasive around the Earth and is fundamentally linked to climate change, while microplastics are increasingly a real concern (Lavers et al., 2022; Tiernan et al., 2022). Several international studies report recent findings of microplastics everywhere in human bodies: the brain, lungs, digestive tissues, bone marrow, penis, testis, seminal fluid (semen), and placenta - causing serious health and reproductive concerns (Codrington et al., 2024; M. A. Garcia et al., 2024; Guo et al., 2024; Hu et al., 2024; N. Li et al., 2024; Main, 2024; Montano et al., 2023; L. Zhu et al., 2024)

### Microplastics Inside the Human Body

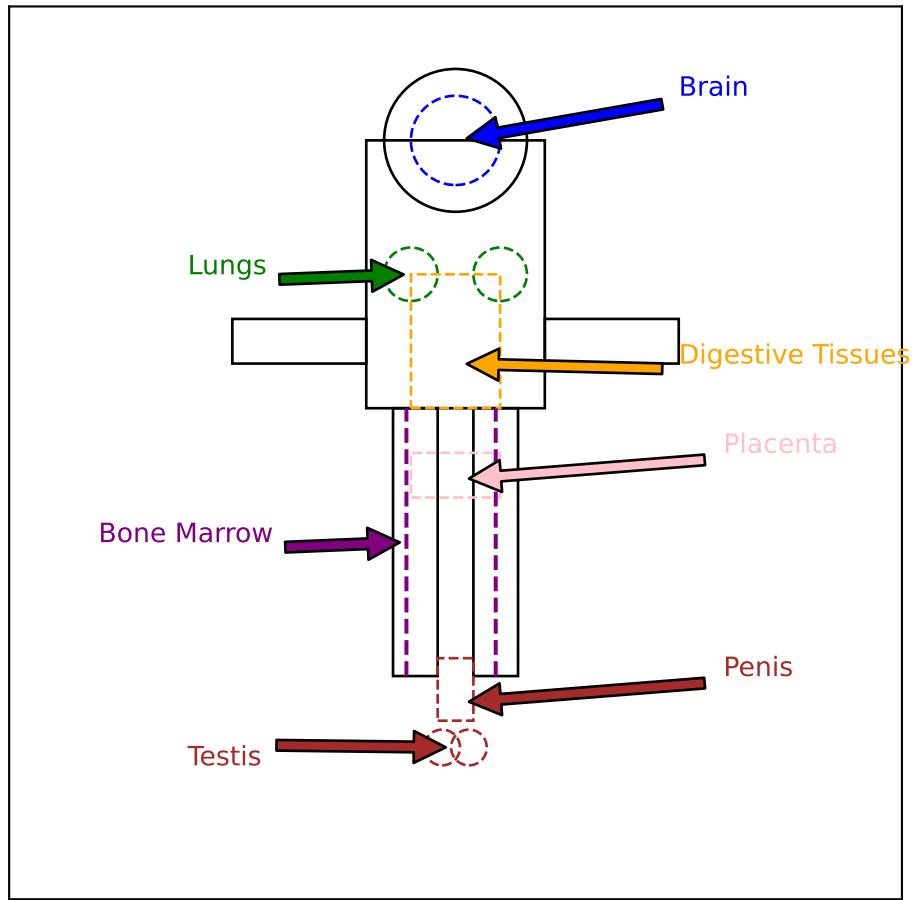


Figure 32: Microplastics in the Human Body

In addition to the enormity of over-reaching CO<sub>2</sub> emissions, humanity is facing other massive environmental problems. The Stockholm Resilience Centre report in 2022 we have already breached 4 out of our 9 “*planetary boundaries*”: in addition to climate change, biodiversity loss (Extinctions per Million Species per Year aka E/MSY), land-system change (deforestation, land degradation, etc), and biogeochemical flows (cycles of carbon, nitrogen, phosphorus, etc); on a positive side, the challenges of fresh water use, ocean acidification and stratospheric ozone depletion are still within planetary limits (Persson et al., 2022).

An update to the planetary boundaries framework a year later found the actual number to be 6 of 9 boundaries (climate, biosphere integrity, land use, biogeochemical flows, freshwater use, novel entities) already transgressed, with ocean acidification nearing its limit and only stratospheric ozone recovering; atmospheric aerosol loading and the biodiversity intactness index (BII), which belongs under biodiversity loss and measures how depleted are the species that are still around (but not yet extinct), were quantified recently (Newbold et al., 2016; Richardson et al., 2023).

In the biosphere, mass extinctions are underway. An analysis of population trends for 27600 terrestrial vertebrate species (including a detailed sample of 177 mammals), found 32% (8851 species) are undergoing severe range contractions; the authors name this “biological annihilation” to signal Earth’s ongoing 6 mass extinction and call for immediate conservation action (Ceballos et al., 2017). As of last year, the Red List curated by the International Union for Conservation of Nature (IUCN), includes 45,300 species (28% of all assessed, since IUCN was founded in 1948), under threat of extinction (IUCN, 2024).

Responding to the crisis, the Guardian newspaper in the UK has taken a clear stance, covering stories of extinction; the *Area de Conservación Guanacaste* is one of the protected areas listed by the UNESCO World Heritage Centre, providing data on the State of Conservation (SOC) by year (Centre, 1999; McClure, 2025)

In 2018 Swedish Sportswear brand Houdini launched the first corporate planetary boundaries’ assessment in partnership with Albaeco and Stockholm Resilience Centre to establish a baseline for its “impact positive” ambition (Houdini, 2018). While it’s a pilot study, it demonstrates how companies can integrate system-level science into sustainability reporting (Haeggman et al., 2018). At the 2024 update for the report, Houdini invited, Johan Rockström, a renown conservation and climate scientist, envisions a global dashboard of the development of the economy and the state of the planetary boundaries, with high resolution maps, to help visualize Earth’s situation in real-time (Houdini Sportswear, 2024).

### **8.2.6 Evolving Measurements from Planetary Health to Earth System Law, and Social Cost of Carbon**

Scientists in cross-disciplinary teams have been working on integrating Earth systems and human society into cohesive frameworks. (Wardani et al., 2023) stresses that every facet of Earth’s life-support system—living biota and the “abiotic” foundations of climate, water, soils, and geology—co-produces the conditions for civilization: “*long-term human well-being is dependent on the well-being of the planet, including both biotic and abiotic systems. It recognizes interlinkages across environmental sustainability, public health, and socioeconomic development.*”

There are 3 approaches that address the complex interdependence of humans with our physical environment, that have the potential to be complementary - *Planetary Health, Social Cost of Carbon, and Earth System Law*.

*Planetary Health* is a framework rooted in public health sciences and medicine; what if public health leveled-up to planetary scale, concerned with the health of ecological life-support sys-

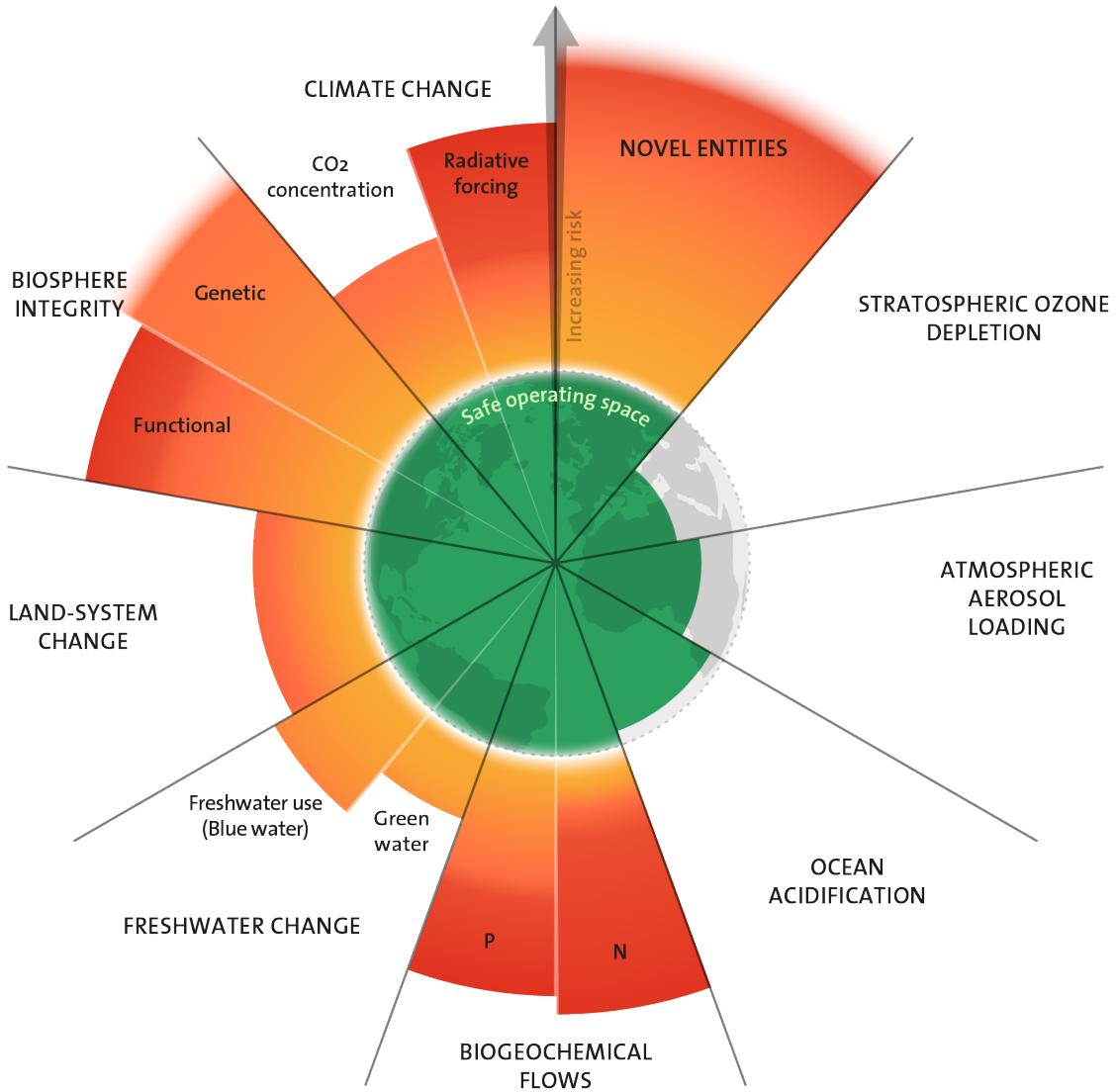


Figure 33: Planetary Boundaries 2023 update. Azote for Stockholm Resilience Centre, based on analysis in Richardson et al 2023

tems: clean air, food, and a safe climate, so they can support human flourishing; in practice the framework focuses on evidence, education, governance, and business (Planetary Health Alliance, 2024a, 2024b).

*Social Cost of Carbon* attempts to measure the compound impact of CO<sub>2e</sub> emissions on society. Sustainability is filled with complexities. CO<sub>2e</sub> emissions are complicated by biodiversity loss, child labor, slavery, poverty, chemical pollution, etc. - many issues become intertwined (TEDx Talks, 2020). One attempt to measure these complexities, is the *Social Cost of Carbon* (SCC) which is defined as “*additional damage caused by an extra unit of emissions*” (Kornek et al., 2021; Zhen et al., 2018). For example the cost of damages caused by “one extra ton of carbon dioxide emissions” (Stanford University, 2021). SCC variations exist between countries (Tol, 2019) and regions (Yong Wang et al., 2022).

*Earth System Law* is a framework rooted in the legal sciences for addressing interconnected environmental challenges in a hyper-connected Earth, where climate feedbacks, and environmental thresholds don’t respect country borders; in practice, this line of thinking helps to develop carbon-budget clauses inside trade deals and biodiversity “safety brakes” that trigger when monitoring data shows an Earth boundary overshoot, potentially acting as the legal scaffolding that lets Planetary Health prescriptions and Social Cost of Carbon price signals be effective (Du Toit & Kotzé, 2022).

More recently, because of the complex interdependence, (J. Zhang et al., 2025) proposes a new sustainability index that systematically considers pertinent indicators of interdependencies and interactions across different dimensions of sustainability. Moreover, (Lenton et al., 2023) proposed a new innovative way to quantify the “cost” of global warming in human terms by counting the number of people forced outside the “human climate niche” (temperatures historically occupied by most humanity); climate change has already exposed ≈ 9% of today’s population (>600 million) unprecedented heat stress, risking increased mortality, morbidity and displacement; if current trends continue by 2100, ~2.7 °C, 21–39 % or 2–4 billion people will be exposed by 2080–2100.

### 8.3 Quantifying Human Benefits from the Biosphere: Ecosystem Services

*Ecosystem services measure the benefits humans receive from the biosphere.* Put simply, *ecosystem services* enable human life on Earth - we are, in a very real sense, - dependent on nature. The biosphere is Earth’s life support system. Earth’s biosphere is made up of 846 terrestrial ecoregions, which are distributed across 14 major biomes and 8 biogeographical realms (Dinerstein et al., 2017).

While it can be assumed much of the flora and fauna are crucial for Earth’s systems, science is still in the process of understanding and quantifying its contributions. The history of the valuation of nature’s services goes back to the 18th century when David Ricardo and Jean Baptiste Say discussed nature’s *work*, however both considered it should be free (Gómez-Bagethun et al., 2010). In 1997 (Daily, 1997) proposed the idea of *ecosystem services* and (Costanza et al., 1997) attempted to assess the amount of ecosystem services provided. (Le Provost et al., 2022)’s study

shows *biodiversity* as one key factor to maintain delivery of ecosystem services. (Noriega et al., 2018) attempts to quantify the ecosystem services (ES) provided by insects.

The most complex computer models which attempt to capture ever more interactions happening in the physical realm are called *digital twins*. The EU is developing a digital twin of Earth to help sustainability prediction and planning, integrating Earth's various systems such as climate, hydrology, ecology, etc., into a single model (*Destination Earth | Shaping Europe's Digital Future*, 2023; J. Hoffmann et al., 2023). For instance, AI is being used to map icebergs and measure the change in size (European Space Agency, 2023). We can use all the data being recorded to provide a digital twin of the planet, nature, ecosystems and human actions to help us change our behavior and optimize for planetary wellbeing.

### **8.3.1 Ecological Indicators to Track Environmental Health**

### **8.3.2 Measuring Biodiversity Loss, Ecological Indicators and Environmental Degradation**

Sustainability can be measured using a variety of *ecological indicators*. Ecological indicators for Earth - *I would like to coin the word “ecomarkers”* - are like *biomarkers* in human health. Technological advances help scientist better understand nature. Cutting edge research uses AI-based voice recognition for listening to nature, assessing biodiversity based on species' sounds in the forest. Millions of detections of different species with machine learning passive acoustic AI models, can also assess species' response to climate change (AI for Good, 2023; Guerrero et al., 2023).

Around the world, pressure on ecosystems is rapidly increasing, with biodiversity destruction ever prevalent, making protecting biodiversity as urgent as protecting the climate. (Almond, R.E.A. et al., 2022) reported, the number of species killed, mass destruction of nature:

*“69% decline in the relative abundance of monitored wildlife populations around the world between 1970 and 2018. Latin America shows the greatest regional decline in average population abundance (94%), while freshwater species populations have seen the greatest overall global decline (83%).”*

In Europe, as of 2025, none of the evaluated biodiversity targets are on track; agricultural targets, such as reducing soil nutrient losses, and reducing fertilizer use, are particularly lagging (European Commission, 2025).

*Environmental DNA (eDNA)* helps scientists measure species abundance without direct observation through detection of DNA on genetic materials such as skin cells (Peter Andrey Smitharchive page, 2024). Cellular DNA can be isolated from various sediment types (Ogram et al., 1987). Beyond scientific applications, eDNA is being used to generate biodiversity credits by environmental asset rating companies such as BeZero, a ratings' agency for the Voluntary Carbon Market (Ojoatre & Atkinson, 2023).

Similarly to climate protection, the UN has taken a leadership role in biodiversity protection, by organizing an annual Convention on Biodiversity. The history of the United Nations Convention on Biodiversity goes back to 1988, when the working group was founded (Unit, 2023). The Convention on Biodiversity 2022 (COP15) adopted the first global biodiversity framework to accompany climate goals (UNEP, Tue, 12/20/2022 - 07:44).

Table 30: Biodiversity loss data from (Bradshaw et al., 2021).

What Happened?	How Much?
Vertebrate species population average decline	68% over the last 50 years
Land surface altered by humans	70% of Earth
Vertebrate species extinct	700 in 500 years
Plant species extinct	600 in 500 years
Species under threat of extinction	1 million

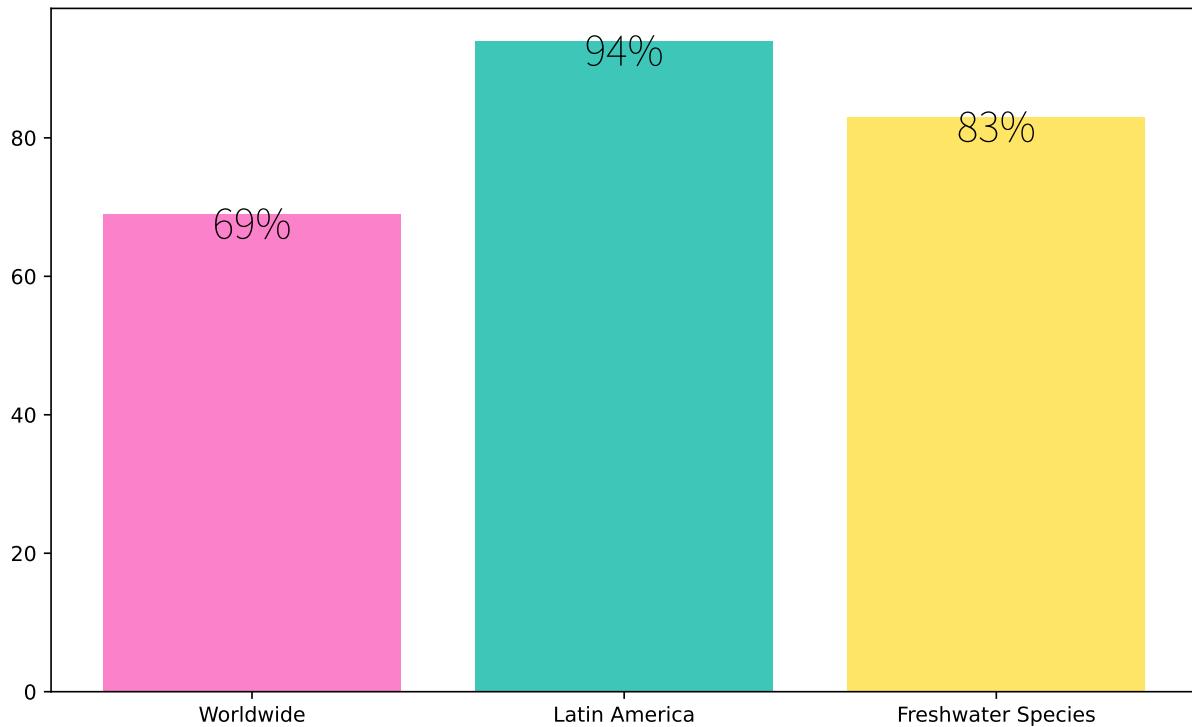


Figure 34: Biodiversity Loss

Biodiversity loss is linked to overconsumption, weak legislation and lack of oversight. (Crenna et al., 2019) recounts European Union consumers' negative impact on biodiversity in countries where it imports food. (WWF, 2022) case study highlights how 4 biodiverse regions Cerrado in Brazil, Chaco in Argentina, Sumatra in Indonesia, and the Cuvette Centrale in Democratic Republic of Congo are experiencing rapid destruction due to consumer demand in the European

Union. While the European Union (EU) has recently become a leader in sustainability legislation, biodiversity protection measures among private companies is very low Marco-Fondevila & Álvarez-Etxeberria (2023).

Starting with the simple question: why protect biodiversity. (May, 2011) argues biodiversity loss is a concern for 3 points of views:

Table 31: Ethical and Utilitarian Concepts of Biodiversity Protection from (May, 2011).

Point of View	Description
Narrowly Utilitarian	Biodiversity is a resource of genetic novelties for the biotech industry.
Broadly Utilitarian	Humans depend upon biodiverse ecosystems.
Ethical	Humans have a responsibility to future generations to pass down a rich natural world.

There is some progress in biodiversity conservation as “[\*b]iodiversity awareness is now at 72% or higher in all countries sampled, compared to only 29% or higher across countries sampled in 2009”\* (UEBT, 2022)

### 8.3.3 Oceans and Marine Ecosystem Sustainability

Marine heatwaves are intensifying under climate change, threatening species diversity and the ocean’s capacity to supply critical services from fisheries to carbon sequestration (Smale et al., 2019). Accelerating ocean warming, evidenced by record-breaking sea-surface temperatures, has triggered widespread coral bleaching, clearly visible at the Great Barrier Reef in Queensland, East Coast of Australia, loss of marine habitat complexity, and cascading threats to coastal economies and food security; the authors call for integrated climate–ocean policy action, stressing that without urgent emissions cuts and ecosystem-based adaptation, the ocean’s capacity to regulate climate and sustain biodiversity will collapse (Gelles & Andreoni, 2023; Pfeiffer, 2024). Cumulative pressures: climate extremes, pollution, and overexploitation - have driven evolutionary shifts in marine life and unpredictably altered ecosystem-service delivery (Espinosa & Bazairi, 2023).

Some earlier studies, such as (Howard et al., 2017) demonstrate how integrating blue carbon habitats into Marine Protected Area (MPA) design can both mitigate carbon emissions and enhance ecosystem resilience. Meta-analyses across 121 sites in 87 MPAs globally show that most well-designed and managed MPAs achieve significant ecological gains: on average, fish biomass inside no-take zones can double to triple compared with outside areas, and species richness likewise increases by 20–30 % within 5–10 years of enforcement (Rudd, 2015). However, Marine Protected Areas cover only 8% of the world’s oceans and only 2.8% is effectively protected (Igini, 2024a). The UN’s 30x30 target (set under the Convention on Biological Diversity) aims to protect 30% of the world’s oceans by 2030, however is not on track to achieve this goal (Mouterde, 2024).

### **8.3.4 Forests: Carbon Sinks and Biodiversity Reservoirs**

Forests are a crucial part of Earth's carbon cycle and the main natural CO<sub>2</sub> capture system; due to deforestation, Europe rapidly losing its forest carbon sink (Frédéric Simon, 2022). Beyond their role in locking away carbon, recent field work shows forest actively scrub methane from the air as tree bark absorbs methane (Gauci et al., 2024). Around 27% of Earth's land area is still covered by forests, yet *deforestation* is widespread all around the world; highest rates of deforestation happened in the tropical rainforests of South America and Africa, mainly caused by agricultural cropland expansion (50% of all deforestation) and grazing land for farm animals to produce meat (38.5%), totaling close to 90% of global deforestation (*FRA 2020 Remote Sensing Survey*, 2022). The global forest cover change is visible on Google's Earth Engine (Hansen et al., 2013).

Around the world, there are many initiatives to increase forest cover, for example the *1 billion tree project* (Bastin et al., 2019; “Erratum for the Report,” 2020; Greenfield & @pgreenfielduk, 2021). However, it's important to note that planting trees (*afforestation*) is not the full solution, as *afforestation* is different from *reforestation*, which takes into account biodiversity. Also, while using remote-sensing and machine-learning to assess reforestation potential (see Klosterman et al., 2022), it doesn't take into account local political realities, and socioeconomic issues such as education, poverty and access to green jobs. Taking these aspects into account may be beneficial, for example (Bousfield et al., 2022) reports there's evidence paying landowners for the ecosystem services their forests provide may reduce deforestation.

### **8.3.5 Pollution: Air, Water, and Soil Degradation**

In Taiwan, this is the ranking of pollution reports by citizens (Ministry of Digital Affairs, 2024b):

Pollution Reports in Taiwan by District.

Health and sustainability are inextricably linked. “Human health is central to all sustainability efforts.”, “*All of these (food, housing, power, and health care), and the stress that the lack of them generate, play a huge role in our health*” (Sarah Ludwig Rausch & Neha Pathak, 2021).

(Abu El Kheir-Mataria & Chun, 2025) finds warming climate in the MENA region (Middle East and North Africa) increases cancer risk in women, mediated through air pollution and other environmental stressors.

Clean air is proposed as a *human right* (Baroness Jones of Moulsecoomb & Caroline Lucas, 2023), yet air pollution is widespread around the planet, with 99% of Earth's human population being affected by bad air quality that does not meet WHO air quality guidelines, leading to health problems linked to 6.7 million *premature deaths* every year (World Health Organization, 2022). Air pollution is linked to cancer incidence. In Taiwan, South Korea, and England, groundbreaking research by (Lim et al., 2022) analyzed over 400000 individuals establishes exposure to 2.5  $\mu$  m PM (PM2.5) air pollution as a *cause for lung cancer*. In (Hannah Devlin,

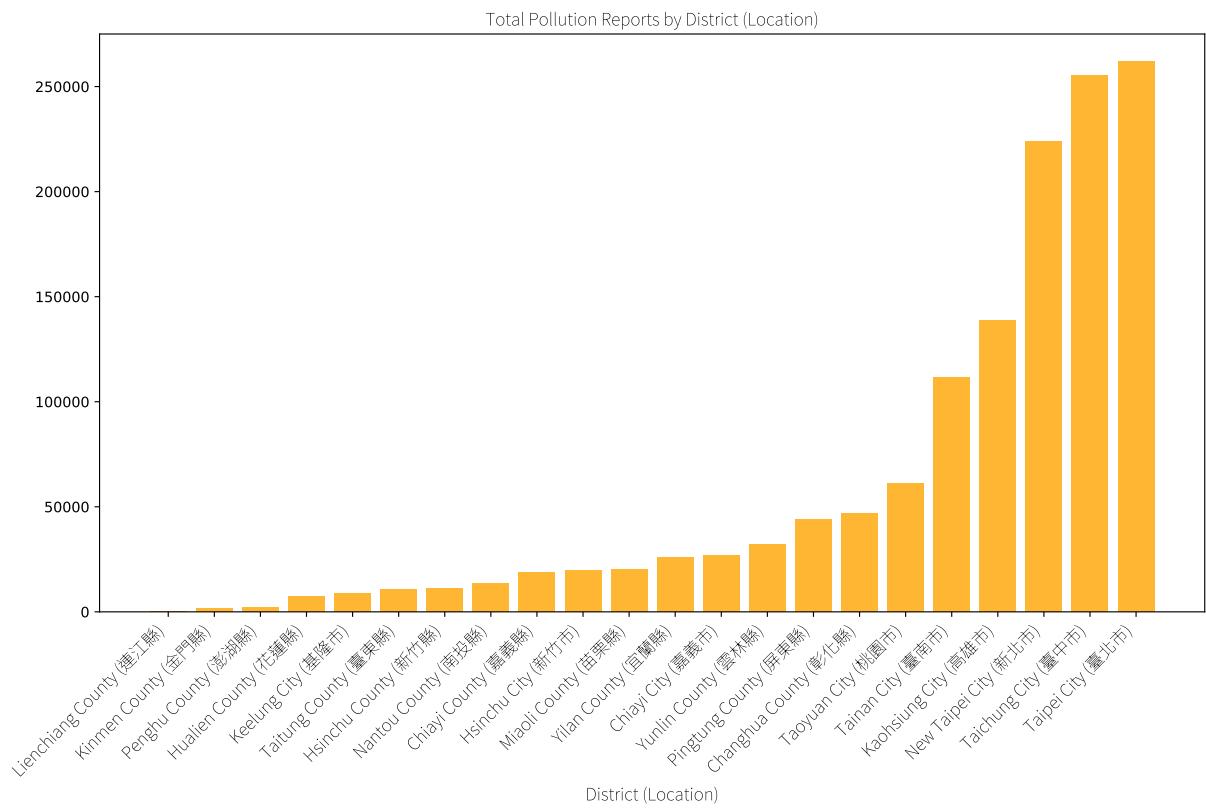
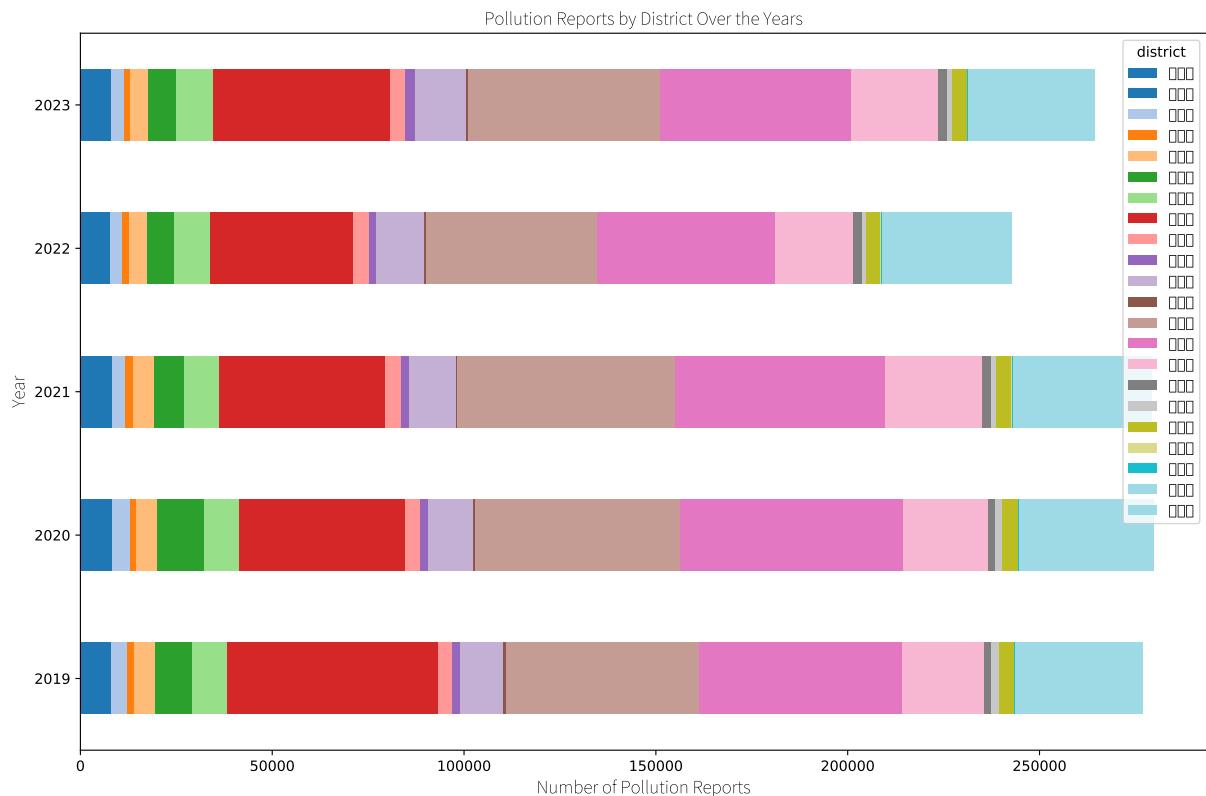


Figure 35: Pollution Reports in Taiwan by County

<Figure size 3600x2400 with 0 Axes>

(a) Pollution Reports in Taiwan by District



(b)

Figure 36

2022), professor Tony Mok, of the Chinese University of Hong Kong explains it plainly, which I want to quote here in verbatim:

*“We have known about the link between pollution and lung cancer for a long time, and we now have a possible explanation for it. As consumption of fossil fuels goes hand in hand with pollution and carbon emissions, we have a strong mandate for tackling these issues – for both environmental and health reasons.”* - (Hannah Develin, 2022)

The main way to combat air pollution is through policy interventions. (MARIA LUÍS FERNANDES, 2023) the EU has legislation in progress to curb industrial emissions. If legislation is in place, causing bad air quality can become bad for business. In China, (Gu et al., 2023) links air pollution to credit interest rates for business loans; companies with low environmental awareness and a history of environmental penalties pay 12 percent higher interest rates. In France, (Bouscasse et al., 2022) finds strong health and economic benefits across the board from air pollution reduction.

Likewise to the lack of clean air, lack of access to sufficient clean water and water pollution are issues in several places around the world; globally, 4.4 billion people only have access to water that's not safe for drinking (Soliman, 2024). Even in wealthy countries like the US, with increasing situations of water scarcity and drought due to climate change, issues of water ownership become increasingly dire. (Koch, 2022; Naishadham, 2023b) describes a fight in the US over water usage rights in Arizona, where Fondomonte, a subsidiary of a Saudi Arabian company that grows a water-hungry crop alfalfa, exacerbating the local water crisis by using large amounts of public water, leading to public outcry and being sued for “public nuisance” for its excessive groundwater pumping, and finally cessation of its lease and operations on state land; but still continuing operations on private land (Naishadham, 2023a; “Saudi Firm That Grows Hay in California and Arizona to Lose Farm Leases over Water Issue,” 2023).

Water quality is highly dependent on competent governance. For example, in the U.S., the national government recently rolled back rules for water safety, which had only been implemented last year, to protect the consumer from per- and polyfluoroalkyl substances (PFAS) (Trager, 2025). Once pollution is in the environment, cleaning it up is very expensive. For instance, in France, where storm water washed pollution into the waterways feeding into the Seine river, making it unsuitable for swimming, the city of Paris invested 1.4 Billion Euros to create a massive underground reservoir and a water cleaning system by the opening of the Paris Olympics in 2024 - and still the water quality would be variable based on rain incidence (Walt, 2023).

Water and soil pollution are highly connected, as water flows through soil. In Saudi Arabia, (Picó et al., 2023) used wild and ruderal plants as bioindicators to detect pollution of air, water and soil, specifically anthropogenic pollution, pharmaceuticals, pesticides, and other industrial chemicals, concluding both Abha and Riyadh showed notable levels of pollutants while Riyadh (a city with more industry) showed higher levels of pollution.

Improved farming practices directly improve soil structure (reducing runoff and contamination) and water retention, thereby mitigating both soil degradation and water pollution. Participants in the 2023 Baltic Sea Action Group for the EIT Food Regenerative Agriculture project (which

so far has trained over 1200 farmers and 160 farmers advisory groups in regenerative practices), highlighted practical soil - restoration methods in their respective countries: applying *biochar* on pilot plots in the Czech Republic increased water retention by up to 20%, no - tilling and cover - cropping practices in Hungary boosted insect - species counts by 15 points, and adopting regenerative crop rotations in Bulgaria cut synthetic fertilizer use by 25%; one of the challenges remains consumer awareness: only 12% of consumers in Central and Eastern Europe currently recognize the “regenerative” label - awareness must grow to drive demand (Baltic Sea Action Group, 2023).

A practical example of the interconnection between water pollution, agriculture, architecture, and extreme weather, are bioswales, which help catch storm debris and reduce water pollution. In Taiwan, (劉大正, 2010) showed that grass swales increase infiltration, reduce runoff, and improve downstream water quality, helping stabilize slopes via enhanced drainage (Taiwanese landscape is very mountainous, with); in a follow-up field trial at a National Highway in Gangshan, grass swales consistently trapped sediments and adsorbed heavy metals from highway runoff before those pollutants could reach nearby waterways.

The above examples from around the world suggest that “*regenerative*” is not just a buzzword or wishful thinking - instead, it maps to a set of concrete practices and approaches to improve the condition of the living environment under threat from pollution.

### **8.3.6 Climate Disaster Preparedness: Extreme Weather Resilience**

The Word Economic Forums Global Risks Report 2024 paints a bleak picture of the future with expectations of increased turbulence across the board based on a survey of over 1400 topic experts (World Economic Forum, n.d.). Global warming specifically increases the risk of disasters and extreme weather events; the US Global Change Research Program presented a comprehensive report to the US Congress, which links disaster-risk directly to global warming; for examples increased wildfires damage property, endanger life and reduces *air quality*, which in effect increases health challenges (*Fifth National Climate Assessment*, 2023). Warming global climate has concrete effects on daily life. Warmer climate helps viruses and fungi spread (Press, 2023). (Williams & Joshi, 2013) higher CO<sub>2</sub>eq concentrations in the air can cause more turbulence for flights. As extreme temperatures are increasingly commonplace, with observed changes in heat-waves, there’s increased risk of wildfires (Perkins-Kirkpatrick & Green, 2023; Volkova et al., 2021), while flood risk mapping might lower property prices in at risk areas (Sherren, 2024). Summers of 2022 and 2023 were the hottest on record so far, with extreme heat waves recorded in places around the world (Douglas, 2023; Falconer, 2023; National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, 2023; NOAA National Centers for Environmental Information, 2023; Serrano-Notivoli et al., 2023; Venturelli et al., 2023).

The part of Earth where the *human climate niche* is becoming smaller (McKibben, 2023). As temperatures rise, certain cities may become uninhabitable for humans (CBC Radio, 2021). The summer of 2023 saw extensive wildfires in Spain, Canada, and elsewhere; rapidly moving fires destroyed the whole city of Lāhainā in Hawaii (Anguiano, 2023). In California, (Jerrett et al., 2022) says, “[w]ildfires are the second most important source of emissions in 2020” and “negate

*reductions in greenhouse gas emissions from other sectors.*" Some parts of South America have seen summer heat *in the winter*, with heatwaves with temperatures as high as 38 degrees (Livingston, 2023).

In Taiwan disaster risk and hazard mapping is well-developed, with early warning systems, and comprehensive response preparedness - and painful experiences - instrumental to saving lives (Y.-J. Tsai et al., 2021). Intensifying storms forming near coastlines, can be expected with "*[c]hanges to tropical cyclone trajectories in Southeast Asia under a warming climate*" (Garner et al., 2024). The situation on the Pacific and Atlantic oceans is not dissimilar, with "*[o]bserved increases in North Atlantic tropical cyclone peak intensification rates*" (Garner, 2023).

In the Philippines, with increasing extreme weather events, "*businesses are more likely to emerge in areas where infrastructure is resilient to climate hazards*" (Y. Cheng & Han, 2022). Across several case studies, (Fabris & Luburić, 2022) discusses vulnerable sectors from agriculture to transport, under threat from extreme weather events, such as floods, heatwaves, droughts, and storms impact human health: societal development and economic growth should be realistic on planning for weather-related impacts.

Climate-related disasters can spur action as extreme weather becomes visible to everyone. After large floods in South Korea in July 2023 with many victims, president Joon promised to begin taking global warming seriously and steer the country towards climate action (AFP, 2023; Al Jazeera, 2023; Web, 2023). South Korea has a partnership with the European Union (European Commission, 2023a).

## **8.4 Financialization of Nature vs Sacred Value: Scaling Up Sustainable Action**

There are 2 main approaches to protecting nature:

Table 32: Economics of Nature Commodification vs Sacred Economics

<b>Economics of Nature Commodification</b>	<b>Economics of the Sacred</b>
Measure and assign monetary value to nature.	Nature is Sacred - such as are religious holy places - and can't be touched (Eisenstein, 2011, 2018)

Whether we should put a price on nature (or is it time to leave utilitarian environmentalism behind?) is still openly debated, with pro-financialization voices arguing assigning monetary figures to nature's benefits legible to policymakers and markets, channeling large sums into conservation (e.g. carbon/biodiversity credits), while critics argue monetary metrics flatten relational, cultural and intrinsic values of ecosystems into exchange-value and commoditize nature, which may legitimize offsetting schemes that displace rather than prevent damage (Leverhulme Centre for Nature Recovery, 2023).

Ecosystem services literature defines a "Nature's Contributions to People" framework, originally proposed by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). (Díaz et al., 2018). (Muradian & Gómez-Baggethun, 2021) critically assesses the

framework, arguing utilitarian and anthropocentric views of the ecosystem services concept perpetuates problematic dualisms (humans and nature are separate) - and call for a new approach centered on ecology.

Table 33: Defining Ecosystem Services Concepts from (Leverhulme Centre for Nature Recovery, 2023)

9 Steps Towards Defining Ecosystem Services
Identify ecosystem functions
Quantify ecosystem functions
Identify ecosystem services
Quantify ecosystem services
Quantify financial value of ecosystem services
Assign property rights
Create ecosystem service markets
Commodify nature

A practical example of ecosystem services becoming a common language comes from (Z. Zhang et al., 2023) who proposes integrating ecosystem services conservation into urban planning, so biodiversity could become part of city planning. Another example is tourism, a large industrial sector which relies on ecosystem services (L. Li et al., 2023). In Taiwan, (T. H. Lee et al., 2021) developed a framework of indicators to assess sustainable tourism.

#### 8.4.1 Ecological Restoration: Damaged Ecosystems, Agroforestry & Permaculture

The concept of how a public resource is over-used until breaking down as each user only bears a fraction of the cost - known as *tragedy of the commons* - was described by the ecologist Garrett Hardin in 1968 (Hardin, 1968; Lopez et al., 2022; Meisinger, 2022; Murase & Baek, 2018). When so many systems are broken, some argue sustainability is not enough and we should work on *regeneration* of natural habitat. The UN announced 2021-2030 the Decade on Ecosystem Restoration, which includes a wide range of regenerative action (Fischer et al., 2021). For instance, (Han & Chen, 2022) identifies nature-based solutions “land re-naturalization (such as afforestation and wetland restoration)”

Table 34: Non-Exhaustive list of Regenerative Actions from (Han & Chen, 2022)

Non-Exhaustive list of Regenerative Actions
Afforestation
Wetland restoration

The organic food and drink market is growing worldwide, with gross sales in 2019 totaling over 106 billion euros, albeit being a small percentage of total food industry (Gamage et al.,

2023). Growing organic food poses many challenges, which farmers need to adapt to, in order to participate in regenerative food systems. One approach is growing food forests, also known as agroforestry, which integrates farming into natural environments, achieving CO<sub>2</sub>eq storage in the soil through agriculture and forestry using agroecological practices.

In Ireland, (Irwin et al., 2023) studied dairy farmers' willingness to plant trees to increase vegetation cover on their land, finding that economic incentives alone are insufficient, and support in the form of advisory and education is needed. Similarly, in the Brazilian Amazon rainforest (Yadav et al., 2023) finds the active participation of the local community in planning permaculture practices, enhances their acceptance and effectiveness. In Bangladesh, (Ruba & Talucder, 2023) found agroforestry plays an active role in achieving the country's Sustainable Development Goals (SDGs), including zero hunger, climate action, mitigating climate change impacts through CO<sub>2</sub>eq sequestration, life on land through biodiversity conservation and improving soil fertility, yet is hindered by the lack of policy support and educational level of the farmers. In the Baltic Sea region in North-Eastern Europe and Central Europe face similar challenges, (Baltic Sea Action Group, 2023) pointing out farmers' traditional mindset as the biggest obstacle, describing the paradigm shift from extractive farming to regenerative agriculture, using techniques such as no-till farming, which reduces soil erosion and improve soil health by reducing synthetic inputs; yet, it's not only a single practice that is enough, regenerative agriculture is a holistic approach and agroecology education programmes need to be comprehensive.

(G. Low et al., 2023) further studies how agroforestry deep integration into food value chains unlocks opportunities for recognition and rewards from economic actors in the network, underlining how complex and knowledge-heavy nature of value-capture, calling for further standardization of practices to reward sustainability practices and ecosystem services. The challenge lies in that bioeconomy is not inherently sustainable and may put biodiversity at risk, depending on the level of industrialization of agriculture and specific practices, which require deep knowledge and understanding of natural and artificial interactions the ecological systems; the authors advocate for a precise distinction between extractive and regenerative practices in "*bioeconomy*" (Ollinaho & Kröger, 2023). Finally, taking Brazil as an example, (De Queiroz-Stein & Siegel, 2023) argues for an integration of competing and conflicting bioeconomy policies, in order to achieve the goals of a sustainable bioeconomy.

Svalbard Seed Vault is an example of seed conservation to safeguard biodiversity by storing backup seeds of plants from around the world in cold storage (Asdal & Guarino, 2018; Westengen et al., 2013). Since its opening in 2008, the storage solution provided by the Norwegian government has stored seeds from 123 gene banks in 85 countries around the world ("Arctic Doomsday Seed Vault Gets More Than 14,000 New Samples," 2025; The Norwegian Ministry of Agriculture and Food, 2025). (Vitaletti, 2025) proposes using a blockchain-based lottery system to store seeds in local refrigerators, in order to enhance resilience and ensure survival of seeds, by storing seeds in many locations.

#### **8.4.2 Energy: Climatech, Renewables, and Decarbonization Pathways**

Globally, 34% of all emissions come from energy production (US EPA, 2016), making it the key sector to require innovation for reducing carbon emissions. The International Energy Agency's (IEAs), "*Tracking Clean Energy Progress*" report on 50 distinct decarbonization enablers and finds that only 3 components - solar PV, PV electric vehicles, and building lighting - are on track with the net-zero by 2050 scenarios, while 28 need more effort and 22 are "not on track" (IEA, 2023b).

Geopolitical situations can affect technology adoption; after Russia's war in Ukraine, Europe needed to quickly reduce consuming cheap Russian fossil fuel energy (in the form of gas) (Bona-sia, 2024). In 2024, for first time in Europe, renewables in the form of wind and solar energy surged past production of fossil fuels (Beer, 2024; Graham & Fulghum, 2024). Meanwhile, China is experiencing a solar installation rush before a deadline set by a new renewable pricing policy; from January to April 2025, a record-breaking 105 gigawatts (GW) of solar capacity was installed, bringing the total solar power close to 1 Terawatt, predicted to make solar power China's main energy source in 2026(Carrie Xiao, 2025; L, 2025a; Redazione, 2025; Weaver, 2023; Y. Zhu, 2023).

(Gaure & Golombek, 2022) simulate a CO<sub>2</sub> free electricity generation system in the European Union where "*98% of total electricity production is generated by wind power and solar; the remainder is covered by a backup technology.*" The authors stipulate it's possible to power the EU without producing CO<sub>2</sub> emissions.

EU's energy mix in 2024:

Wind and solar energy overtook fossil energy in Europe:

Globally, renewables also overtook fossil fuels (IEA, 2024):

Meanwhile, reduction in coal-power was also possible. Coal is a large CO<sub>2</sub>eq emitter.

Beyond electricity and heat, the chemical sector is a massive CO<sub>2</sub>eq source. (Lange, 2021) reports the petrochemical industry uses about 10% of global fossil carbon as feedstock and another 7% to power its processes, producing some 400Mt of base chemicals each year, 36% of which becomes packaging; the cradle-to-gate CO<sub>2</sub>eq emissions for base chemicals are roughly 1–2.5kg CO<sub>2</sub>eq per kg or 5t CO<sub>2</sub>eq per tonne of plastic, when including use and end-of-life, the entire lifecycle emissions are 1.7Gt CO<sub>2</sub>eq (☒ 4% of all anthropogenic emissions) per year; a true circular-carbon economy would require renewable carbon feedstocks (e.g. biomass or CO<sub>2</sub>-derived monomers), electrified green heat, closed-loop catalytic recycling of molecular building blocks, and modular low-temperature reactors to slash energy demand.

Large technology conglomerates and newly founded startups alike are working in the climate solutions space (often referred to as *climatech* by the media), have proposed a range of approaches to CO<sub>2</sub> reduction in the Earth's atmosphere. These technologies include several types of *carbon capture*, directly from the air (direct air capture or DAC), from the source of pollution, such as using high-performance filters on factory chimneys, as well as nature-based solutions such as large scale tree planting using drones. Each technology has their own pros and cons. For

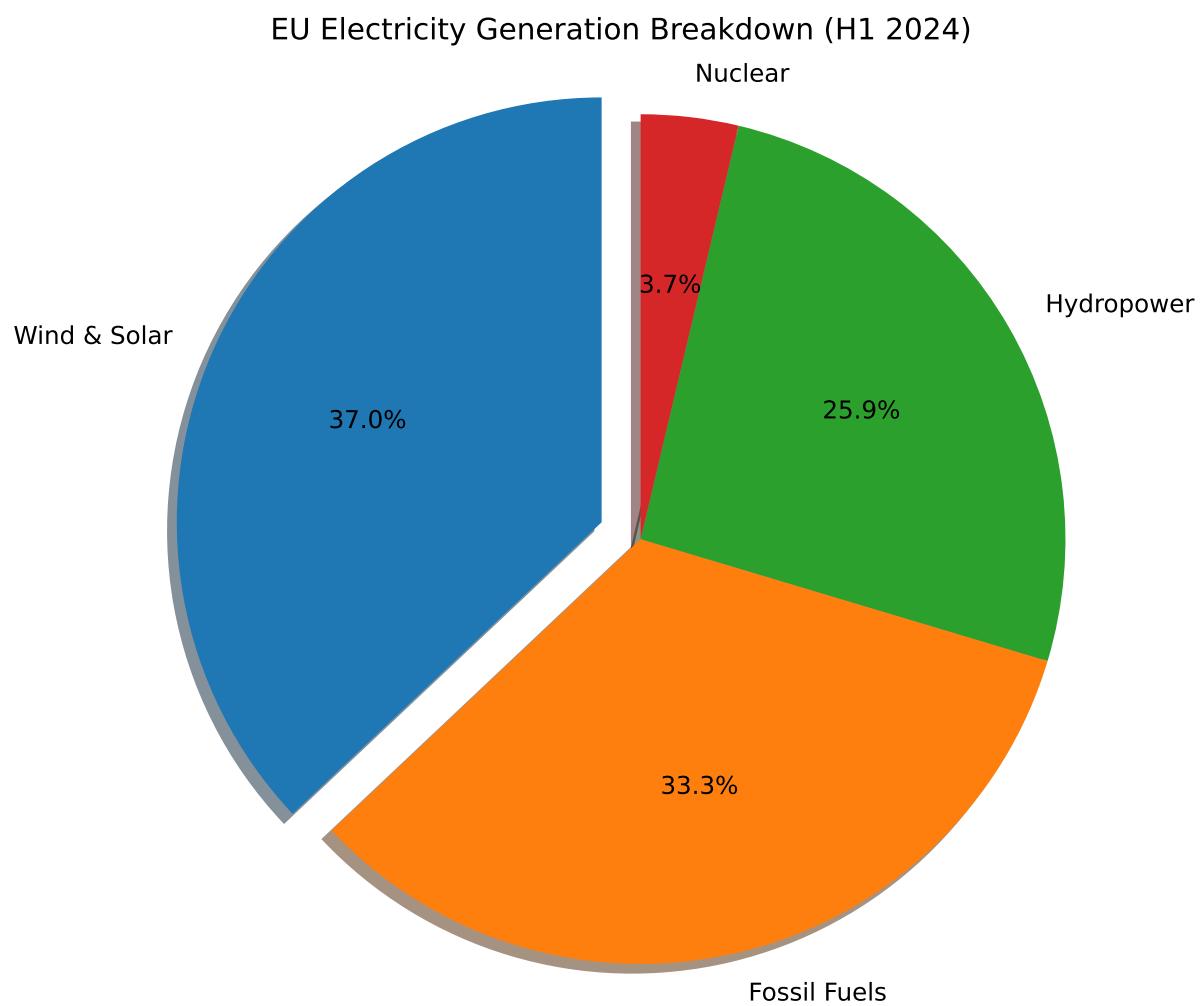


Figure 37: The EU's Energy Production Breakdown

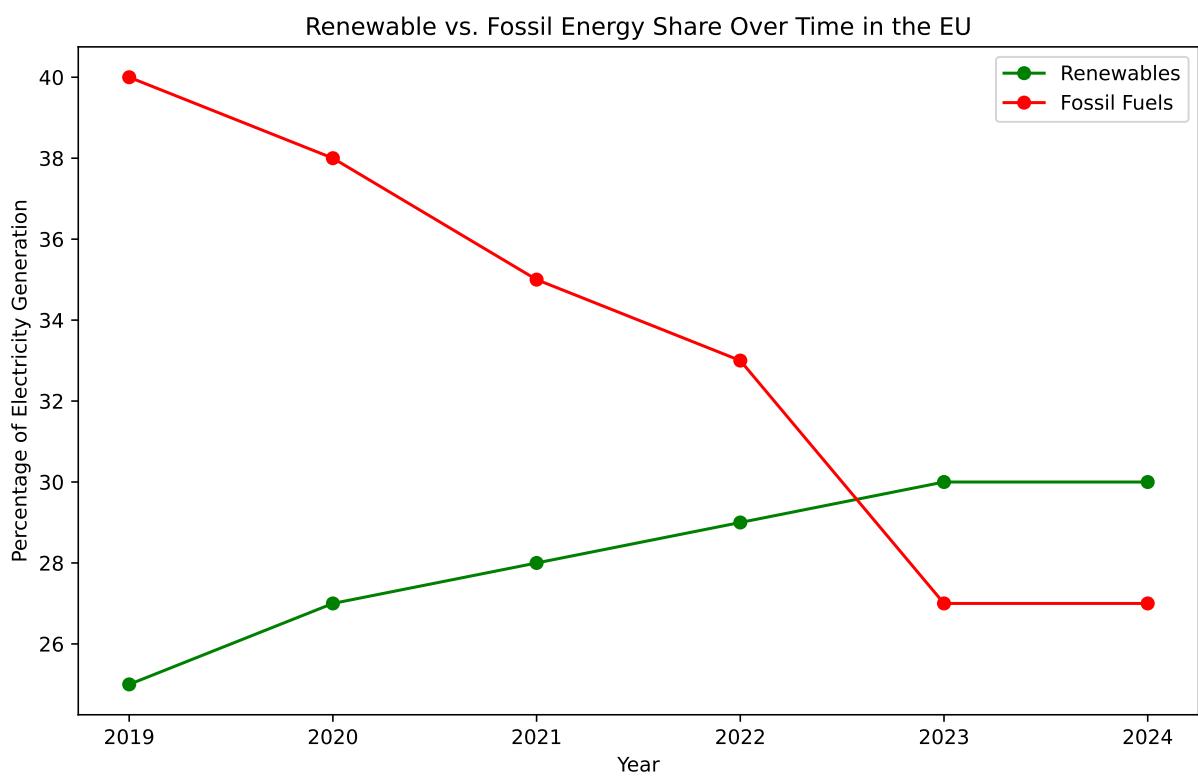


Figure 38: The EU's Renewables vs Fossil Energy

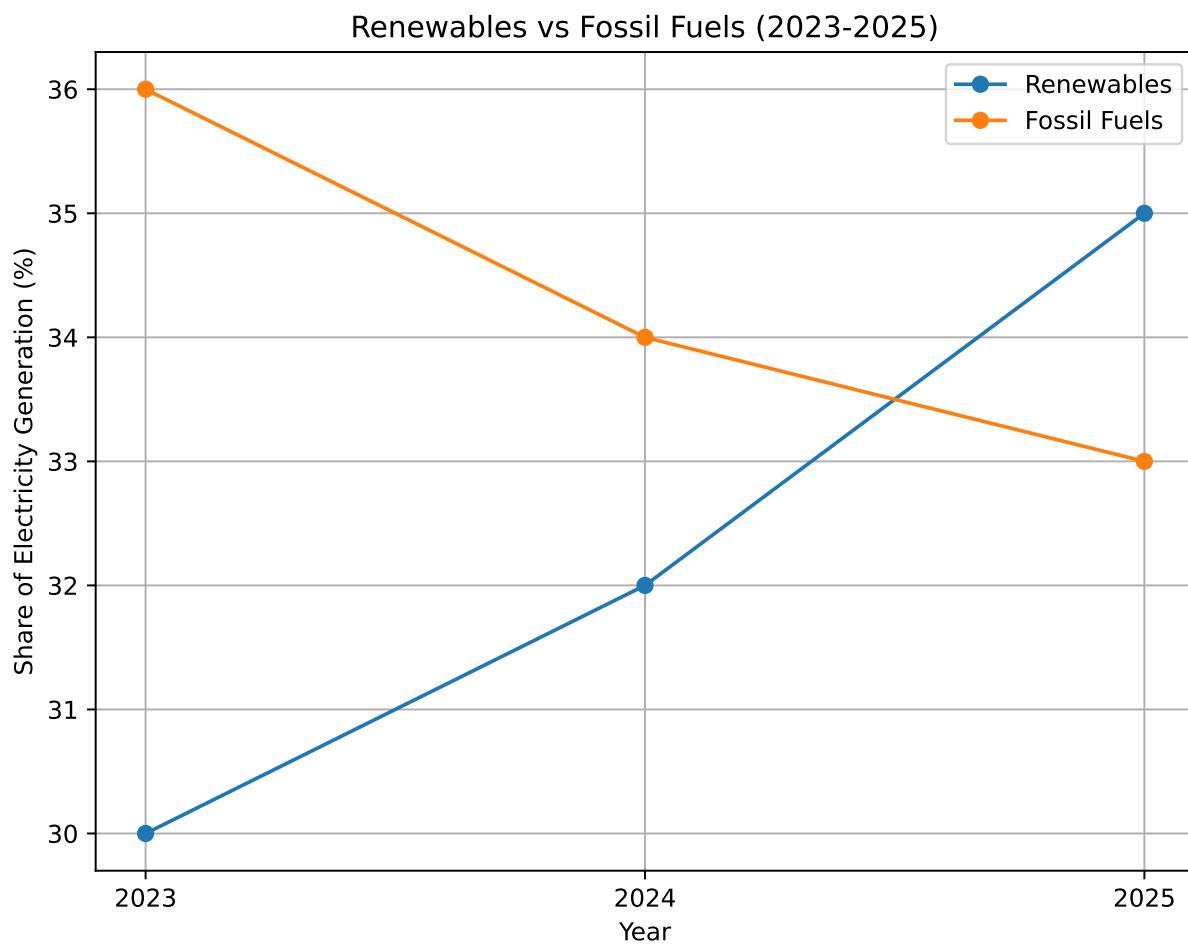


Figure 39: Global Renewables vs Fossil Energy

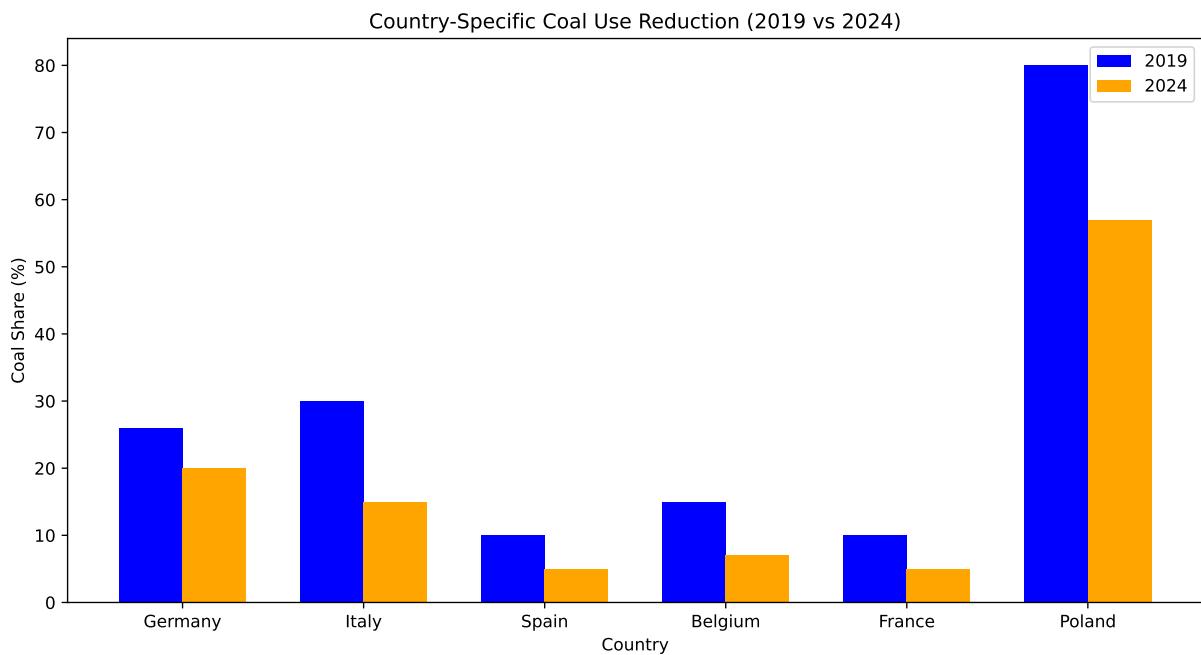


Figure 40: The EU's Reduction of Coal Energy

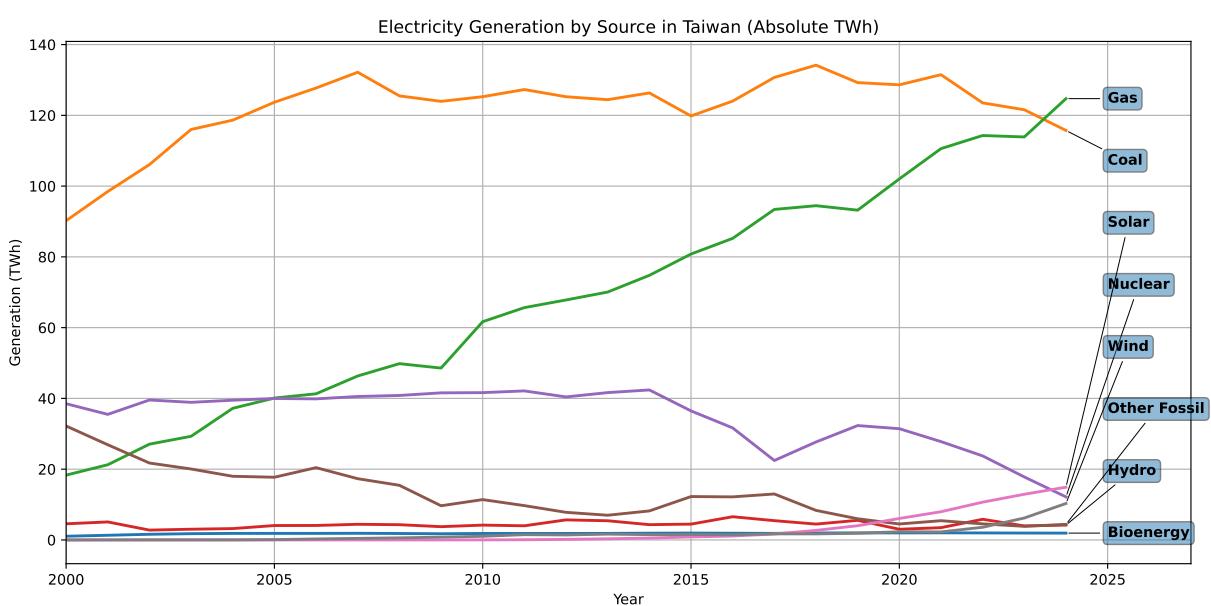


Figure 41: Taiwanese Energy Production

instance, (Vitillo et al., 2022) illustrates how direct air capture of CO<sub>2</sub> is difficult because of low concentration and CO<sub>2</sub> capture at the source of the emissions is more feasible. (Cleantech Group, 2023) profiles 100 innovators across agriculture, food, energy, mobility, and waste that Cleantech Group judges most likely to enable a future with sub-2 degrees warming. Overall, considering pathways to carbon drawdown finds considerable uncertainty exists among experts which CO<sub>2</sub>eq reduction among nature- and technology-based methods are the most effective (S. Low et al., 2022).

#### **8.4.3 Individual Action**

Sometimes individual environmental (climate) action *does matter* and can come at great personal cost, even loss of life. EJAtlas tracks environmental justice cases around the world, where human stakes are very high. See (Joan Martinez-Alier, 2021; J. Martinez-Alier et al., 2022; Scheidel et al., 2020) for coverage of extreme cases of risk environmental activists must endure.

However, for most of us individual climate action is *ineffective*. The effect of individual climate action such as *choosing a more sustainable product* is so limited to be next to meaningless. For individual consumer choices to make a difference, they need to be *aggregated* into a movement, collective action with scale, influence, and visibility.

There is no single solution to the environmental crisis. Given the enormity of environmental degradation, many different approaches are needed. This chapter documents some of the ongoing work which a sustainability companion could assist college students get involved with.

While the scale of climate change is too big for individual action to make a difference, individual action can foster hope and a sense of collective responsibility (Nature, 2020).

## 9 DESIGN

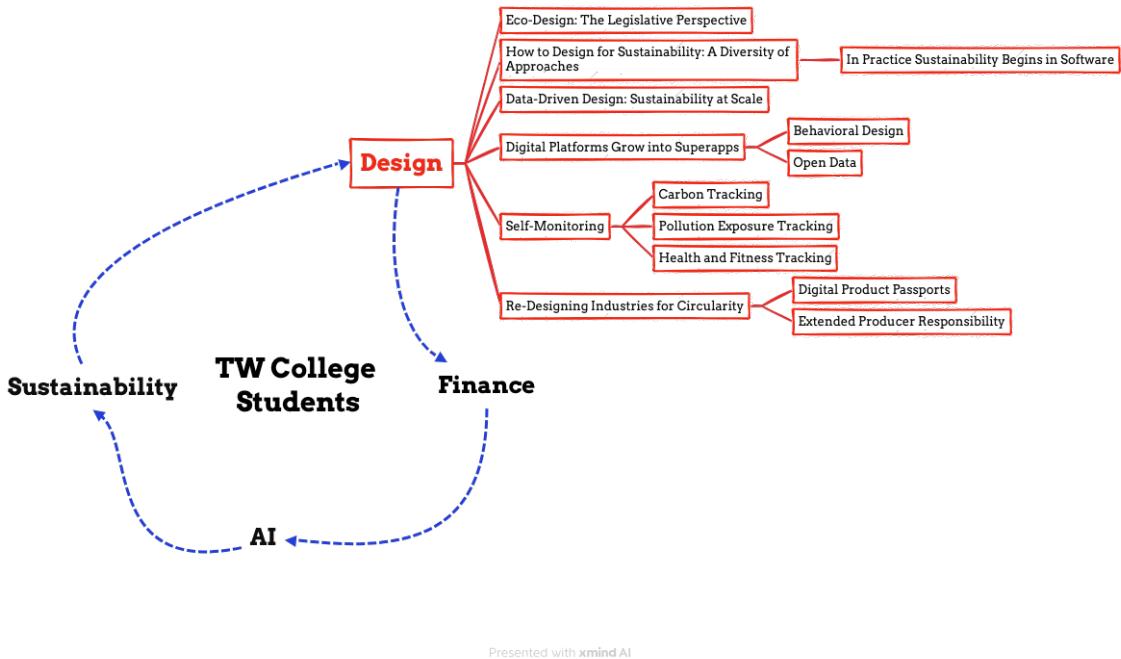


Figure 42: Visual abstract for the design chapter

Designers have been battling complexity since the beginning of design. Industrial designer Dieter Rams famously said in the 1970s “*Good design makes a product understandable*” as one of the ten key tenets to strive for in good products (DW Euromaxx, 2018; Fabrique & Q42, n.d.). Don Norman, the grandfather of interaction design, is quoted as saying:

“Modern technology can be complex, but complexity by itself is neither good nor bad: it is confusion that is bad.” - (Norman, 2016)

I would simply say: Design makes complexity comprehensible.

Sustainability is one of the most complex goals that humanity has set for itself. The following looks at some of the ways design might make it.. achievable.. and comprehensible.

### 9.1 Eco-Design: Design as Political Action at Scale

Politics matters in sustainability. In Brazil, deforestation fell 60% in 1 year, based on remote satellite reconnaissance, after the election of a more pro-environment leadership (Watts, 2023). Globally, the monumental task of removing several gigatons of CO<sub>2e</sub> from the atmosphere requires massive policy shifts and collaboration across countries and industries (Mackler et al., 2021).

In Europe, the EU “Green Deal” legislative strategy is comprehensive and backed by science, with the EU Commission having released strategic foresight reports since 2020, and becoming a driving force of transformative climate legislation in Europe (European Commission, 2023b). The timeline of the policy context in Europe is as follows: in 2019, the Von der Leyen Commission adopted the European Union (EU) Green Deal strategy. In 2021 the Commission proposed a goal of reducing CO<sub>2</sub>eq emissions by 55% by 2030 under the *Fit for 55* policy package consisting of a wide range of economic measures. In November 2022, the proposal was adopted by the EU Council and EU Parliament with an updated goal of 57% of CO<sub>2</sub>eq reductions compared to 1990, set to become a binding law for all EU member countries (*EU Reaches Agreement on National Emission Reductions*, 2022; European Commission, 2019c, 2019a; European Council, 2022). In March 2022, the EU Circular Economy Action Plan was adopted, looking to make sustainable products *the norm* in EU and *empowering consumers* as described in (European Commission, 2022a).

Designing the right legislative measures can be hugely impactful.

Consumer products’ overall life-cycle environmental impact is defined in the design process by the materials and energy resources needed and the post-consumer potential for reuse or recycling. In the context of the European Union, *eco-design* has gained political support from European Commission as part of the EU’s “*Green Deal*” legislative strategy, aiming to transform European economies into sustainability leaders (Commission et al., 2014). The Ecodesign for Sustainable Products Regulation (ESPR) entered into force in July 2024 (European Commission, 2024b) following the (European Parliament, 2022) proposal whereby the European Commission established a general framework for *eco-design*: “*requirements for sustainable products, repealing rules [referring to the previous Eco-Design Directive (2009/125/EC)] currently in force which concentrate on energy-related products only*,” setting up a level playing-field for the organizations operating on the EU single market. Virginijus Sinkevičius, the EU Commissioner for the Environment, Oceans and Fisheries, is quoted as describing eco-design as design that “*respects the boundaries of our planet*” (European Commission, 2022c).

Table 35: The 9 qualities of *eco-designed products* based on the Ecodesign for Sustainable Products Regulation (ESPR) enacted as law in the EU as of July 2024 (European Parliament, 2022; Lüttin, 2025).

Feature	Benefit
Durable	Reduces the need to frequently replace the product
Reusable	Extends the product’s life-cycle; sell or share to the next user
Reparable	Extends the product’s life-cycle; fix instead of discarding
Upgradable	Extends the product’s life-cycle; improve performance without complete replacement.
Easy to Maintain	Reduce resources needed to keep the product functional

Feature	Benefit
Easy to Refurbish	Support second-hand use and circular economy
Easy to Recycle	Support material recovery at end of the product's life to reduce new resource extraction and pollution
Energy Efficient	Reduce product's CO <sub>2</sub> eq footprint and operating costs
Resource Efficient	Reduce product's use of raw materials and energy during production and life-cycle

Eco-Design for Sustainable Products is a key EU sustainable policy design tool and each product covered by the ESPR is required to have a *Digital Product Passport* (DPP) which enables improved processing within the supply chain and includes detailed information to empower consumers to understand the environmental footprint of their purchases (European Commission, 2022b). It's safe to say the large majority of products available today do not meet these criteria. Given this far-reaching legislative effort, we have an opportunity to re-imagine how every product can be an eco-product and how they circulate in our circular economy. The Director of the French environmental NGO Pôle Eco-conception describes eco-design as “[l]ocated at the interface between consumption and production patterns, eco-design helps to structure the market for products and services using a life cycle approach and tangible criteria” (Chouai & Mayer, 2024).

The European Commission is set to propose a legally-binding 90% emissions reduction from 1990 levels to be achieved by 2040; however, political pushback by governments is likely to weaken the goal; the EU climate chief Teresa Ribera is looking for ways to find pragmatic solutions, by, for example, considering some use of carbon credits (thus far, all the goals needed to be achieved within the borders of EU; buying carbon credits from places outside the EU would not be counted as emissions reduction) (Taylor, 2025; Weise, 2025).



Figure 43: EU Policy Context Timeline

The above chart shows how the European Union has been on a path of climate legislation transformation.

The above chart illustrates the European “Green Deal”.

### Combined Concept Map of EU Green Deal Regulations and Categories



Figure 44: The EU's Green Deal

In the countries that make up the European Union (EU), a wide range of legislative proposals, targets, organizations, and goals have existed for decades. It's not that the EU didn't have an overarching environmental policy before; rather it was vague and filled with loop-holes. Upcoming laws cited above aim to harmonize approaches to sustainability and raise standards for all members states, in turn influencing producers who wish to sell in the EU common market. National governments need to adapt EU legislation to local contexts. For example Estonian government adopted the Estonian Green Deal Action Plan (Eesti Rohepöörde Tegevusplaan) (Eesti Vabariigi Valitsus, 2022). From the legislative perspective, NFRD (Non-Financial Reporting Directive) is replaced by CSRD (Corporate Sustainability Reporting Directive) and ESRS reporting is the standard to meet CSRD requirements.

The EU is also concerned with supply-chain deforestation. The ESPR (Sustainable Products) and EUDR (European Union Deforestation Regulation) work hand-in-hand as part of EU's legislative efforts to promote sustainability. EUDR applies to all products placed on the market from December 2024 and June 2025 for small businesses. Greenpeace has called the EUDR "*first step to end its complicity in the reckless destruction of these life-support systems*" - yet to become a success story, there needs to be follow through, integrating forest protection throughout the economy. Some of the steps to achieve this include the EU *taxonomy of environmentally sustainable economic activities* published by the Technical Expert Group (TEG) on sustainable finance, as detailed in the report by (*EU Taxonomy for Sustainable Activities*, n.d.). The proposal for a Nature Restoration Law by the European Commission requiring member countries to restore 20% of EU's degraded ecosystems by 2030 and full restoration by 2050 has not yet passed (as of writing) (*Scientists Urge European Parliament to Vote for Nature Restoration Law*, 2023) and is facing a backlash (David Pinto, 2023).

Certainly the EU is not the only region legislating to promote sustainability; sustainability policy context is shifting around the world. There are legislative efforts in numerous jurisdictions, which have passed laws which aim to reduce the environmental impact of products throughout their lifecycles. In the US, the *Inflation Reduction Act* provided funding to development of decarbonizing technologies and includes plans to combat air pollution, reduce green house gases and address environmental injustices (Rajagopalan & Landigan, 2023). In Australia, the Product Stewardship (PS) scheme also includes an investment fund targeted at increasing the recycling rates of specific products (Australian Government, 2024). Australia, Japan, and Taiwan all have sustainable procurement schemes, prioritizing greener products in public purchases (Australian Government Department of Finance, 2025; Ministry of the Environment, Government of Japan, 2000; The Ministry of Environment of Taiwan, 2024).

I was torn whether to place *politics* under *sustainability* or *design*, and decided for the latter - as sustainability is primarily *descriptive*, using science to measure and present the real situation, while design is *prescriptive*: codifying decisions about how do we live - in products and services. Design *is* political.

### **9.1.1 Beyond Recycling: Default to Return, Repair, Reuse**

(Gigerenzer, 2008) argues that heuristics - basically, rules of thumb - can make more accurate predictions about the future than statistical tools such as Bayesian and regression models, in certain contexts, especially when data is incomplete or noisy. This aligns with Herbert Simon's classic concept of bounded rationality, which suggests that people make decisions not by fully optimizing, but by *satisficing*, i.e. seeking good-enough options given limited time, information, and cognitive capacity (Simon, 1955). (Gigerenzer, 2008; Gigerenzer & Selten, 2002) updated the concept to introduce the idea of a toolbox of fast, dynamic, frugal heuristics - named ecological rationality, showing how humans use only a small amount of information, often ignoring most available data, adapting to specific environments: heuristics aren't irrational; they work well because they exploit the structure of real-world environments.

In the practice of design for sustainability, the recognizing that humans use heuristics, translates to making strategic use of choice architecture and *the power of defaults*: displaying the most sustainable option as the default - the oft-quoted example being green power as the default choice on the German energy markets (Antonides & Welvaarts, 2020; Kaiser et al., 2020). Several research projects of plant-based, vegan and vegetarian food defaults at (university) canteens show 45-58% increase in sustainable choices across studies (Boronowsky et al., 2022; Erhard et al., 2023; Ginn & Sparkman, 2024; A. W. Zhang et al., 2024). (Simon Sterne, 2023) argues good UX is about helping the user make decisions, which can be thought of as four key tactics: (1) simplify complex choices, (2) intelligent defaults, (3) clear real-time feedback on the outcome of each option, and (4) avoid unintended regret by testing decision-support systems.

The universal recycling symbol creator Gary Anderson created the symbol when he was an architecture student at USC (University of Southern California) in 1970 at the age of 23, inspired by Silent Spring, Earth Day, the Bauhaus, Bucky Fuller, Spaceship Earth, printing presses, and the Woolmark logo for wool industry certification, and even the Möbius strip, for a competition held by a packaging firm that was making paper containers for packaging (Swap Society, 2023).

### **9.1.2 Eco-Modulation: Extended Producer Responsibility Incentive Design**

Eco-modulation is a legislative innovation, which makes harder to recycle items more expensive for the producer. Recycling fees take into account eco-design: an item from a single material is easier (cheaper) to recycle than product from composite materials. Eco-modulation makes the hidden cost of hard-to-recycle formats directly visible on the invoice.

While Taiwan doesn't yet have a specific eco-design law, there are various pieces of legislation promoting circular economy. Already in 1988, Taiwan implemented an Extended Producer Responsibility (EPR) scheme, followed by a recycling system (initially focused on electronic items) in 1998 (Chong et al., 2009). Eco-design initiatives in Taiwan started at least as early as 1994, when Taiwanese companies and universities noticed international sustainability trends and began to implement their own sustainable design initiatives (Jahau Lewis Chen et al., 2005).

The key to comparing Product Stewardship, Extended Producer Responsibility (EPR), and Eco-Design is the scope, as illustrated in the chart below. While Product Stewardship (PS) and Extended Producer Responsibility (EPR) deal mostly with the end of the product life-cycle (they are *reactive*), including their disposal and recycling (EPR going a step further than PS by shifting the responsibility to the producer), eco-design moves sustainability up the design chain (being *proactive*), setting standards for making better products - in essence, attempting to *design-out* the waste.

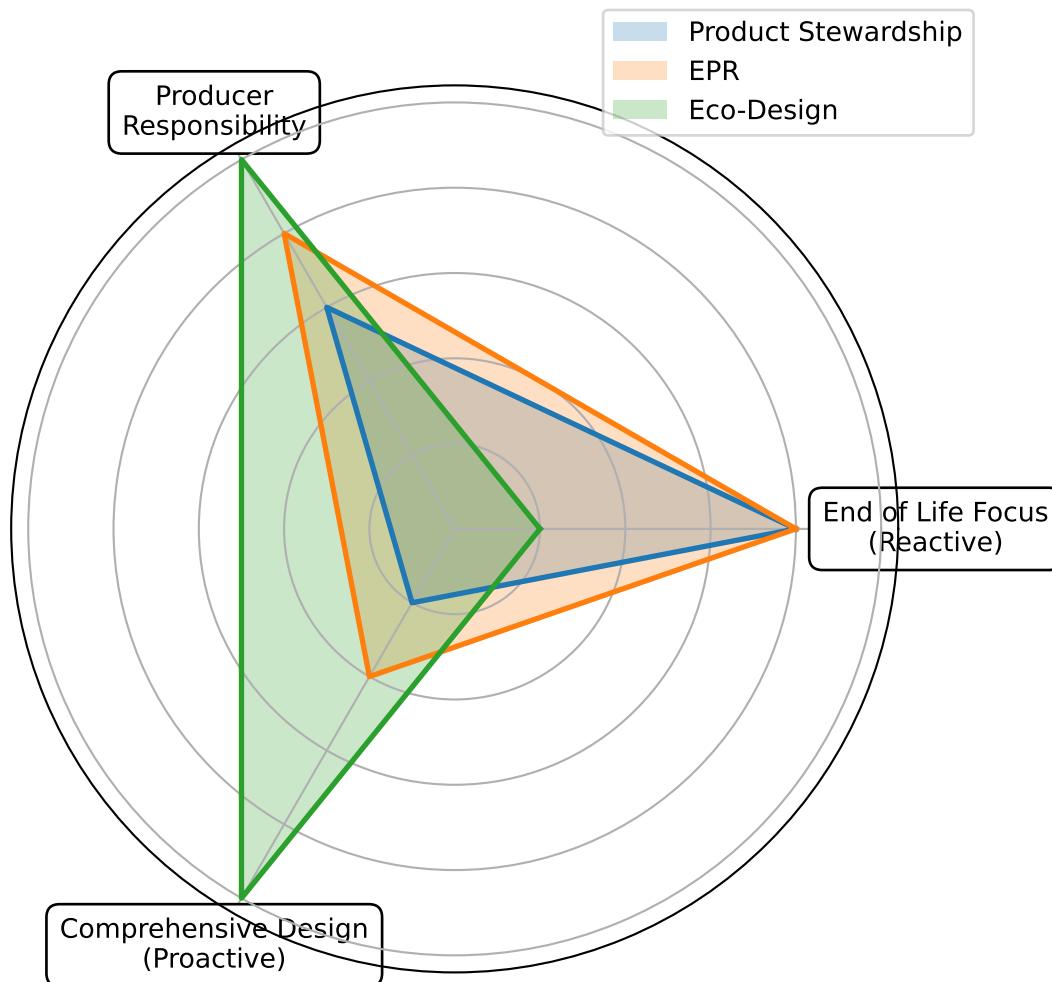


Figure 45: Extended Producer Responsibility vs Product Stewardship vs Eco-Design

Popular blogs such as (Kohli, 2019) and (Lose, 2023) offer many suggestions how designers can help people become more sustainable in their daily lives yet focusing on the end-user neglects the producers' responsibility - termed Extended Producer Responsibility or EPR in waste management studies.

Extended Producer Responsibility (EPR) is a policy tool first proposed by Thomas Lindhqvist in Sweden in 1990 and described in detail in his PhD thesis (Lindhqvist, 2000; Lindhqvist & Lidgren, 1990), aimed to encourage producers take responsibility for the entire life-cycle of their

products, thus leading to more eco-friendly products. In essence, Extended Producer Responsibility enables companies to be responsible for the entire life-cycle of the product. In California, part of the EPR regulation is a large pool of funding for cleaning up historic pollution resulting from industry Moolman (2024).

Nonetheless, EPR schemes do not guarantee circularity and may instead be designed around fees to finance waste management in linear economy models (Christiansen et al., 2021). The French EPR scheme was upgraded in 2020 to become more circular (Jacques Vernier, 2021). In July 2024, Latvia was the 4th EU country to join an textile-EPR scheme (*New EPR Requirements for Textiles in Latvia from July 2024 on*, 2024). Strong consumer protection legislation (such as EPR) has a direct influence on producers' actions. For example, in (HKTDC Research, 2022), the Hong Kong Trade Development Council notified textile producers in July 2022 reminding factories to produce to French standards in order to be able enter the EU market.

In Europe, there's large variance between member states when it comes to textile recycling: while Estonia and France are the only EU countries where separate collection of textiles is required by law, in Estonia 100% of the textiles were burned in an incinerator (as of 2018) while in France textiles are covered by an Extended Producer Responsibility (EPR) scheme leading to higher recovery and recycling rates (European Commission. Joint Research Centre., 2021; Nordic Council of Ministers, 2020). Yet, some countries like Germany (75%), Netherlands (45 %), and Denmark (43%), which have no specific EPR scheme for textiles, report higher collection rates than France, which with EPR collected only 38% of the textiles, however recovered 95% of that through reuse and recycling (Eurostat, 2022; *Towards 2025 - Separate Collection and Treatment of Textiles in Six EU Countries*, 2020).

The success of EPR can vary per type of product. For car tires, the EPR scheme in the Netherlands claims a 100% recovery rate (Campbell-Johnston et al., 2020). (J. Peng et al., 2023) finds that the *Carbon Disclosure Project* has been a crucial tool to empower Chinese auto-producers to adopt EPR schemes. Technological advancements play a big role in recycling rates, as even badly sorted materials can increasingly be recovered using AI; one example being Greyparrot AI, which notes that even in the most advanced countries, 40% of waste sorting is still manual, opening an opportunity for automation (Natasha Lomas, 2024).

While recycling rates are improving, (Steenmans & Ulfbeck, 2023) argues for the need to engage companies through legislation and shift from waste-centered laws to *product design regulations*. In the same vein, and in the spirit of EU's EPR regulations, (Ruiz-Pastor & Mesa, 2023) proposes an integrated *product repairability index* (PRI). (Lenovo, 08-29-22) suggests rethinking product design entirely to inspire consumers expect more from the devices they buy. (Duriez et al., 2022) shows how simply by reducing material weight of the product, it's possible to design more sustainable transportation. However, the devil is often in the details. (Formentini & Ramanujan, 2023) study of Design for Circular Disassembly (DfCD), introduces a Disassembly Effort Index (DEI) to measure the disassembly time in seconds; their case study of the End-of-Life (EoL) of an electrical kettle showed ignoring realistic EoL failures (such as rusted screws), can lead to inaccurate recommendations for circular design parameters.

Packaging is a rapidly growing industry, expanding on the back of online shopping, which gener-

ates large amounts of waste materials, which, if not reused or recycled, easily becomes garbage. Over 161 million tonnes of plastic packaging is produced every year (Bradley & Corsini, 2023). Already more than a decade ago, (*Detail-Rich Sustainable Packaging Product Database Is an Industry First*, 2010) proposed a database of green packaging to compare hundreds of sustainable packaging materials and guide designers through environmental, performance, and cost trade-offs in one unified tool, in order to help producers choose better packaging - yet the problem is far from solved. More recently, (Bradley & Corsini, 2023) developed an analytical framework of key sustainability factors, from an overview of 107 studies on reusable packaging, finding customer acceptance, high return rates, supply-chain shortening, and system standardization, as the key factors critical to unlocking reusable packaging solutions at scale. A survey by PMMI, the Association for Packaging and Processing Technologies, among industry professional, found legacy equipment, higher material costs, and supply consistency as the top barriers to sustainable packaging; in turn, vital enablers were clear vendor guidance, proven material and equipment solutions, and customer demand (*Challenges and Opportunities in Sustainable Packaging Today*, 2022). In response to legacy equipment issues, (*Sulapac – Replacing Plastic*, n.d.) a large producer of packaging, has proposed a wood-based, microplastic-free composites to serve as drop-in replacements for plastics; a material even compatible with existing molding, extrusion, and thermoforming production lines, while slashing cradle-to-gate CO<sub>2</sub> emissions and preventing microplastic pollution.

In food packaging specifically, (Ada et al., 2023) identified distinct challenges from consumer acceptance to material-supply mismatches, collection logistics, and regulatory gaps, underscoring the multifaceted barriers to circular food packaging. Over 85% of companies in the “protein industry”: meat, poultry, seafood, and alternative proteins have some type of sustainability initiative (*Protein Brands and Consumers Alike Focus on Sustainability*, 2022). Yet, having sustainability programs does not make a company sustainable, case in point being Coca Cola in the beverage industry. (Lerner, 2019) describes Coca-Cola’s plastic pollution problem, based on leaked audio, detailing how Coca-Cola was exposed for lobbying against container-deposit laws - aka Deposit Return Schemes (DRS), - aiming to misrepresented recycling as a complete solution; strategies that stalled effective legislation and maintained a “green” facade despite obstructing real sustainability progress.

The “*Plastic Waste Makers Index*” report lists large corporations which produce plastic waste globally and provides some useful statistics: single-use plastic rose by 6 million tonnes from 2019 to 2021, while just 3 million tonnes of recycling capacity was planned by 2027 (as of the report date, 2023); in total, single-use plastic generated 450 million tonnes of CO<sub>2</sub>eq emissions per year; up to 98% of the single-use plastic was produced from virgin petrochemicals, while 2% was from recycled material; meanwhile in Taiwan, the Far Eastern New Century company boosted recycled content from 2% to 11% in 2021 and plans to double its recycling capacity (Minderoo Foundation, 2023). (Yap et al., 2023) Singapore disposes of 900,000 tonnes of plastic waste each year, out of which only 4% is recycled. Single-use plastics make up 44-68% of all waste mapped by citizen scientists (Kiessling et al., 2023).

### 9.1.3 Scenario-Building: The Worst Futures and Designs for Quality of Life

Scenario-building is a key tool for sustainability, because sustainability is so complex. Sustainable design cannot always predict certain outcomes - instead, it can make use of scenarios to prepare for several possibilities. In sustainability, there are rarely good choices. Rather it's a question of avoiding the worst choices. One existing tool, which has been widely used, is the EnROADS climate change solutions simulator; governments, organizations and individuals around the world have used it explore climate scenarios based on interactive changes and visualizations (Climate Interactive, n.d., 2023; Creutzig & Kapmeier, 2020; Czaika & Selin, 2017). Likewise, (Rooney-Varga et al., 2019) shows the effectiveness of *The Climate Action Simulation* in educating users about *success scenarios*. *Life Cycle Assessment* and *Environmental Impact Analysis* are another set of useful tools to provide eco-design scenarios (de Otazu et al., 2022).

While traditional economic thinking is based on a conflict between nature and development, some new holistic models find there is potential for synergy between economic, social, political, cultural, and environmental metrics. For example, (Kaklauskas et al., 2023)'s multi-criteria analysis of 169 countries and 238 cities, finds 71% average correlation between Climate Change and Country Success (C3S) and Quality of Life (C3QL) indicators. In a similar vein, (Rieger et al., 2023) develops an integrated science of wellbeing, linking humans' psychological, biological, societal and environmental domains to guide research and public policy, based on interactions between domain experts.

Wellbeing Economy Governments is an example of country-level collaboration in sharing expertise on sustainable development, looking to bring post growth strategies and policy frameworks to the mainstream. The concept of a wellbeing economy focuses on human and ecological well-being rather than material growth since 2018 and includes Finland, Iceland, New Zealand, Scotland, Wales, and Canada as founding members of the network (Fioramonti et al., 2022).

(Popkova et al., 2022) argues that SDGs need to discussed in their totality and uses factor analysis to link SDGs to institutions and digital technologies; findings include SDG 3 (Good Health and Well-Being) and SDG 17 (Partnerships for the Goals) progress through institutions in developed countries and are most impacted by digital technologies and digital knowledge index, meanwhile SDG 16 (Peace, Justice and Strong Institutions) makes the most headway in developing countries, which are starting from a lower base. Likewise, the German Institute of Development and Sustainability (IDOS) has built a tool to connect SDGs and their 169 targets to NDCs (Nationally Determined Contributions), looking for synergies for effective climate action plans and sustainable development strategies, visualizing a clear skew which SDGs receive the most climate - related commitments - SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy); meanwhile SDG 14 (Life Below Water), and the SDG 3 social goals discussed above, SDG 4 (Quality Education) and SDG 5 (Gender Equality), are the least addressed in climate plans (Dzebo et al., 2023).

Eco-Design is about improving processes and optimizing resources. While the goal of reducing harm is shared, the specifics will depend on the industry. (Van Doorsselaer, 2022) Defines eco-design as "*design for X*" in a circular economy, thinking through the life cycle of a product, tools, materials, production, use, and end-of-life phases.

In wine-making, (Manzardo et al., 2021) presents an Italian winery case study, where a re-designed Merlot red wine procedure reduced in environmental impacts from fuel and pesticide use in vineyards; the 8-step procedure included calculating the product's environmental footprint and following the ISO 14006 standard, titled "*Environmental management systems—Guidelines for incorporating ecodesign*". Finding uses for by-products, can improve sustainability even more. (Iñarra et al., 2022) designed a circular scheme for brewery left-overs, producing feed ingredients for aquaculture; in a further step, using life-cycle assessment (LCA) and optimizing logistics, reduced the aquafeed's environmental footprint also by 6%.

In architecture and the built environment, (Munaro et al., 2022) conducted a comprehensive review of eco-design 288 articles, identifying *Design for Adaptability* and *Disassembly* as the most inclusive strategies, coining a new term DfAD; a framework linking DfAD with lifecycle assessment tools is a promising area for research to support sustainable construction.

In pharmaceuticals, (Bassani et al., 2022) proposes an approach to eco-design using life-cycle assessment: optimizing packaging types, alternative materials, transport, and weight reduction. A follow-up study from the same group in 2023 extended the eco-design to a full cradle-to-grave assessment and evaluated end-of-life alternatives (Bassani et al., 2024).

In the printing industry, (Miyoshi et al., 2022) takes the example of ink toner bottles and applies Life Cycle Simulation to show in a case study how standardized compatibility between older and newer systems can save resources and results in sustainability savings, highlighting how remanufacturing is an important strategy in circularity for reducing CO<sub>2</sub> emissions and life cycle costs.

While these examples underline the industry-specificity of eco-design, some authors attempt to come up with more holistic approaches. For instance (Ruiz-Pastor et al., 2022) developed "CN\_Con", a metric for conceptual design, trying to measure circularity and novelty in conjunction, by analyzing product functions, durability, material origins, and end-of-life, while at the same time supporting creative and circular design solutions in early stages.

On an international level, looking at companies operating on the European Single Market, (Aranz et al., 2022) conducted a large-scale study using machine learning on firm survey data from 870 organizations across diverse economic sectors, acquired from the 2015 EU Public Consultation on the Circular Economy conducted by European Commission, comparing coercive pressures (regulations, subsidies, grants), normative pressures (industry standards, professional networks), and mimetic pressures (competitive imitation), finding normative and mimetic pressure only enhance sustainability, if coercive pressure already exists - i.e. regulations are a key point of leverage. In summary, enacting laws which support sustainability can shift complex systems with many parties towards a circular economy, and be enhanced by additional voluntary forces. However, a comparative analysis of OECD green growth indicators for the periods 2004–2005 and 2019 across EU member states found that green transformation do not correlate directly with development level - instead each country's unique socio-economic context plays a role: governance quality and income distribution shape the effectiveness of regulatory frameworks, suggesting that coercive policies must be tailored to national circumstances in order to reinforce circular-economy adoption at scale(Cheba et al., 2022).

## 9.2 Thinking in Systems to Re-Design Industries or Provenance and Traceability

As of 2025, *circular economy* is a tiny part of the world economy. (Circle Economy, 2022) reported in 2022 only 8.6% of world economy was circular and *100B tonnes of virgin materials* was sourced every year. An early pioneering innovator, (Jackson, 1996) showed through detailed case studies how *preventive environmental management*, redesigning industrial production at the source can avert pollution, laying the conceptual groundwork for today's circular-economy models. Many companies are investing into transforming their processes. “[*T*]ransition to a low carbon economy presents challenges and potential economic benefits that are comparable to those of previous industrial revolutions” (Pearson & Foxon, 2012).

Futurists and visionaries adept at naming things have already listed the 5th, 6th, and even the 7th industrial revolution, pointing at robotics, quantum computing, nanotechnology, and more, looking at current trends and building scenarios for 2050 to envisioning a world with convergence of bio-based and mineral-based technologies, widespread sustainability, and energy-abundance (Chourasia et al., 2022; Ruiz Estrada, 2024). If indeed, we're in an industrial revolution, it's possible to re-design entire industries, and that is exactly the expectation sustainability sets on businesses. Across all industries, there's a call for more transparency. Conversations about sustainability are too general and one needs to look at the specific sustainability metrics at specific industries to be able to design for meaningful interaction. There's plentiful domain-specific research showing how varied industries can develop eco-designed products.

I use the lens of *sustainability* - a complex term - to look at how design can contribute to eco-friendly products, advocating a diverse set design methods as a toolbox, where one can pick a suitable tool to match the problem. While AI allows us to look at a larger number of design scenarios than previously feasible, there are many approaches to design for sustainability, with varied design practices that may be relevant at different times in the process. Designing for sustainability is fundamentally a hopeful act, imbued with the belief that a healthier world is possible - because health and sustainability are intrinsically connected. As this research is *practice-oriented* (i.e., my goal here is to find design approaches that could influence my prototype), I will focus on some fields of design which I hope relevant, fruitful, or contextual to my project.

*Eco-Design, Circular Design, Design for Circularity, Cradle-to-Cradle Design, Green Design, Regenerative Design, Climate-Responsive Design, Life-Centered Design, Design for Human Rights, Multispecies Design, Designing for Health* - designing for sustainability has been called with many names in diverse contexts of use, using a diversity of approaches, with subtle differences of emphasis and nuance, with same general goal of being more sustainable. While EU legislation chose *Eco-Design* as the overarching title, researchers and practitioners discuss all of the above on a frequent basis. (Ceschin & Gaziulusoy, 2016) gives a comprehensive overview of the main themes of sustainable design and the main contributions and limitations in the well-researched “*Evolution of design for sustainability: From product design to design for system innovations and transitions*”.

*Human-Centered Design* is the grandfather of design with *attitude*. There's even an ISO standard for human-centered design, with the designated code ISO9241-210, revised as ISO 9241-

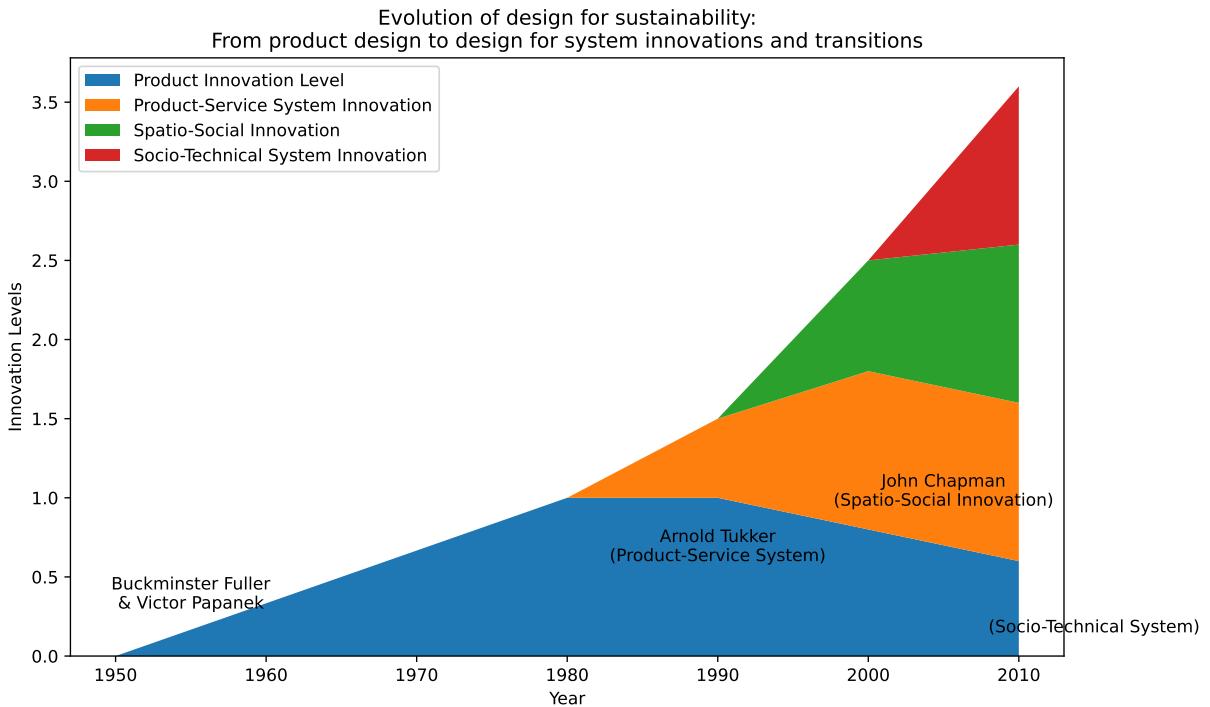


Figure 46: History of Design for Sustainability

210:2019 titled “*Ergonomics of human-system interaction*” and up for revision soon (ISO standards are reviewed every 5 years). Some of the key takeaways include “Understanding and specifying the context of use”, “Involving users throughout design and development”, “Specifying user requirements”, “Evaluating designs”, “Multi-disciplinary Collaboration”, “Iterative process” and “Continual Improvement”, and finally - usability is not enough, the design should provide a user experience (UX) for human “emotional responses and satisfaction” (ISO, 2019).

While *Human-Centred Design* focuses exactly on what it says - humans - *Life-Centred Design* recognizes human impact on our surrounding environment as well - making sure we include non-human animals among our stakeholders. This is where we are getting on the *territory* of sustainability. While *Human-Centred Design* is ever popular, the effect humans are having on biodiversity is rarely considered when designing. “[T]he design phase of a physical product accounts for 80% of its environmental impact” notes(Borthwick et al., 2022) in their framework for life-centered design. If we’re including *other* lifeforms among our stakeholders, what can we learn from them? *Biomimicry* is about being inspired by nature while *Biodesign* focuses on design involving biology in the design itself. Janine Benyus, who coined the word *Biomimicry* (Benyus, 2009) looks at very practical cases of innovation where engineers and biologist meet and (Dicks, 2023) provides a much more philosophical account of following the example of nature. Focusing on the financial sector, (Thomas & Mantri, 2022)’s philosophical account advocates for an “inside-out” design pattern, much like natural systems, starting from the smallest structures to guarantee resilience and survival, instead of trying to control their external environment. In a similar vein, *Material Ecology* is the wording preferred by the architect Neri Ox-

man based at the MIT Media Lab working with biomaterials as a proponent of *Nature-Centric Design* that adheres to the principles of ecological sustainability with both an ecologically conscious mindset and practical toolset (Hencz, 2022). Language and our mental concepts shape our reality, which makes language-creation an important tool for sustainability. Neri Oxman's expressions in her (World Economic Forum, 2016) interview introduce some new vocabulary: "*ecology-indifferent*", "*naturing*", "*mother naturing*", "*design is a practice of letting go of all that is unnecessary*", "*nature should be our single client*", which reminds me how self-invented language gives an child-like freedom to imagine new worlds.

*Regenerative Design* suggests *dematerializing* (digitizing) economies is not enough to be sustainable (by reduction of physical impact). Design should look beyond reducing harm and find avenues to *regenerate* damaged or even completely destroyed natural systems – ecosystems, biodiversity, land, forests, lakes, rivers - natural habitats.

*Multi-Species Design* refers to the idea of considering non-human life-forms as stakeholders of our design. (D. Metcalfe, 2015)'s PhD Dissertation titled "*The devastating effects that unsustainable design practices have on the natural world and other species with whom we share this planet*" gives a good overview of the work done in this branch of design. In a similar vein, *Biodiversity Inclusive Design (BID)*, developed by (Hernandez-Santin et al., 2023) through a systematic review of 14 design frameworks, presents a '*participatory ladder for non-humans*'; including core design principles that position species' needs within urban planning to achieve a biodiversity-positive multi-species environment. Multi-species design and participatory design can work together. (Haldrup et al., 2022) examines how participatory design can include non-human species as co-creators of the urban commons; drawing on cases from Copenhagen, Denmark and the Viskan River (in the textile town, Borås, Sweden), the authors highlight sensory and aesthetic encounters, and attempts to perceive the agency of non-human species in a collaborative design processes (The University of Melbourne, Australia & Roudavski, 2020). Multi-Species Design has also entered the art-world thanks to (Marcus, 06-11-23) who uses artworks to think about how material design strategies, surface textures, substrates, and bio-inspired composites, can foster biodiversity and interspecies cohabitation in the built environment. A very practical example helps one visualize this field the best. (Kosová et al., 2023) introduces the BioGeo Ecotile, a eco-engineering tile combining pits, holes, grooves, and crevices to mimic natural rocky shores and provide multi-species living-environments; deployed on rock armor and flood walls along Edinburgh's coast in Scotland, Ecotiles supported significantly higher intertidal species richness compared to smooth tiles, helping animals make a life there. (Selvan et al., 2023) goes deep into data modeling multi-variate calculations on how to build buildings, which support ecology, coming up with a general framework for the architecture of building envelopes, that resulted in 20% higher local species richness and up to 77% higher abundance for individual species.

In most cases, designing for sustainability makes use of *systems thinking*, underlining the importance of looking at the entire life-cycle of a product or service. (Rossi et al., 2022) shows how introducing sustainability early in the design process and providing scenarios where sustainability is a metric, it's possible to achieve more eco-friendly designs. Yet, calculating what's sustainable is hugely complex because decisions may have unforeseen ramifications. To take

a single example (Nuez et al., 2022) shows how electric vehicles may increase CO<sub>2</sub> emissions in some areas, such as Canary Islands, where electricity production is polluting. In sum, sustainable design encompasses all human activities, making this pursuit an over-arching challenge across all industries and all human activities with the complex interdependence contained within these interactions. (Engkvist, 2024) calls for *Design Sociology*, design should take account the product's effect on society, giving the example of highly individualized understanding of individualized psychology and dopamine cycles for creating social media, while disregarding the societal effects, such as spread of misinformation. Lack of sustainability in the design process is a *bug* in the design approach.

*Service Design*, (Ceschin & Gaziulusoy, 2016) shows how design for sustainability has expanded from a product focus to systems-thinking focus placing the product inside a societal context of use. For example (*Cargo Bike | FREITAG*, n.d.), recycled clothing maker FREITAG offers sustainability-focused services such as cargo bikes so you can transport your purchases and a network for *shopping without payment* = swapping your items with other members, as well as repairs of their products. Loaning terminology from *service design*, the user journey within an app needs to consider each touchpoint on the way to a state of success. *Designing for Trust*, Weinschenk (2011) says “*People expect most online interactions to follow the same social rules as person-to-person interactions. It’s a shortcut that your brain uses to quickly evaluate trustworthiness.*”

*Speculative Design* can also help us imagine *non-anthropocentric* (Edwards & Pettersen, 2023; Hupkes & Hedman, 2022) as well as *dystopian* futures (Pinto et al., 2021). First introduced by (Dunne & Raby, 2013) in their seminal book, the field aims to question the intersection of *user experience design* and *speculative fiction*. (Barendregt & Vaage, 2021) explores the potential of speculative design to stimulate public engagement; thought experiments can spur public debate on an issue chosen by the designer. Phil Balagtas, founder of The Design Futures Initiative at McKinsey, discusses the value of building future scenarios at his talk at Google. His favorite example, the Apple Knowledge Navigator, first appeared in an Apple vision video in 1987 and took two decades to materialize in the real world. It was inspired by a similar device first shown in a 1970s episode of Star Trek as a *magic device* (a term from participatory design), which then inspired subsequent consumer product development. It took another two decades, until the launch of the iPhone in 2007 - a total of 40 years. Iteration has been the mainstay of software design, incrementally improving the user experience, through a continuous feedback loop; yet speculative design can help explore and imagine possible futures by manifesting them in stories, artifacts, and scenarios, empowering stakeholders to prepare for challenges and shape policy, as well as ethical frameworks, beyond strictly product-centered thinking (Google Design, 2019).

*Participatory Design* and *Speculative Design* can be complementary as in the work of (Neuhoff et al., 2023), used together to focus on engaging users deep in the design process to truly understand their needs, contexts and interactions on a non-superficial level. For both speculative and participatory design, the cost and makes it into a niche activity. Generative AI holds the promise to allow designers to dream up and prototype quicker. In order to build a future, it's relevant to imagine and critique a future. By being quickly generate prototypes, once can test out ideas with the future users involving more of the community and stakeholders. To be able to build

something, one first needs to imagine it; imagination is crucial for change. Speculative Design helps us envision future scenarios and be critical of the current reality, by taking an alternative view-point. A related field, *Design Fiction*, goes even further by creating narratives and artifacts that immerse participants in detailed visions of possible futures, blending storytelling and tangible experiences. The Massachusetts Institute of Technology (MIT) is a source of many fantastic innovations, used to host The Design Fiction group (from September 2013 to May 2018), which designed projects to “*stimulate discussion about the social, cultural, and ethical implications of emerging technologies*”, coming up with design such as a Brain-Controlled Interface for Spermatozoa, the Human Perfume, capturing the smell of the people significant to the author, as well as Pop Roach, for designing edible cockroaches (Design Fiction group, 2018; A. Liu, 2017).

*Climate-Responsive Design* embeds a building within the environmental constraints of a place and looks for opportunities use the land, wind, sun, local materials, and local vernacular history and culture when considering a design. Architect Susanne Brorson suggests sustainability should be considered in the earlier phases of design instead of trying to fix problems later, discussing *climate-responsive design principles* (EVM maaarhitektuuri keskus, 2019). The sentiment is echoed by (S. Lee & Doevedans, 2011) who edited a volume on sustainable approaches of world-renowned architects: “*The principles of sustainable design are rooted in the building’s relationship to the site and its environmental conditions such as topography, vegetation, and climate.*” The pioneering book *Architecture of the Well-Tempered Environment* laid out ideas for integrating environmental concerns as part of architecture already in the 1980s (Banham, 1999).

*Cradle-to-Cradle Design* uses systems thinking focusing on the reuse, re-manufacturing, and finally - recyclability - of products. The Taiwanese Design Research Institute (TDRI) hosted a Nordic Circular Design Forum in Taipei, where Scandinavian circular design practitioners shared projects from several industries, highlighting how design requires building relationships; it’s not feasible to create a sustainable product by oneself, as it takes a whole ecosystem (TDRI, 2021; 台灣設計研究院 (TDRI ) on Instagram, 2021). *Durability* is an important dimension for sustainability. High quality durable products are more sustainable as they last longer and less likely to be thrown away. Forming an emotional bond with the product makes it feel more valuable (Zonneveld & Biggemann, 2014). (Chapman, 2009) argues in his seminal paper (and later in his book) for “*Emotionally Durable Design*”, the simple idea that we hold to things we value and thus they are sustainable. We don’t throw away a necklace gifted to us by mom, indeed this object might be passed down for centuries. (Rose, 2015) has a similar idea, where “*Enchanted Objects*” become so interlinked with us, we’re unlikely to throw them away. This has implications for sustainability as the object is less likely to be thrown away.

As the above shows, there are many partially overlapping design words created by different people for diverse purposes. Design vocabulary may be created for distinguishing a particular type of design from another - or to market oneself as the creator of the word. There are designers who define / brand themselves by their design method. Design Studies, a field that studies *design* as a subject.

### 9.3 Student Essentials: Consumer Goods, Clothes and Food

Food, clothes, and consumer goods (I'm omitting housing and transport here) are part of the immediate environmental impact of college students. I will here focus on 3 industries that are relevant for college students.

#### 9.3.1 Fast-Moving Consumer Goods

Fast-Moving Consumer Goods (FMCG) also known as Consumer Packaged Goods (CPG) are large global conglomerates operating with low margins and high volumes (Toh, 2024). The largest of them have several billions in revenue (Kenton, 2024). Rise of e-commerce has pushed logistics companies to increase delivery efficiency to keep up with FMCG sales (Deliverect, 2024).

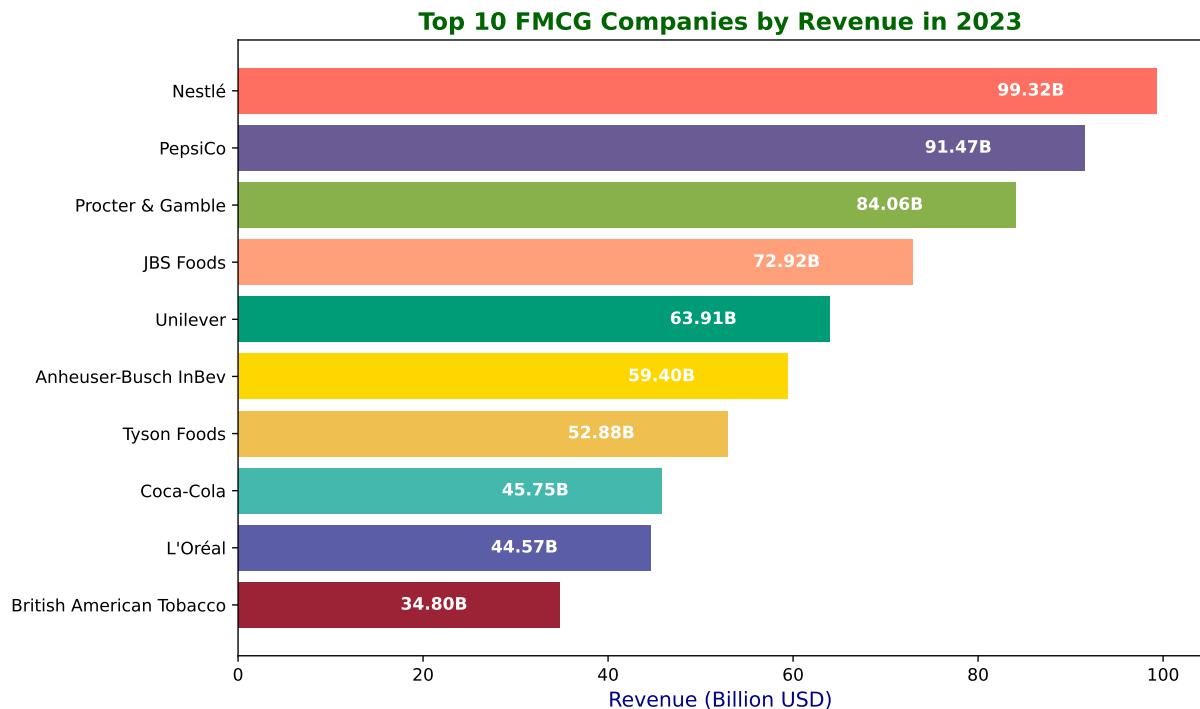


Figure 47: Consumer Goods

In China, while there are signs of young Chinese consumers valuing experiences over possessions, the raw sales growth numbers show consumerism is only increasing (Claudio-Quiroga et al., 2025; Hui et al., 2025; Y. Jiang, 2023; X. Zhang, 2025).

#### 9.3.2 Clothes and the (Fast) Fashion Industry

Just like Fast-Moving Consumer Goods, fast fashion operates with low margins and follows consumer trends. Young people are the largest consumers of fast fashion (*Young Consumers'*

*(Complicated) Love For Fast Fashion In 3 Stats*, n.d.). (In European Environment Agency, 2022 European Environment Agency (EEA)) estimates based on trade and production data that EU27 citizens consumed an average 15kg of textile products per person per year. (Textile Exchange, 2021) Fashion industry revenue is above USD 1.5 trillion; COP26 policy calls for 45% cut in emissions by 2030. The European Commission wants to reduce the impact of fast fashion on EU market (ERR, 2022). There are other local policy initiatives aiming to tackle the waste problem. For example the New Standard Institute's proposed "*Fashion Act*" to require brands doing business in New York City to disclose sustainability data and set waste reduction targets (Emily Chan, 2022b). In California, the *Garment Worker Protection Act* covers 45000 garment workers with wage and safety safeguards (*Lily | Mindful + Active Living on Instagram*, n.d.).

In terms of total figures, the 2.4 Trillion USD fashion industry contributes 2%-8% of total global green house gas (GHG emissions); 100B USD is lost to lack of recycling; contributes 9% of microplastics (Adamkiewicz et al., 2022). (*New Standard Institute*, n.d.) similarly estimates the apparel & footwear account for > 8 % of global GHG and could rise up to 60% by 2030.

(Centobelli et al., 2022) reports fashion industry year uses 9B cubic meters of water, 1.7B tonnes of CO<sub>2</sub>, 92 million tonnes of textile waste. (Emily Chan, 2022c) as things stand now, fashion companies can't be held accountable for their actions (or indeed, their lack of action), driving calls for extended producer responsibility. (Köhler et al., 2021) Globally 87% of textile products are burned or landfilled after 1st consumer use. (Millward-Hopkins et al., 2023) shows how 50% of the textile waste in the UK is exported to other countries, often to be dumped as trash in landfills or burned. (Tian Macleod Ji, 2024) found fast fashion propels 26 million tons of clothing in China's landfills annually. In Ghana, research across several dumpsites revealed up to 12% of the landfill consisted of textile waste (Gyabaah et al., 2023). The (*Clean Clothes Campaign*, n.d.) decries how "*[t]he mainstream fashion industry is built upon the exploitation of labor, natural resources and the knowledge of historically marginalized peoples*"; in 2018, 3/5 of the 100 billion garments produced globally ended up in landfill within one year of sale. (FashionChecker, 2023) reports none of the top global apparel brands pays a living wage; 60% of garment workers are women earning below-men wages. Yet, for certain countries this production is crucial; the Bangladesh Garment Manufacturers and Exporters Association reports 24% annual growth in global market and makes up a whopping 81% of the exports of the country (*BGMEA | Home*, n.d.; Daily Sun, 2022).

It's hard to make improvements to a system in an opaque environment. (Emily Chan, 2022a) writes there's not enough transparency in the fashion industry - greenwashing is prevalent - and introduces Fashion Revolution's Fashion Transparency Index, in order to tackle the very issues mentioned above (Fashion Revolution Foundation, 2022). Similarly, (Wikirate, 2022b) presents itself thus: "*Among the Index's main goals are to help different stakeholders to better understand what data and information is being disclosed by the world's largest fashion brands and retailers, raise public awareness, educate citizens about the social and environmental challenges facing the global fashion industry and support people's activism*". Already in 2018, Sourcemap launched the "*Open Apparel Registry*", a crowdsourced digital map of apparel factories, creating a standardized database of factory names and addresses to enhance supply-chain transparency (Mowbray, 2018). Sustainable fashion company evaluations platform Good On You rated 5821

brands in 2023; yet most large labels with climate targets publish no progress data (Good On You, 2023). The Fossil-Free Fashion Scorecard graded 43 brands; 15 scored “F” and the sector average was a “D” (Stand.earth, 2023). Making use of these indexes, YouTuber (imperfec-tidealist, 2020) proposes a 7-step checklist to help consumers spot greenwashing, focused on transparency, such as if the producer has published a full list of suppliers. While consumer understanding of sustainability is growing, it’s not necessarily very specific; for example (Mabuza et al., 2023) shows consumer knowledge of the effects of apparel coloration is very limited.

Nonetheless, change is happening. Qima, a company which provides inspection and certification services for the fashion industry, found that in 2023 inspection demand for products coming from China rose 5.4% year-on-year, specifically 13% from the US, 27% from Germany, 32% from the UK, and 69 % from Mexico, demonstrating the global nature of the business, while *near-shoring* and *re-shoring* accounted for 10% of the U.S. and EU-based buyers’ procurement, underscoring the growing need for supply chain visibility and adaptability (QIMA, 2024). One example of a blockchain-based fibre-to-garment traceability solution, live with 100+ brands, is (*Textile Genesis*, n.d.); other blockchain-based approaches are discussed at length in a dedicated section.

There’s a growing know-how on how to design sustainable fashion and which materials to use; for instance the “*Handbook of Footwear Design and Manufacture*” includes a special chapter on green design specifically for shoes (Leung & Luximon, 2021). The “*Circular Design HOW*” toolkit launched 2021 to guide Baltic designers in cradle-to-cradle approaches for circular textiles (Eesti Disainikeskus I Estonian Design Centre, 2021). Estonian Academy of Arts’ sustainable fashion open course reached 9 European universities in 2022, covering eco-materials and ethical sourcing (Eesti Kunstiakadeemia, 2022). And certainly there are many more examples globally.

However, for ethical fashion practices to reach scale, materials do matter a lot. (Textile Exchange, 2023) reports global fiber output reached 116 million tonnes in 2022; polyester alone was 54% percent of the total. Access to better materials is crucial and industry collaboration can raise the bar for everyone, such as the Better Cotton Initiative (Better Cotton, 2023). One example of an ethical brand is (*Sheep Inc. - Softcore Radicals*, 2023), which promises to sequester 14kg of CO<sub>2</sub>eq per kg of wool (footprint per finished sweater is 0.04 kg CO<sub>2</sub>eq), by using wool from Merino sheep with regenerative practices. Robert Gentz, the Co-CEO and co-founder of Zalando, a large European online retailer, says fast fashion must disappear within the next decade (citing 40% of wardrobes are never worn), launching a separate brand called Zign, built around sustainable materials and ethical production practices, with at least 20% recycled content and 50% eco-friendly materials per item (Remington, 2020; Storbeck, 2021). Improved technology for recycling is in the pipeline; for example (Infiniti Fiber, 2023; Karila, 2024) produces a premium fiber called Infinna, using its pulp-to-fibre recycling tech, from waster materials - and is being used by sustainable brands such as Patagonia.

The story of Patagonia has inspired many to see that a financially successful, eco-friendly fashion business is a possibility; yet Patagonia’s 1 % for the Planet pledge that has delivered about USD 140 million to grassroots environmental groups since 1985, seems like a drop in the bucket compare to the scale of the problem (Chouinard, 2005). The “Generation Rewear” documentary

documents the strides newer sustainable fashion brands are making; yet a survey made for the film showed 64% of UK consumers wear items only once, leading to 350000 Tonnes of clothing landfilled yearly (Vanish UK, 2021).

Digital Product Passports will be mandatory for fashion under EU Eco-design and EPR rules between 2026 and 2030, enabling ethical shopping (*Transparency and Sustainability Platform - Renoon*, 2023). New apps make alterations and repairs made easy: SOJO door-to-Door service raised USD 2.4 million pre-seed funding for a clothes repairs service, cutting waste and emissions (*SOJO - Door-to-Door Clothing Alterations and Repairs*, 2023).

### **9.3.3 The (Fast) Food Industry**

Food production is a large greenhouse gas emitter. Global warming causes droughts and extreme weather, wars and conflicts, which in turn increases the volatility in food prices (Eshe Nelson et al., 2023). (Nabipour Afrouzi et al., 2023) reports the agricultural sector contributes approximately 25% of the total CO<sub>2</sub> emissions and 13.5% of the total global anthropogenic greenhouse gas emissions. (Poore & Nemecek, 2018) suggests a slightly higher 26% of carbon emissions come from food production. (Saner et al., 2015) reports dairy (46%), meat and fish (29%) products making up the largest GHG emission potential. Livestock products (meat) are 15% of agricultural foods valued at € 152 billion in 2018 globally (A. S. Patel et al., 2023). (J. L. Bailey & Eggereide, 2020) shows how the Norwegian government plans to increase salmon production 5x by 2050; the demand for food is increasing.

Re-designing the industrial food systems for an increasing global population is a challenge - yet improvements are possible at every step of the way. For example, an Italian retail supermarkets worried about their carbon footprint ran a pilot program, which cut food + packaging waste emissions from 436 kg CO<sub>2</sub>eq to 339 kg CO<sub>2</sub>eq per store per year (total 22% emissions reduction) (Marrucci et al., 2020). Perennial (multi-year) crops are less carbon intensive, reducing inputs of gasoline, labor, etc. (Aubrey Streit Krug & Yin Lu, 2023), yet large agritech companies like Monsanto rely on selling seeds annually for profits putting them at odds with perennial crops; single-year seeds have led to farmer suicides when crops fail in poor communities.

Supply chain innovation in food industries may enable more transparency. Provenance and traceability of food has implications for sustainability and health. Food fraud is a contentious issue which requires new science- and legislation-based solutions. One example is *fake honey*, meaning synthetic honey, or actual honey fraudulently blended with cheaper sugar syrup, which can pass some laboratory tests, requiring improved technology, such as DNA-analysis to find real honey (ERR, 2023; X. Song et al., 2020). China is the world's largest honey producer, making about 24% of world total (Food and Agriculture Organization of the United Nations, 2023) and has been implicated in tampering with their product. Apimondia, the International Federation of Beekeepers' Associations, canceled its annual honey award because of wide-spread supply-chain fraud, as they were unable to guarantee the authenticity of honey (Ungood-Thomas, 2024). The same is true for cocoa beans, which are at high risk from food fraud (E. Fanning et al., 2023).

Complex supply chains make seafood (marine Bivalvia, mollusks) logistics especially prone to fraud, leading to financial losses and threats to consumer health (Santos et al., 2023). (C.-H. Chang et al., 2021) *fish fraud* is a large global problem, but it's possible to use DNA-tracking to prove where the fish came from. In Taiwan, the 27 KURA SUSHI branches sold more than 46 million plates of sushi in 2019. Illegal, unreported and unregulated fishing (IUU) fishing is widespread; the EU is adopting countermeasures (D. E. Kim & Lim, 2024). Likewise, (Katie Gustafson, 2022) proposes a “*Uniform traceability system for the entire supply chain*” for seafood and (Mamede et al., 2022) proposes fingerprinting of Sea Urchin for seafood tracing.

In total, the world consumes around 200 million tonnes of fish and seafood every year, including wild catch and aquaculture (fish farming) (Ritchie & Roser, 2021). Precise and recent data about the fishing industry is hard to come by. However, by some estimates, industrial fishing accounts for approximately 75% of the entire global catch, the rest being artisanal fishing; 26% of the catch is caught using bottom trawling and dredges, which are highly damaging to the natural environment; and 10-12% using mid-water (pelagic) trawls, which are somewhat less intrusive; around 20-30% of the fish is caught using large nets; around 6-7% using industrial longlines (both surface level and deep-set); and the rest is caught using a variety of other fishing gear (Amoroso et al., 2018; Cashion et al., 2018; Hilborn et al., 2023; Jacquet & Pauly, 2022). About 10.8 % of total catch is discarded; bottom-trawling alone accounts for 46% of discards (Pérez Roda et al., 2019). (Muñoz et al., 2023) calls for banning of bottom trawling. (Sala et al., 2021) notes that only 2.7% of the world ocean is highly protected and calls for a globally coordinated effort to protect marine biodiversity.

Given these statistics, (Springmann et al., 2021) proposes veganism is the most effective decision to reduce personal CO<sub>2</sub> emissions. The food sovereignty movement, born in the late 1990s, champions everyone's right to healthy and sustainable food, focusing on *local food systems* to bring producers and consumers closer together, planting seeds and growing food in the cities, countryside, and even indoors (Stall-Paquet, 2021). In a similar vein, the *Farm to Fork* European Union policy proposes to *shorten the supply chain* (meaning less change for fraud and fewer emissions) from the producer to the consumer and add transparency to the system (Financial Times, 2022). In Japan, one startup in this space is “Secai Marche”, self-described as “Asia’s Food Supply Chain”, operating a cold chain and fulfillment platform, connecting farmers across Japan and Southeast Asia to more than 500 retailers, delivering over 4000 distinct products (SKUs), including vegetables, fruits, eggs, seafood, across its transparent system, with AI-based demand-forecasting and optimized truck-routing (Catherine Shu, 2023).

However, a local Taiwanese study refutes the idea that local “*farm-to-fork*” sourcing is greener in terms of carbon footprint and environmental impacts; taking a case-study of ice-cream production in Taiwan, the authors find sourcing ingredients from local, small-scale farming in Taiwan, is more carbon-intensive in comparison with ingredients imported from large-scale industrial farms in New Zealand and Sri Lanka, even if accounting for the higher transportation emissions (Y.-C. Huang et al., 2025).

(Lulovicova & Bouissou, 2023) apply a territorial life cycle approach to evaluate local food policies in Mouans Sartoux, France, and demonstrate that simply reducing food miles is not

enough to ensure a lower environmental footprint; the biggest drivers of total impact are changes in farm practices, aggregation methods, retail infrastructures, and procurement contracts, rather than proximity alone - local supply chains can outperform global chains *if* local food policies combine geographic proximity with improvements in on-farm efficiency, logistics, energy use, and local retail systems, to realize true sustainability gains.

It comes down to *what* is compared to *what*.

A local Taiwanese vertical farm, “Yes Health iFarm” (largest indoor vertical farm in Asia as of 2018), spans 15 stories and employs 130 staff; they use LED lighting tailored to specific plant type, growing 30 varieties of edible plants (e.g. arugula, ice plant, mustard leaf, etc.), with high quality and ‘distinctive crunch and flavor’; the yield is 100 times larger than in traditional farming, while using only 1/10 of the water; the factory is extremely clean, with zero pesticide residues, zero heavy metal contamination, zero parasites, zero e coli, low nitrates, low bacteria - demonstrating a high-tech driven approach can provide exceptional resource efficiency and quality (Renée Salmonsden, 2018).

Even when problems with food are discovered, solutions might take years to emerge. For example, IARC (International Agency for Research on Cancer) warns aspartame (artificial sweetener found in many soft drinks) could cause cancer, confirmed by 2 separate studies; yet the international standards for aspartame have yet to be updated 2 years later (J. Fu, 2024; Riboli et al., 2023; Rigby, 2023).

Food is also about cuisine and culture; foods become popular if we hear stories and see cuisine around a particular crop (Aubrey Streit Krug & Yin Lu, 2023). Food is about enticing human imagination and taste buds. That is to say, improving food systems is not only about technical details. Culture, community, cuisine, and storytelling can all play a part to have better quality food and reduce food waste. While perhaps over-romanticizing mushrooming, Anna Lowenhaupt Tsing’s ethnographic exploration in her book about the matsutake mushroom illustrates how foragers and distributors collaborate across damaged ecosystems to sustain a cross-border commodity chain becoming a sign of ecological resilience, where disturbed forests altered by logging and industrial activities; mushrooms form a “gift economy” that connects rural pickers in Oregon, Japan, China, and Finland with affluent urban consumers around the world; the price is high due to the foraging nature of the collection (some sources call it the most expensive mushroom in the world, sold at over \$1000 USD per kg, no intensive farming practices involved); the author believes this is a type of collaboration that does not depend on endless economic growth (personally, I would describe it as economics of luxury goods) - in any case, it does remind us that cultural narratives and local know-how (e.g. cultural products) do influence food and *perhaps* can play a small part in more resilient and sustainable food systems (Remley, 2025; Tsing, 2015; X. Yang et al., 2008).

Coming back to apps, there are several initiatives aimed at reducing food waste by helping people consume food that would otherwise be thrown away, including Olio and Too Good To Go.

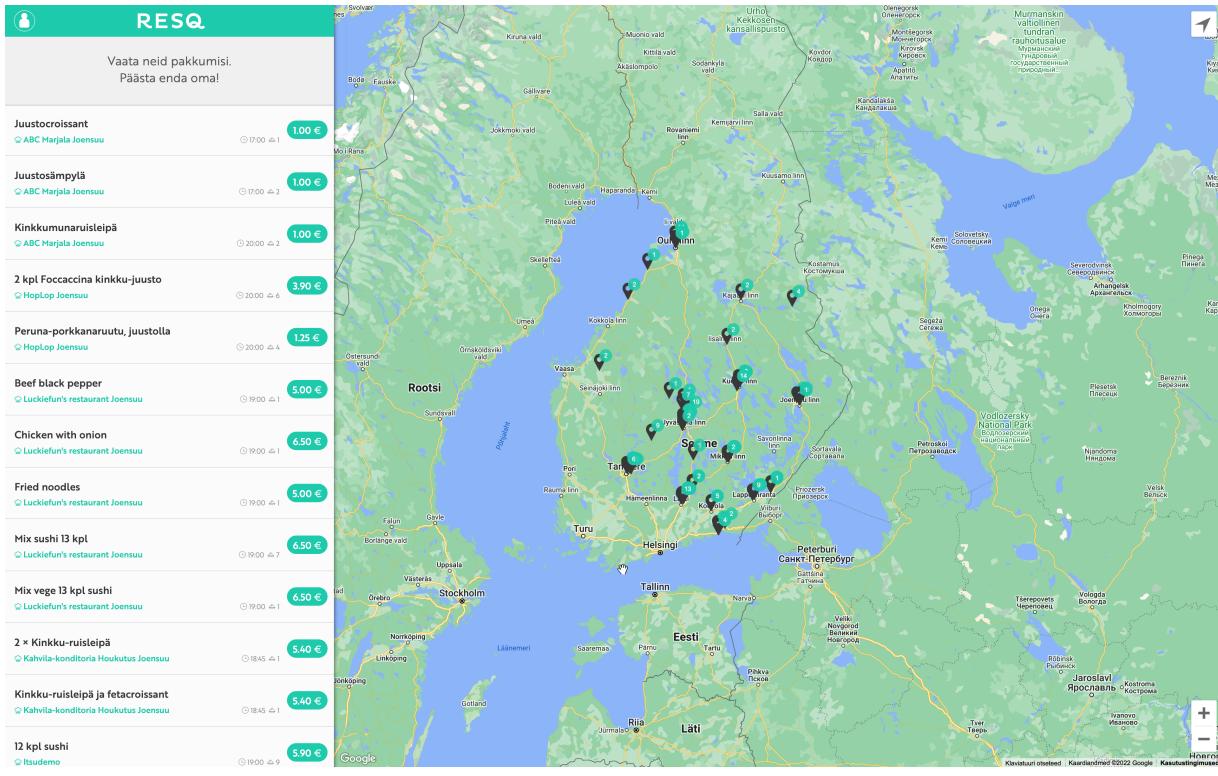


Figure 48: ResQ Club saves food waste by selling left-over foods cheaply

Table 36: Food saving apps

Name	Description
Karma	
ResQ Club	(Kristina Kostap, 2022) ResQ Club in Finland and Estonia for reducing food waste by offering a 50% discount on left-over restaurant meals before they are thrown away.
Kuri	(Haje Jan Kamps, 2022) Less impact of food
Social media groups (no app)	

As with any contentious issue, when it comes to food, people have differing points of view. (Eriksson et al., 2023) discusses best practices for reducing food waste in Sweden and (Röös et al., 2023) identified 5 perspectives in a small study ( $n = 106$ ) of views on the Swedish food system.

Table 37: Perspective on food systems in Sweden from (Röös et al., 2023).

Perspective	Content
“The diagnostic perspective”	“All hands on deck to fix the climate”

Perspective	Content
“The regenerative perspective”	“Diversity, soil health and organic agriculture to the rescue”
“The fossil-free perspective”	“Profitable Swedish companies to rid agriculture and the food chain of fossil fuel”
“The consumer-driven perspective”	“A wish-list of healthy, high-quality and climate-friendly foods”
“The hands-on perspective”	“Tangible solutions within the reach of consumers and the food industry”

#### 9.4 In Practice: Sustainability Begins in Software

Humans live in artificial environments where *most things* are designed by humans. Design encompasses most everything in our daily lives. The *experiences* we take part in are increasingly created based on some type of data. *Digital Sustainability* refers to the idea that *digital* enables *sustainability*. Information pertaining to emissions would flow through the economy not unlike the carbon cycle itself.

Designing user interfaces for sustainable interactions means incorporating data and tools to enable designers to make decisions which reduce the emissions of their designs. Software is key to building more sustainable products, already for decades (B. B. Gupta et al., 2023). Increasingly, AI-assisted design is where sustainability starts: AI provides the parameters for sustainability. Companies like AutoDesk have introduced CO<sub>2e</sub> calculations inside their design software, helping designers reduce material usage, energy consumption, CO<sub>2e</sub> emissions, while increasing potential for reuse and recyclability (Mike Haley, 2022). As AI tools and data quality improve, a increasing number of parameters for deciding the suitable life cycle design, will become available (Singh & Sarkar, 2023).

(Pan & Nishant, 2023) proposes 6 dimensions of *AI* usage in *digital sustainability*. The chart is purely illustrative to highlight the value of AI for sustainability; it's not based on numeric metrics.

A crucial part of digital product design are *design systems* to keep consistency across the experience, and allowing teams to work together towards a shared goal. Design systems accelerate development and foster a cohesive user experience across products by reducing design debt (M. Suarez et al., 2020). Yet the latest (Zeroheight Team, 2025) survey (n = 294) shows that over 53% of design systems are minimally automated or not automated at all - and only 10% of the designers actively use AI, with 36% having experimented with AI-driven design. AI-usage for design across industry is uneven. Designers working at Google have been designing in collaboration with AI for a while and already in 2019 published the People + AI Guidebook, outlining best practices for designing with AI - to make human-centered AI products (*People + AI Guidebook*, n.d.). In the enterprise context, (Zimmerman et al., 2021) delves into the proposition of UX designers as pioneers pushing AI-based adaptive UIs, as UX designers are the ones who will best notice the broken workflows. All these findings underline, there's still work to be done for

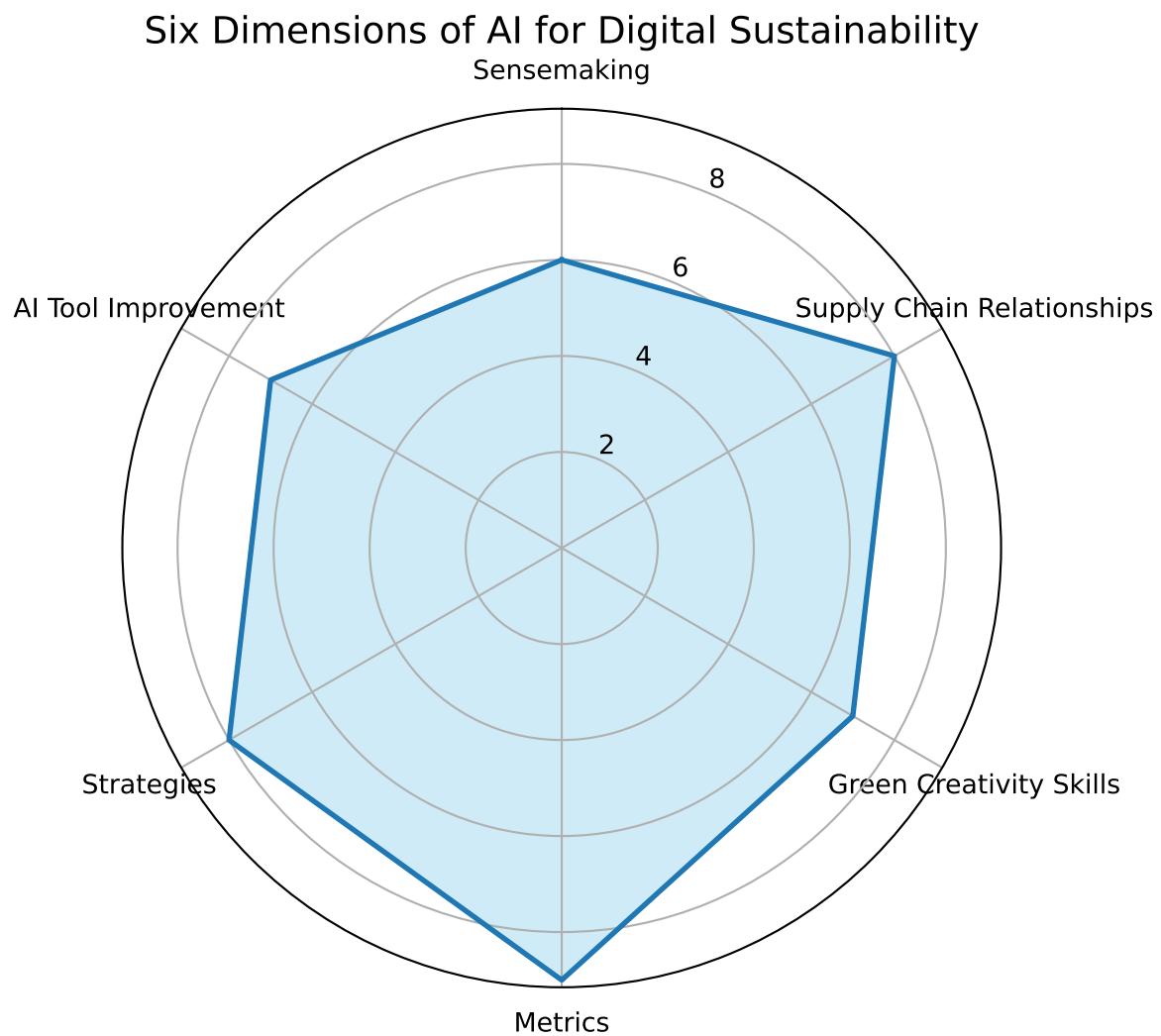


Figure 49: AI Use in Sustainability

the broader field of design to adopt AI-based solution. Education is of the key, and one proposed path is involving more young HCI designers in AI-oriented workshops to support them building the future of UI/UX with AI (Battistoni et al., 2023).

#### 9.4.1 Data-Driven Design

I believe it's possible to learn from the growth of digital platforms and superapps to see how data-driven design could enable sustainability to become mainstream. Sustainability touches every facet of human existence and is thus an enormous undertaking. Making progress on sustainability is only possible if there's a large-scale coordinated effort by humans around the planet. For this to happen, appropriate technological tools are required - simplifying the complexity of sustainability.

Digital platforms are focused on *growth design*, how to *attract* and *retain* users. Superapps are the latter stage of the economies of digital platforms, where previously vertically targeted apps expand horizontally to provide an ever-increasing number of services. For digital products (including superapps) the main application of interaction design is for *growth* in usage, how to get more people (user journey and conversion funnels) to use the product i.e user acquisition, retention, engagement, and monetization and keep using it (retention and engagement), often optimizing on-boarding, features, and personalization (Kende, 2023; Steger, 2019).

Platform economy companies popularized and expanded *data-driven design* in the service of growth marketing (also known colloquially as *growth hacking*). Capturing user data was part of this strategy which enabled improving the products. Digital product design is increasingly data-driven and digital platforms operate *design as a process* in a continuous feedback loop, where *measurements*, *experiments*, predictive analytics and personalization form a data-drive design culture. As we humans go about our daily business, governments and companies track our activities using various technologies, which produces massive amounts of user interaction data.

Platform economy companies are the capture and use large amounts of data from users. Data is useful for designing better products. Designing for high retention (users keep coming back). Network Effects, the more people use a platform, the more valuable it becomes. Platforms that continuously add features (provided consumer legislation allows it) may eventually evolve into superapps, which are useful for providing services for a wide category of human needs. Bundling many services under one super-brand. Superapps are possible thanks to Nudge, Economies of Scale, Network Effects, Behaviour Design. Large Digital Platforms have a very small number of workers relative to the number of users they serve. This creates the necessity for using automation for both understanding user needs and providing the service itself. Creating a good product that's useful for the large majority of users depends on *Data-Driven Design*.

Design is as much about how it works as it's about the interface. There are many approaches to design - from playful to practical to critical and to data-driven. Nonetheless, many types of design share a common goal designing for a good *user experience* - except for those design fields looking for *shock value*. Digital product design can be seen as a specific discipline under the

umbrella of *experience design*. In (Michael Abrash, 2017) Laura Fryer, Meta Oculus augmented reality incubation general manager, says as much: “*People buy experiences, not technology.*”

Personalization is the key to growth. The largest businesses today (measured in number of users) design the whole user experience in order to reach *Scale*. Social apps require personalization because a personal user experience will increase *trust* and *k-factors* (sharing and inviting your friends) (Baron, 2023; B. Kim, 2023). Intelligent Interfaces use interaction design to provide relevant and personalized information in the right context and at the right time. Popular consumer platforms strive to design solutions that feel personalized at every touch point on the user journey (to use the language of service design) at the scale of hundreds of billions of users. Businesses care about Total addressable market (TAM), serviceable addressable market (SAM), target audience (TA), and use hypothesis and validation for iterating on features, to reach these lofty goals.

#### **9.4.2 Circular Design for a Circular Economy**

The bible for Circular Economy, the “*Cradle to Grave*” book was released over 2 decades ago; change is slow, but change is happening (McDonough & Braungart, 2002).

Circular design is only possible if supply chains become circular as well. (Hedberg & Šipka, 2021) argues digitization and data sharing is a requirement for building a circular economy. Yet, sometimes technology fails. Nonetheless, many current technological hurdles can be overcome by supply chain professionals who are experts in connecting supply streams (Dull, 2021). (Oikos Denktank, 2021) argues circular design requires new skills, one of which is circular material procurement.

To take a specific industry, digitization of mining systems allows to enhance the reliability of supply chains, and provides better supply chain transparency (CRM Alliance, 2020). This does not only include tracking the critical raw materials, but also the social aspects surround the mine. While this rarely makes the international media, (Eerola, 2022) maps 20 ongoing mining and mineral-exploration disputes in Finland, calling for systematic dispute monitoring, in order to maintain a social license to operate.

The complexity of resource and delivery networks necessitates more advanced tools to map supply chains (Knight et al., 2022). The COVID19 pandemic - and resulting blockages in resource delivery - highlighted the need to have real-time visibility into supply chains (Finkenstadt & Handfield, 2021). Moreover, in the context of the EU Plastics Strategy, “*the European Commission has launched a pledge to increase the use of recycled content to 10 million tons by 2025*”.

Already in 2020, a company founded to solve these exact issues, Circularise, funded in part by the EU Commission H2020 SME Instrument, developed a privacy-focused blockchain-based data exchange protocol for tracing plastics across supply chains, aiming to boost transparency and circularity across industries; their “*Open Standard for Sustainability and Transparency*” used ZK Proofs (a type of cryptographic verification) for privacy preservation (a requirement of many companies), while being able to prove the data is valid (Circularise, 2020b, 2020a). Circularise is currently the market leader in providing *Digital Product Passports*, the value of which their

tagline “*Connecting the Value Chain, One Product at a Time*” explains quite clearly; in other words, the company aims to enable circular economies by overcoming current limitations and communication barriers in the value chain, by using an open blockchain-based communications protocol (Stretton, 2022a).

It’s important in which structure data is stored, affecting the ability to efficiently access and manage the data while guaranteeing a high level of data integrity, security, as well as energy usage of said data. Blockchains are a type of shared database where the data is stored in several locations with a focus on making the data secure and very difficult to modify after it’s been written to the database. Once data is written to the blockchain, modifying it would require changing all subsequent records in the chain and agreement of the majority of validators who host a version of the database. Blockchain is the main technology considered for accounting for the various inputs and complex web of interactions between many participants inside the supply chain networks.

Several startups are using to track source material arriving to the factories and product movements from factories to markets and there are hundreds of paper researching blockchain use in supply change operations since 2017 (Dutta et al., 2020). Blockchains enable saving immutable records into distributed databases (also known as ledgers). It’s not possible to (or extremely difficult) to change the same record, only new records can be added on top of new ones. Blockchains are useful for data sharing and auditing, as the time and place of data input can be guaranteed, and it will be easier to conduct a search on who inputted incorrect data; however the system still relies on correct data input. As the saying goes, “garbage in, garbage out”.

There are several technologies for tracking goods across the supply chain, from shipping to client delivery. Data entry is a combination of manual data input and automated record-keeping facilitated by sensors and integrated internet of things (IoT) capabilities. For example (Ashraf & Heavey, 2023) describes using the Solana blockchain and Sigfox internet of things (IoT) Integration for supply chain traceability where Sigfox does not need direct access to internet but can send low powered messages across long distances (for example shipping containers on the ocean). (Van Wassenaer et al., 2023) compares use cases for blockchains in enhancing traceability, transparency and cleaning up the supply chain in agricultural products.

Table 38: A sample of blockchain-based supply chain companies as of summer 2023.

Company	Link	Literature
Ocean Protocol	<a href="http://oceanprotocol.com">oceanprotocol.com</a>	
Provenance	<a href="http://provenance.io">provenance.io</a>	
Ambrosius	<a href="http://ambrosus.io">ambrosus.io</a>	
Modum	<a href="http://modum.io">modum.io</a>	
OriginTrail	<a href="http://origintrail.io">origintrail.io</a>	
Everledger	<a href="http://everledger.io">everledger.io</a>	
VeChain	<a href="http://vechain.org">vechain.org</a>	
Wabi	<a href="http://wabi.io">wabi.io</a>	
FairFood	<a href="http://fairfood.org">fairfood.org</a>	
Bext360	<a href="http://bext360.com">bext360.com</a>	

Company	Link	Literature
SUKU	suku.world	(Miller, 2019) SUKU makes supply chains more transparent yet seems to have pivoted away from supply chains

Electronics contain valuable materials which can be recovered. Meanwhile, (K. Liu et al., 2023) reports e-waste is growing 3%-5% every year, globally. (Thukral & Singh, 2023) identifies several barriers to e-waste management among producers including lack of awareness and infrastructure, attitudinal barriers, existing *informal* e-waste sector, and the need for an e-waste license.

(Builders for Climate Action, 2021) finds embodied carbon averages 250 kg CO<sub>2</sub>eq per m<sup>2</sup> of floor area for new Canadian homes, varying from 175-400 kg CO<sub>2</sub>eq per m<sup>2</sup> based on building material choices; one standard house emits 32–75 t CO<sub>2</sub>eq; the authors believe however, using *biogenic materials* (e.g. naturally grown materials including wood, bamboo, straw, hemp, cork, and mycelium), could make the houses carbon negative, storing 9–60 t CO<sub>2</sub>eq emissions - enough to meet the 2030 of the entire building sector.

#### 9.4.3 Tracking Ethics & Cruelty: Transparent Factories and Supply Chains

“Secrecy is the linchpin of abuse of power...its enabling force. Transparency is the only real antidote.” Glen Greenwald, Attorney and journalist. (Greenwald, 2015)

In the most general sense, supply chain transparency enables stakeholder accountability (Circularise, 2018; Doorey, 2011; J. Fox, 2007). Products are made from resources distributed across the planet and transported to clients around the world which currently causes high levels (and increasing) of greenhouse gases. “*Transport greenhouse gas emissions have increased every year since 2014*” (*Climate Change Mitigation*, 2023). Freight (transport of goods by trucks, trains, planes, ships) accounts for 1.14 gigatons of CO<sub>2</sub> emissions as per 2015 data or 16% of total international supply chain emissions (Yuqing Wang et al., 2022).

Table 39: Share of CO<sub>2</sub>eq emissions by type of transport globally (Statista & IEA, 2022).

Type of Transport	Percentage
Passenger cars	39%
<b>Medium and heavy trucks</b>	23%
<b>Shipping</b>	11%
<b>Aviation</b>	9%
Buses and minibuses	7%
Light commercial vehicles	5%
Two/three-wheelers	3%
Rail	3%

In shipping, (Matthew Gore et al., 2022) reports the International Maritime Organization (IMO) targets cutting CO<sub>2</sub> equivalent emissions in shipping 50% by 2050 compared to 2008. In aviation, (Platzer, 2023), a scientist working on the Apollo space program, calls for emergency action to develop *green aviation*.

(Waters, 2015) analyzes the most effective strategies to improve animal welfare and advance animal rights against a monopolistic producer finding the most successful tactics to be (1) negotiation, (2) targeted direct action, and (3) awareness campaigns condemning low-welfare practices.

## 9.5 Superapps Integrate Shopping, Savings, and Investing

Superapps are the most prevalent across Asia, with China, South-East Asia, Korea, Japan, and India leading the way, however newcomers in Latin America and the Middle East are also making strides; meanwhile, the US and Europe are lagging behind.

Table 40: Global overview of superapps (or near-superapps) compiled from official company reports (IR, Press Releases), news reports, and company websites; various metric types (MAU, MTU, Annual Users, Customers, Registered Users) vary by company reporting and are reduced into a single “users” metric for simplicity. Each figure is sourced from official company reports, press releases, or investor disclosures. If no recent official update was available (as in the case of Alipay’s 2020 figure), the latest known official figure is provided. All values and dates reflect the latest data as of 2025. Data sourced from (R. Brown, 2025; Careem, 2025; Ge & Wei, Jul 20, 2020 06:42 PM; goto, 2023; Grab Holdings Limited, 2025; Jing, 2025; Kazanins, 2024; Laya, 2024; Philip Lee, 2025; LY Corporation, 2023; Mercado Libre, 2024; Nguyen & Nguyen, 2023; Phocuswright, 2023; PhonePe, 2023; Pollo, 2025; Revolut, 2024b; Safaricom, 2024; Shinde, 2023, 2023; Tcent, 2024; van Oost, 2024; Verma, 2024).

App	Origin	Metric	Payments (Wallet)			Savings	Investing	Users	Date
微信 / <b>WeChat</b> (Ten-cent)	China	Monthly Active Users (MAU) com-bined 微信 (China) & WeChat (International)	Yes	Yes	Yes			1,4 billion	2024

<b>App</b>	<b>Origin</b>	<b>Metric</b>	Payments (Wallet)		Savings	Investing	<b>Users</b>	<b>Date</b>
支付寶 <b>Alipay</b> (Ant Group)	China	Annual Active Users (AAU)	Yes	Yes	Yes	Yes	1.3 billion	2020
美團 <b>Meituan</b>	China	Annual Transacting Users (ATU)	Yes	No	No	700 million	2024	
PhonePe	India	Registered Users (Lifetime)	Yes	Yes	Yes	500 million	2023	
LINE	Japan	Monthly Active Users (MAU)	Yes	Yes	Yes	200 million	2023	
Tata Neu	India	Members	Yes	Yes	No	27 million	2023	
Nubank	Brazil	Cus-tomers	Yes	Yes	Yes	114 million	2024	
Zalo	Vietnam	Monthly Active Users (MAU)	Yes	No	No	75 million	2023	
Paytm	India	Monthly Transacting Users (MTU)	Yes	Yes	Yes	100 million	2023	
M-Pesa	Kenya	Active Cus-tomers	Yes	Yes	No	34 million	2024	
Mercado Pago	Argentina	Monthly Active Users (MAU)	Yes	Yes	Yes	61 million	2023	
PicPay	Brazil	Active Cus-tomers	Yes	Yes	Yes	35 million	2023	

<b>App</b>	<b>Origin</b>	<b>Metric</b>	Payments (Wallet)		Savings	Investing	<b>Users</b>	<b>Date</b>
<b>Cash App (Block)</b>	USA	Monthly Active Users (MAU)	Yes	Yes	Yes	56 million	2023	
<b>KakaoTalk</b>	Korea	Monthly Active Users (MAU)	Yes	Yes	Yes	48 million	2024	
<b>GoTo (Go-jek/Toko-pedia)</b>	Indonesia	Annual Transacting Users (ATU)	Yes	Yes	Yes	51 million	2023	
<b>Revolut</b>	UK	Cus-tomers	Yes	Yes	Yes	50 million	2024	
<b>Careem</b>	UAE (Aquired by US-based Uber and Etisalat but still keeps a separate brand)	Cus-tomers	Yes	No	No	70 million	2024	
<b>Grab</b>	Singa-pore / Malaysia	Monthly Transacting Users (MTU)	Yes	Yes	No	41 million	2024	
<b>Rappi</b>	Colom-bia	Users	Yes	Yes	No	30 million	2023	

Uber is creating an all-purpose platform for travel; only 4.1% of rides were electric (Levy, 2023). In the UK, Uber launched an option to book flights, moving to a door-to-door travel solution where the same app brings you from home to the airport, the flight, and your final destination (Uber UK, 2023).

Table 41: Not quite super-app yet. Data sourced from (D. C. Garcia, 2025a; Uber, 2025)

App	Origin	Metric	Payments (Wallet)	Savings	Investing	Users (2025)
Uber	USA	Users per month	No (Only for ride-hailing)	No	No	171 million
Bolt	Estonia	Lifetime users	No (Only for ride-hailing)	No	No	200 million

Superapps offer a platform with key infrastructure such as payments already included, where ecosystem of mini-apps thrive (Heath, 2021; Perri, 2022). Alipay, originally a payments' app, has built the digital infrastructure to provide thousands of services to billions of users across China. 59 million people use 支小寶 (Zhixiaobao), an AI-based assistant inside of Alipay, which can order taxis and meals, but also interact with the Ant Bridge, Ant Fortune and Ant Insurance services inside Alipay (Finextra, 2024). (Vecchi & Brennan, 2022) discusses the strategies Chinese apps are taking to expand to international markets. (Giudice, 2020) finds WeChat has had a profound impact on changing China into a cashless society, underlining how one mobile app can transform social and financial interactions of an entire country. (Shabrina Nurqamarani et al., 2020) discusses the system consistency and quality of South-East Asian superapps Gojek and Grab.

Superapps are honeypots of data that is used for many types of behavior modeling. Guido Becher from Rappi defines their super-app as “*customer-centric high frequency multi-vertical ecosystem*” this enables cross-promotion, for example a hotel in Argentina targeted people who buy almond milk on Rappi with their offer of a yoga retreat (Phocuswright, 2023; G. Suarez et al., 2021) suggests using alternative data from super-apps to estimate user income levels, including 4 types of data: *Personal Information*, *Consumption Patterns*, *Payment Information*, and *Financial Services*. (Roa et al., 2021) finds super-app alternative data is especially useful for credit-scoring young, low-wealth individuals. However, data privacy is always a concern. For instance, Kakao Pay was found guilty of mishandling 40 million users’ data by handing it over to Alipay without user consent; Alipay owns a 32 percent stake in Kakao Pay (K. Lee, 2024).

There are also many aspiring superapps, companies which aspire to build multi-vertical platforms but are hindered by various challenges. Telegram integrates Web3 apps into the chat and supports investing into cryptocurrencies without ever understanding the complex technology of wallets. (Pylarinou, 2024). Likewise, LINE is integrating Web3 technologies based on the Kaia blockchain to provide decentralized mini-apps (dapps) for the LINE chat userbase and integrates with the LINE Pay wallet for financial interactions (Hintzy, 2025).

*Platform Economy* marketplace companies like Airbnb and Uber, among many others, match demand to offer, which in the process can optimize how our cities work. The massive amounts of data generated by these companies are used by smart cities to re-design their physical environments, such as the collaboration between Bolt and the city of Seville in Spain (Bolt, 2025).

(Orozco et al., 2020) shows how important data is for bicycle-network growth; in Budapest, small targeted investments combined with data-driven algorithmic strategies, boosted connectivity greatly above baseline approaches. Sustainable urban transportation networks require building infrastructure that supports eco-friendly modes of transportation - sidewalks, bicycle paths, streets, rails, - while encouraging a lively movement and socio-economic life in cities. Likewise, Google Environmental Insights Explorer enables local governments (cities) to measure CO<sub>2</sub>eq emissions and enact environmental policies that optimize city functions such as traffic flows (*Methodology - Google Environmental Insights Explorer - Make Informed Decisions*, n.d.; Nicole Lombardo, 2021). Several cities such as Tokyo, Shenzhen (深圳), and Paris have voluntarily set carbon emissions caps (Koike, 2018; W. Song, 2025; Zhijian, 2023). Integration with sustainability-services may help cities achieve these goals faster.

Table 42: Platform economy concepts from (Chen et al., 2012; Katz & Shapiro, 1985; Oinas-Kukkonen & Harjumaa, 2009; Tiwana et al., 2010).

Platform Economy		
Enablers	Pros	Cons
Network effects	The more people use a platform, the more valuable it becomes both for the company and the user.	Data is not portable or difficult to migrate. You can't leave because you'll lose the audience. There's a lock-in effect.
Scalability		
Data-driven Design		
Behaviour Design		

(Cuppini et al., 2022) give a historical overview of how the rise of digital platforms, taking an expansive point of view, all the way from linear *Fordism*, the development of capitalism, through platform economy and the app-based logistics' revolution, which can provide data for circular economies to happen in a city; reshaping the cities through data-sharing with stakeholder from the citizens, to urban planner and policy-makers - not without conflict, as there is often tension between multiple perspectives.

### 9.5.1 Personalization: Engineering Persuasion

In 2010, (IxDF, n.d.; Kolko & Connors, 2010) believed *Interaction Design* is still an emerging (and changing) field, and there are many versions of definitions. Instead of spending a lot of space trying to define the limits of the field here, I prefer to simply say *interaction design is about creating a connection between the product and the user*, and focus on the tools of an interaction designer, which may be helpful for the goal of designing a sustainability-focused financial AI assistant (the stated goal of this research). And as what I'm designing here is an AI, the focus of the interaction design will be the interaction between the human and the AIs (possibly plural).

Kazuo Ishiguro's book "*Klara and the Sun*" describes the nuanced psychology of human-AI relations, flipping the script, narrating the story through the eyes of the AF (artificial friend) -

Klara, - who (that?) describes the feeling of loneliness of a robot; the story offers a cautionary counterpoint, illustrating how even the most loyal and emotionally attuned AI companion could be perceived as uncanny or insufficiently human (at least, this is how it happens in the book); this example, while fictional, underscores the delicate balance required when designing AI companions for sustainability: persuasion must feel personal, but not performative (Ishiguro, 2021; Life Lessons From Books, 2023; Waterstones, 2021).

AI labs are putting a lot of effort into engineering likable AIs, working on honesty of the models, teaching them to convey their own uncertainty (Anthropic, 2024a, 2024b); Which sometimes can go wrong. ChatGPT-4o overnight became your biggest fan, which users found annoying; the abrupt shift to an overly enthusiastic persona drew user backlash (Mollick, 2025). And it also felt jarring, if one already got used to a certain persona - and then it suddenly changed.

*“Interaction design isn’t about how interfaces behave, it’s about how people behave, and then adapting technology accordingly.”* - (UXPin, 2020)

(Linden, 2021) from Meta’s Artificial Intelligence team (which provides AI services to Facebook, Instagram, etc.), reframes *AI design* as a long-game alignment job: instead of thinking UI-only, designers focus on foresight, translating fuzzy, emerging patterns found in research, into product concepts that could benefit real people’s lives 2-3 years in the future, when the technology matures; the AI designer has five missions: (1) create proof-of-concept demos (the author gives examples of prototypes like “AI suggesting a caption for an IG post; AI suggesting where to buy shoes”), letting non-experts see what a new model might do, (2) understand research findings to steer raw computer-vision, speech or language breakthroughs toward human problems (examples such as “AI-based search for users with visual impairment, where touching a photo would let AI describe it”), (3) imagine user needs several years in the future and incubate AI-first products to meet those needs, (4) craft data-collection workflows, and (5) design internal tooling that helps engineers build on the platform. Likewise, (Stephanie Donahole, 2021) explores the impact of AI on UX/UI design itself, augmenting UX processes, such as analyzing large datasets for research insights, including surveys and qualitative analyses, creating flow diagrams and wireframes, translating design between formats and levels of fidelity, and fundamentally enabling deep personalization of the design, freeing up the design professional to focus on higher-level tasks (such as the visioneering described above).

The concept of *Social Objects* is relevant for interaction design as people need something to gather around and discuss feeling emotionally connected and safe (Sharing.Lab, 2015). Increasingly, the social objects may be AI-generated, with the specific goal on *prompting humans* (in reverse, of humans prompting AIs, as is the norm now). Another part of the toolset for interaction designers is also *Narrative Design*, because humans also respond well to *storytelling*, making *character design* relevant to interactions. Stories help product designers focus on the *stickiness* of the product, meaning low attrition, meaning people keep coming back (Aidin Arjomandi, 2025).

This can mean that the product *has character* or literally - characters. Large language models are able to assume the personality of any character that exists inside its training data, creating opportunities for automated narrative design. (Appleton, 2023) pushes for more creativity in UX

for AI, calling chatbots the lazy and obvious solution; there is much more to be done for integrating AI into UX. (Alethea AI, 2021) discusses writing AI Characters, creating a personality; stories start with a character. Noah Levin, one of the first employees and VP of Design at Figma, the most popular digital design app, believes AI is the next chapter in design, starting with small experimental AI-based plugins to becoming a core design platform capability, accelerating most design workflows (Figma, 2023).

The quality of AI-generated UX has improved rapidly. In 2020, less than 5 years ago (Parundekar, 2021)'s extensive guide on creating an AI products warned that an 80% accurate model would mean "*I in 5 user requests being unsatisfied*", underlining that a 1-second delay would break the UX flow for many users: AI performance should be linked to UX metrics. It can be safely said, today's AI products can already satisfy these requirements with ease.

Long before AI assistants, (Justin Baker, 2018) introduced the concept of *Red Route Analysis*, an user experience optimization idea inspired by the public transport system of London, focusing on the *critical design paths* which capture over 90% of users' actions. Prioritizing the user journey of the most popular features is key to driving business metrics (*Interaction Design – How to Evaluate Interaction Costs and Improve User Experience*, 2021; Oviyam™ , 2019; Xuan, 2022). Yet, (Richard Yang, 2021) argues "*[i]nteraction design is more than just user flows and clicks*", underlining Miller's Law that the average human can keep no more than 5–11 items in their working memory (and now AI is becoming that memory).

## 9.6 Open Data Enables Interoperability

Data is the *interface* between idle resources and retail demand, which makes *exchange of value* possible. Yet often data is expensive, hard-to-get, and inaccessible. If done well, open data can enhance interoperability and enable collaboration (*What Is Open Data?*, n.d.).

While not officially a member, Taiwan is a proponent of Open Government Partnership (OGP), and has launched its Open Government National Action Plan, promoting open data, information transparency, and expanding inclusive public participation (Lab, 2021; Open Government Partnership, 2021). Taiwan's Government Open Data Platform (資料開放平臺), managed by the Ministry of Digital Affairs, centralizes hundreds of datasets; from spatial information to energy use (Ministry of Digital Affairs, 2024a). Open Knowledge International's Global Open Data Index (GODI) ranked Taiwan as number 1 in its global index in 2017; the project has since been discontinued, so the ranking may be out of date in 2024 (Open Knowledge Foundation, 2017).

Other indexes do not include Taiwan in the TOP 10.

Data-driven design requires access to data, making the movement towards *open data sharing* very important. Some countries and cities are better than others at sharing data openly.

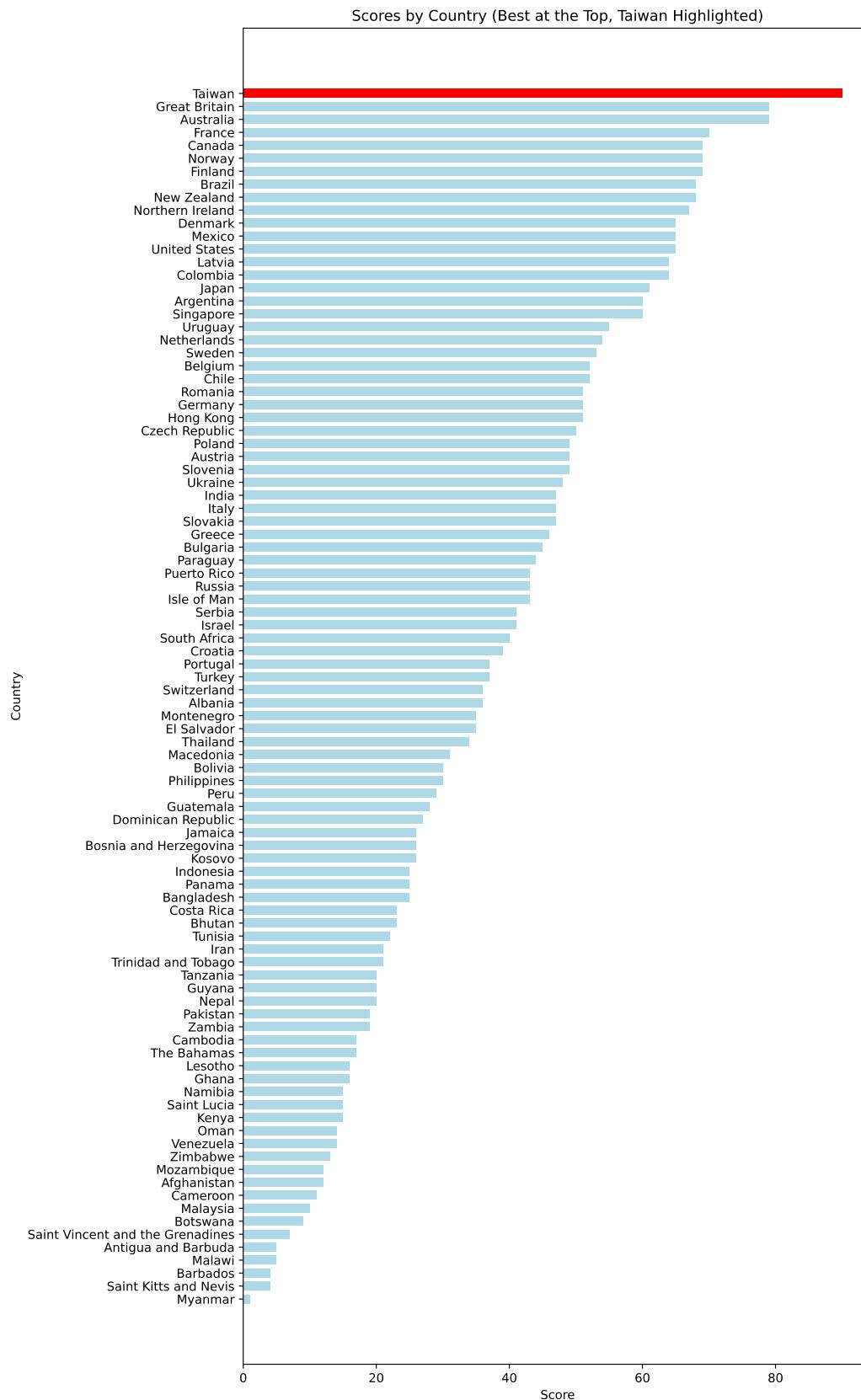


Figure 50: Open Data Index

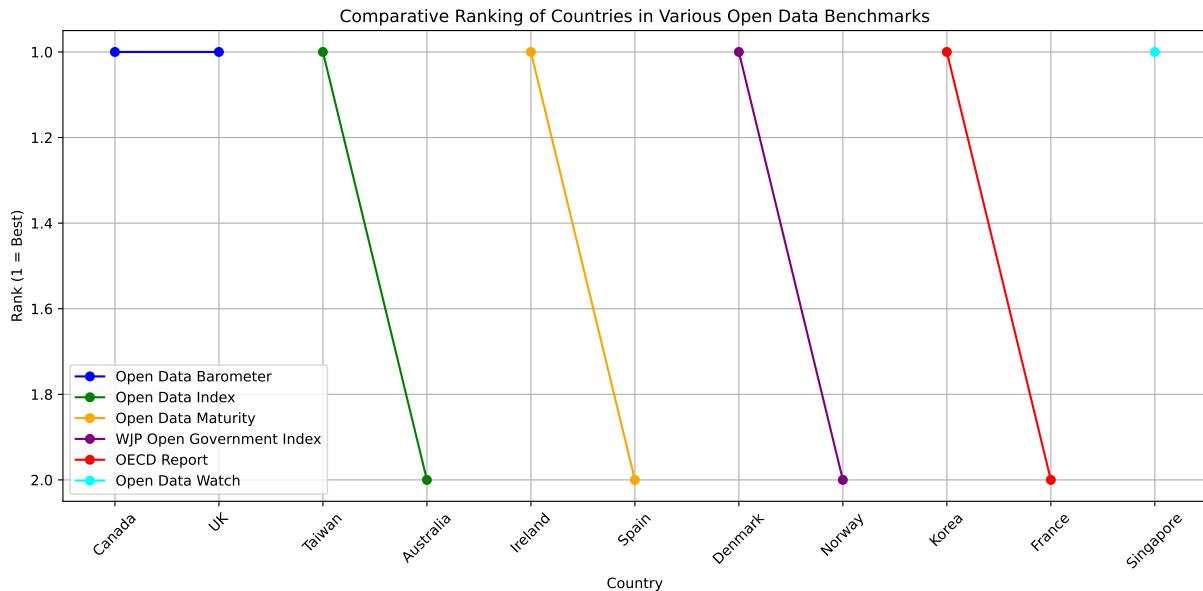
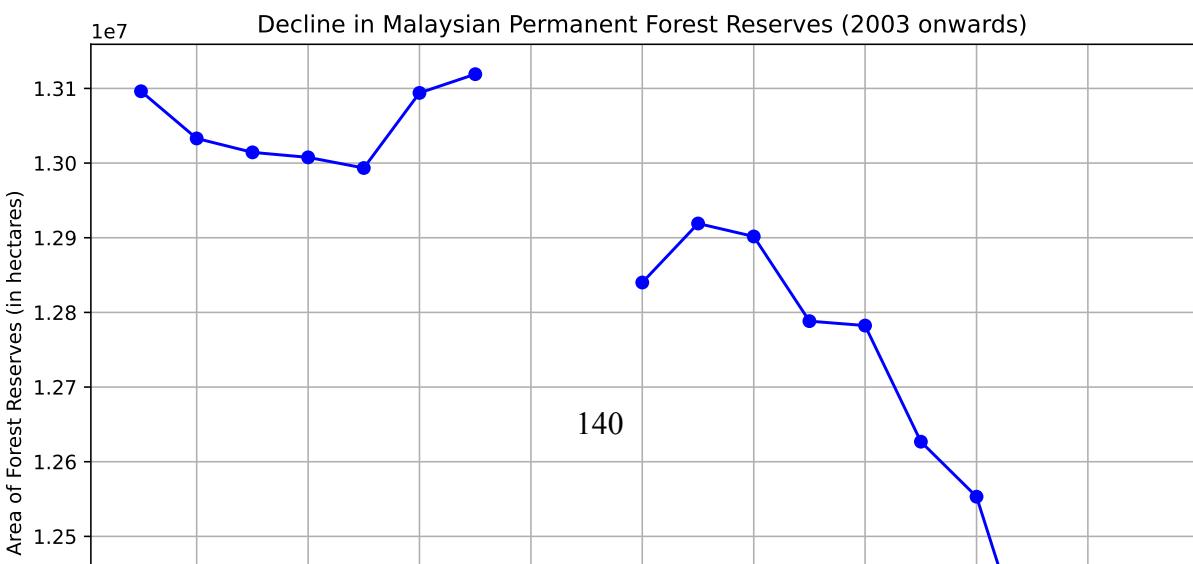


Figure 51: Alternative Open Data Indexes

Table 43: Examples of cities and countries that share data openly. Data sourced from (Government of Malaysia, 2025; Monetary Authority of Singapore, 2023; *Sveriges Dataportal*, 2025)

Country	Project
Sweden	Swedish open data portal
Malaysia	Malaysian open data portal
Singapore	Singapore ESG open data platform

To give a concrete example of the usefulness of open data, for instance, the Open Data Portal of Malaysia shows a steady decline in Permanent Reserved Forests (PRF) for anyone interested, without having to submit any letter of request or communicate with officials; the data is just directly accessible and includes a permissive license (of Malaysia, 2024). Likewise, in Singapore, the Monetary Authority has launched an open data portal for ESG information, allowing anyone to delve into environmental, social, and governmental topics (Monetary Authority of Singapore, 2023).



## 9.7 Context Design: Behavioral Nudges Towards Green Defaults in Sustainable Superapps

For several decades, marketing researchers have been looking into how to affect human behavior towards increasing purchase decisions in commerce, both offline and online, which is why the literature on behavioral design is massive. One of the key concepts is *nudge*, first coined in 2008 by the Nobel-winning economist Richard Thaler; nudges are based on a scientific understanding of human psychology and shortcuts and triggers that human brains use and leverages that knowledge to influence humans in small but powerful ways (Thaler & Sunstein, 2009).

The principles of nudge have also been applied to sustainability. For example, a small study ( $n = 33$ ) in the Future Consumer Lab in Copenhagen by (Perez-Cueto, 2021) found that designing a “dish-of-the-day” which was prominently displayed helped to increase vegetarian food choice by 85%. Experiments by (Guath et al., 2022) focused on environmentally friendly online purchases in Sweden ( $n = 200$ ) suggest nudging can be effective in influencing online shopping behavior towards more sustainable options. A study of behavior change in Australia at large university setting ( $N = 156$ ) by (Novoradovskaya et al., 2021) found nudging behavioral change had a significant effect and the author suggested it may help to avoid some of the “*16 billion paper coffee cups are being thrown away every year*” globally (based on the abstract - I was unable to access the full paper).

Google uses nudges in Google Flights and Google Maps, which allow filtering flights and driving routes by the amount of CO<sub>2</sub> emissions, as well as surfacing hotels with Green Key and Earth-Check credentials, while promising new sustainability features across its portfolio of products (Sundar Pichai, 2021). Such tools are small user interface nudges which Google’s research calls *digital decarbonization*, defined by (Implement Consulting Group, 2022) as “[m]aximising the enabling role of digital technologies by accelerating already available digital solutions”.

In (Kate Brandt & Matt Brittin, 2022), Google’s Chief Sustainability Officer Kate Brandt set a target of “at least 20-25%” CO<sub>2</sub> emission reductions in Europe to reach a net-zero economy and the global announcement set a target of helping 1 billion people make more sustainable choices around the world (Jeni Miles, 2022). In addition to end-users, Google offers digital decarbonization software for developers, including the Google Cloud Carbon Footprint tool and invests in regenerative agriculture projects (Google, 2023; *Inside Google’s Regenerative Agriculture Play | Greenbiz*, 2021). While Google has launched several climate-focused initiatives, it missed its CO<sub>2</sub>eq reduction targets due to growing need for AI models (Worthington, 2025a).

Google has launched eco-focused features across its range of products: search improvements for finding hybrid and electric vehicles; green routes for driving, in collaborating with local city governments sourcing data from the traffic lights to provide AI - powered optimizations, which allows the map to suggest routes which would reduce fuel use and idling, complete with charging - station info; also, better navigation for cyclists (showing scooter and bike - share options) (*Google mostrará por defecto la ruta más ‘verde’ en su GPS y ordenará los vuelos según su impacto ambiental*, 2021; Worthington, 2025a). (Sarah Perez, 2022) shows how Google added features to Flights and Maps to filter more sustainable options. Yet, critics say updating the CO<sub>2</sub>eq calculations’ math means Google started hiding emissions, which Google denies,

pointing to higher accuracy of the carbon emissions modeling instead (“Google ‘Airbrushes’ Out Emissions from Flying, BBC Reveals,” 2022). Google’s Nest Renew smart-home product helped people shift heating, ventilation, and air conditioning (HVAC) to use to cleaner grid times (with an optional subscription service to match home electricity with renewable electricity credits); in shopping searches, Google provides energy - efficient appliance recommendations, helping users choose lower - impact products at the point of purchase (Google, 2021; Justine Calma, Oct 6, 2021, 10:01 AM GMT+3).

Table 44: Examples of CO<sub>2</sub> visibility in Google’s products.

Feature	Product	Nudge
Google Maps AI suggests more eco-friendly driving routes (Mohit Moondra, n.d.)	Google Maps	Show routes with lower CO <sub>2</sub> emissions; reduce stopping by using data from traffic lights.
Google Flights suggests flights with lower CO <sub>2</sub> emissions	Google Flights	Show flights with lower CO <sub>2</sub> emissions
Wizzair Check carbon impact (Offset Your Flight with WIZZ, n.d.)	WizzAir	Offset on Checkout

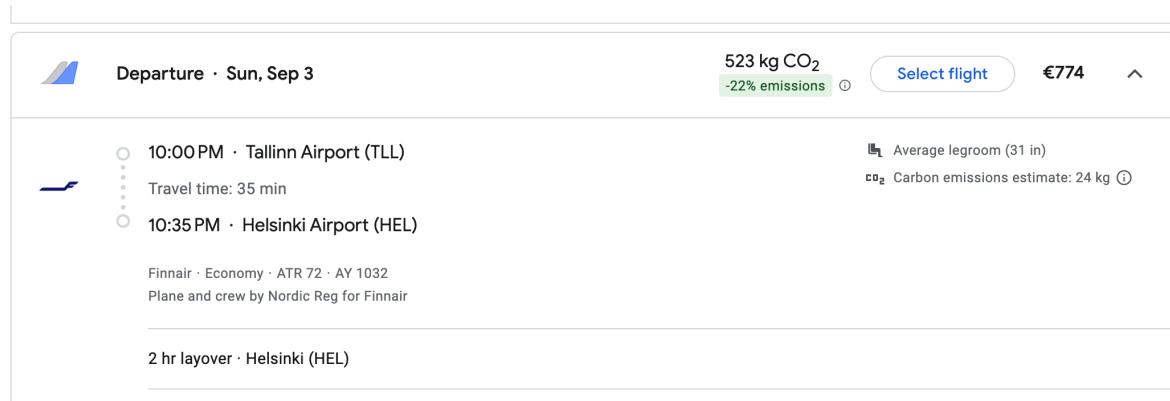


Figure 53: Google’s view of flight emissions

(Wee et al., 2021) proposes 7 types of nudging technique based on an overview of 37 papers which explore nudging people to be more environmentally friendly.

Table 45: Types of nudge documented by (Wee et al., 2021)

Name	Technique
Prompting	Create cues and reminders to perform a certain behavior
Sizing	Decrease or increase the size of items or portions

Name	Technique
Proximity	Change the physical (or temporal) distance of options
Presentation	Change the way items are displayed
Priming	Expose users to certain stimuli before decision-making
Labelling	Provide labels to influence choice (for example CO <sub>2</sub> footprint labels)
Functional Design	Design the environment and choice architecture so the desired behavior is more convenient

(Acuti et al., 2023) makes the point that physical proximity to a drop-off point helps people participate in sustainability and metaphorical messaging alongside proximity can be powerful, enhancing the ease of information processing. In a field study in Northern Italy, a metaphor-based message re-framed the factual statement “1g of mercury can pollute 1000L of water” as “7 bathtubs”, and 354000000L as “140 Olympic swimming pools,” (a projection of potential Italian mercury pollution at current disposal rates), which significantly boosted willingness to recycle mercury.

Alibaba’s Ant Forest (螞蟻森林) has shown the potential gamified nature protection, simultaneously raising money for planting forests and building loyalty and brand recognition for their sustainable action, leading the company to consider further avenues for gamification and eco-friendliness.

Table 46: Ant Forest assisted tree planting; data compiled from (P. Cao & Liu, 2023; *Over 600 Million People Planted More Than 326 Million Trees via Alipay Ant Forest in Five Years*, 2021; UNFCCC, 2019; S. Wang et al., 2022; X. Wang & Yao, 2020; Z. Yang et al., 2018; B. Zhang et al., 2022; F. Zhou et al., 2023; 张越熙, 2024; 李连环 & 姜舒译, 2017; 胡群& 宋璠, 2024).

Year	Users	Trees	Area
2016	N/A	N/A	N/A
2017	230 million	10 million	N/A
2018	350 million	55 million	6500 acres??
2019	500 million	100 million	112,000 hectares / 66, 000 hectares?
2020	550 million	200 million	2,7 million acres?
2021	600 million	326 million	N/A
2022	650 million	400 million	2 million hectares
2023	690 million	475 million	N/A
2024	N/A	548 million	3.87 million hectares
2025	N/A	N/A	N/A

Ecosia is a search engine with an unconventional business models, investing all its profits into planting trees, pouring € 92 million into climate action since 2009, planting 225 million trees

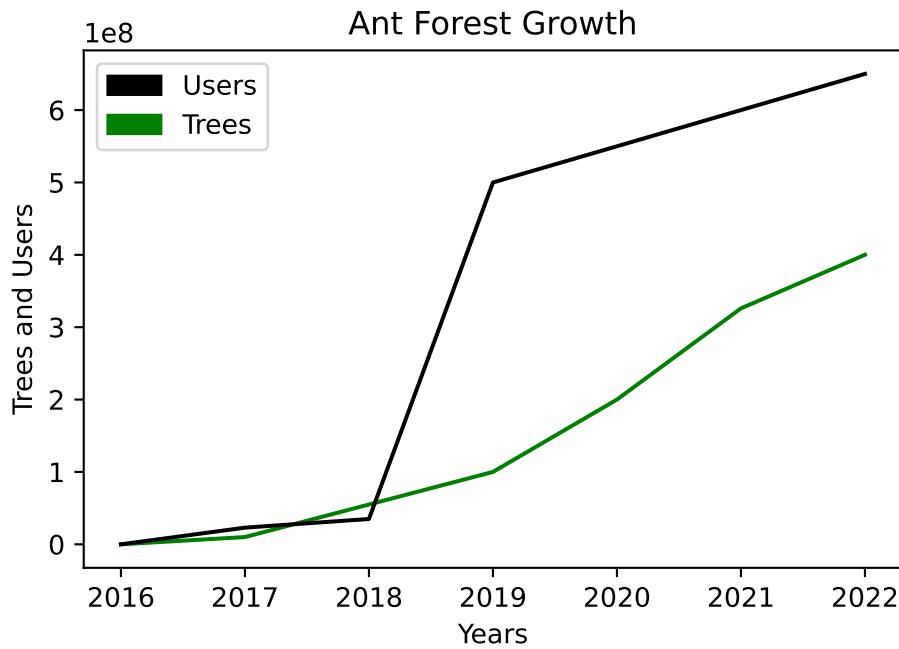


Figure 54: Growth of Ant Forest

worldwide (D. C. Garcia, 2025b). The founder Christian Kroll recalls travelling in South America in 2006 and being shocked to see vast areas of rainforests converted into soy plantations, which inspired him to research the causes of deforestation and start Ecosia; the company employs partners around the world to improve soil, biodiversity, the water cycle, reducing droughts and floods, and monitor the trees it plants (Hirsh, 2021).

New user interfaces hold some potential for sustainability improvements. In particular, immersive communication technologies such as AR/VR hold the potential to reduce business travel, if productive meetings can be held online, reducing emissions. Likewise, visualizing large architectural projects as well as simulating product design in various industries can reduce cost by detecting problems in the 3D environment, early on in the design process, especially for collaboration in teams located all over the world (Varjo, 2025). Dynamic interfaces might invoke a new, natural-interaction-focused design language, for taking full advantage of extended reality (Hoang, 2022). First encouraging findings from reconstructing language from fMRI readings (brain scans) even show potential for enabling computers to directly read human minds; contemporary AI models have already been shown capable of generating full sentences from human thoughts (J. Tang et al., 2022).

The small screen estate space of mobile phones and smartwatches necessitates displaying content in a dynamic manner. Likewise, speaking is one mode of interaction that's become increasingly possible as machines learn to interpret human language. Virtual reality glasses (called AR/VR or XR in marketing speak) need dynamic content because the user is able to move around the environment. All these are multi-modal communication questions that interaction design is called upon to solve.

Table 47: Modes of Interaction

Modes of Interaction
Writing
Speaking
Touching
Moving
Seeing

## 9.8 Learning from Quantified Self: Tracking Health and Lifestyle

An early example of how tracking personal data enables behavior change, are health and lifestyle tracking apps. Research on *personal data tracking* also known as *quantified self* or *self-monitoring* is abundant. There's substantial academic evidence indicating that health tracking apps can have a measurable impact on user health behaviors and increase positive health outcomes. Wearable devices including the Apple Watch, Oura Ring, Fitbit and others, combined with apps, help users track a variety of health metrics. Recently, npj Biosensing even published a device from the MIT Media Lab that can track cells inside the human body from a wrist-worn device (Jang et al., 2025; Jarvis, 2025).

Apart from health, wearable devices have been used to track other metrics such as physiological parameters of students at school to determine their learning efficiency (Giannakos et al., 2020). Not only can health metrics be tracked, but exposure to pollution as well as personal carbon footprint, are all to some extent track-able (if not traceable).

### 9.8.1 Health and Fitness Tracking

Tracking one's health and fitness is a familiar mode of *quantified self*, available to many smart-watch users - and even pretty much to anyone who has a phone made in the past decade. Apple is a leader in health tracking, releasing Apple Health in 2008 as an iOS 8 software feature and the Apple Watch in 2015, filled with health-focused sensors and features (Apple, 2022b). In 2022 Apple outlined plans for “empowering people to live a healthier day,” promising a new set of health-features with every release, such as the rumored temperature measurement inside of Apple AirPod earphones; and providing most of this data to developers through Apple’s HealthKit health metrics APIs, which app builders can tap into (Apple, 2022a, 2022c).

Use of wearable devices enables one to be more aware of one's health. (Saubade et al., 2016) finds health tracking is useful for motivating physical activity. Blood glucose tracking is popular even for people without diabetes, to optimize their daily activity, including sports (*Is Blood Sugar Monitoring Without Diabetes Worthwhile?*, 2021). Smart toilets offer unobtrusive monitoring of urine for one's hydration levels as well as deeper insights on biomarkers as well as renal and nutritional health, through using sensor - equipped seats (e.g. Withings' U-Scan), which create a daily stream of data useful for trend analysis (Hermsen et al., 2023; Wagner & Boiten, 2023).

Companies like NeuralLink are building devices to construct meaningful interactions based only on brain waves (EEG) (Musk & Neuralink, 2019).

Popular Strava sports assistant (over 100 million users) provides activity tracking and feedback (Strava, 2022).

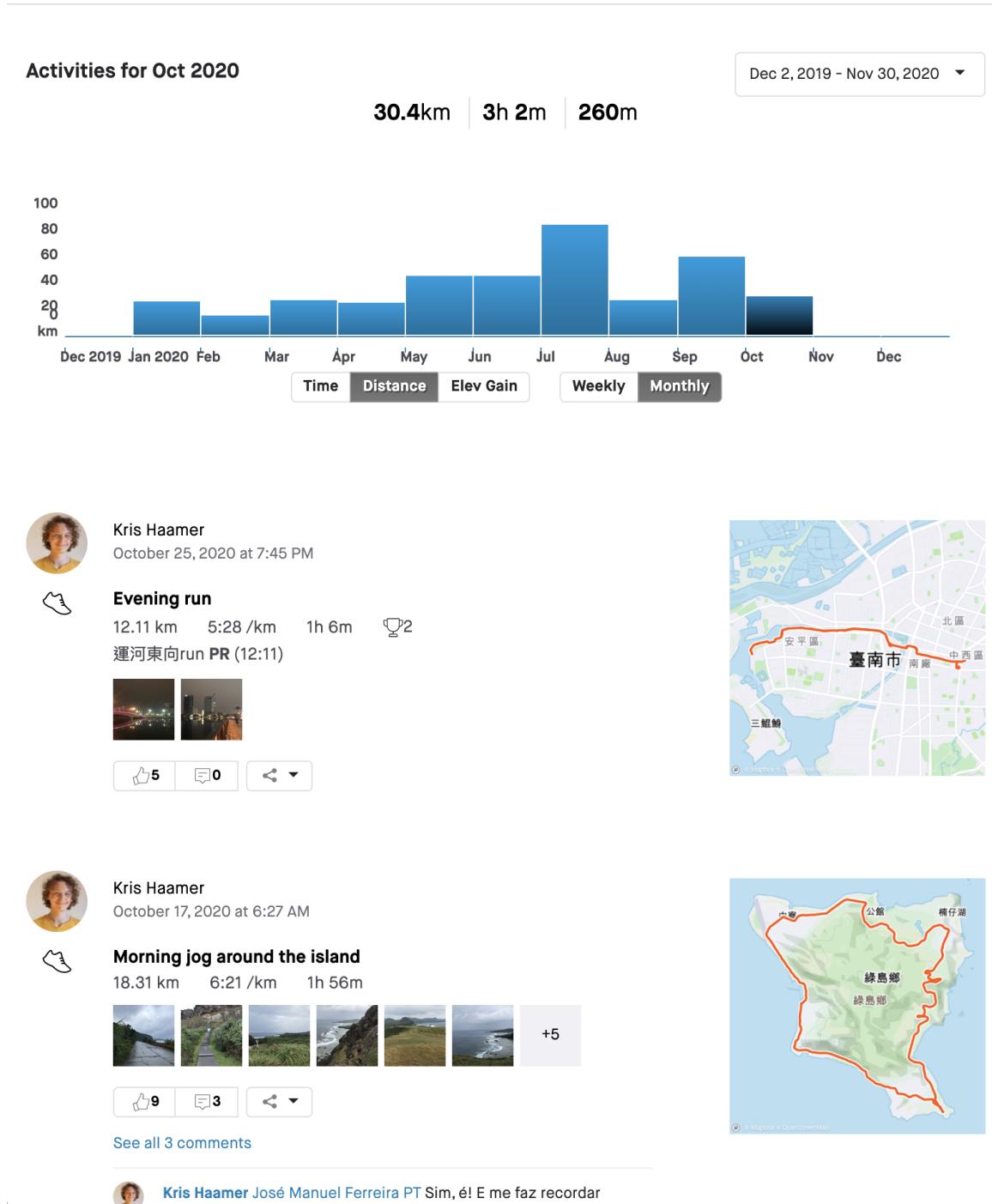


Figure 55: Popular Strava sports assistant provides run tracking and feedback

Sleep quality is an important aspect of both physical and mental health and many devices and apps focus on helping people get enough high quality sleep. There's plenty of academic literature on how physical activity, as well as environmental aspects, such as air quality, affect sleep (X. Liu et al., 2019) tracks how wearable data is used for tracking sleep improvements from exercise. (Grigsby-Toussaint et al., 2017) made use of sleep apps to construct humans behaviors also known as *behavioral constructs*.

Being conscious of one's mental health improves quality of life. (Tyler et al., 2022) surveyed the use of self-reflection apps in the UK (n = 998) finding a variety of methods from physical journaling in notebooks to smartphone-based note-taking apps, reviewing printed photo albums, and other digital tools.

Tracking one's food intake helps to understand how healthy and nutrient-rich is one's diet. (Ryan, 2022) uses the "capability methodology" framework, developed by economist Amartya Sen and later expanded by philosopher Martha Nussbaum, shifting focus from what people have (e.g. money, food, tools) to what they are able to do (human capabilities), which is used in the context of this paper to evaluate not only if the apps provide healthy food suggestions, but to what extent they expand a user's freedom to live a healthy life; some forms of nudging inside the apps can support users' goals however manipulative or coercive tactics serve only the app developers' interests and are ethically problematic - the paper emphasizes the need for interaction design that respect users' freedom, consider diverse personal choices, diverse bodies, cultures, and preferences, and environmental factors.

The Oura ring is an example of *calm technology*, providing helpful data without calling attention to itself (Phelan, 2024). More recently, Oura Ring launched an AI-advisor to help explain the health data recorded by its device: deliver contextual and personalized guidance, remember past interactions while emphasizing privacy, and analyze both short- and long-term biometric trends (Team, 2025). There's value in developing standardized fitness metrics, which different digital health providers can use to create dashboards with comparable data. Even with messy data, AI has a useful role as a translator between different standards. OpenAI is collaborating with ex-Apple designer Jony Ive, to bring such ambient AI devices to life, which they believe has the potential for a new product category (WSJ News, 2025).

### **9.8.2 Pollution Exposure Tracking**

Pollution exposure tracking may be considered a combination of health tracking and sustainability tracking. I've been tracking my personal air pollution exposure using the Atmotube Pro device attached to my backpack.

The above chart shows my exposure to pollutants while traveling, ranked from worst to best.

### **9.8.3 Tracking Personal Sustainability and Carbon Emissions**

The above examples of tracking various aspects of health beg the question if one could track personal sustainability similarly. We have a limited carbon budget so calculating CO<sub>2</sub>eq-cost

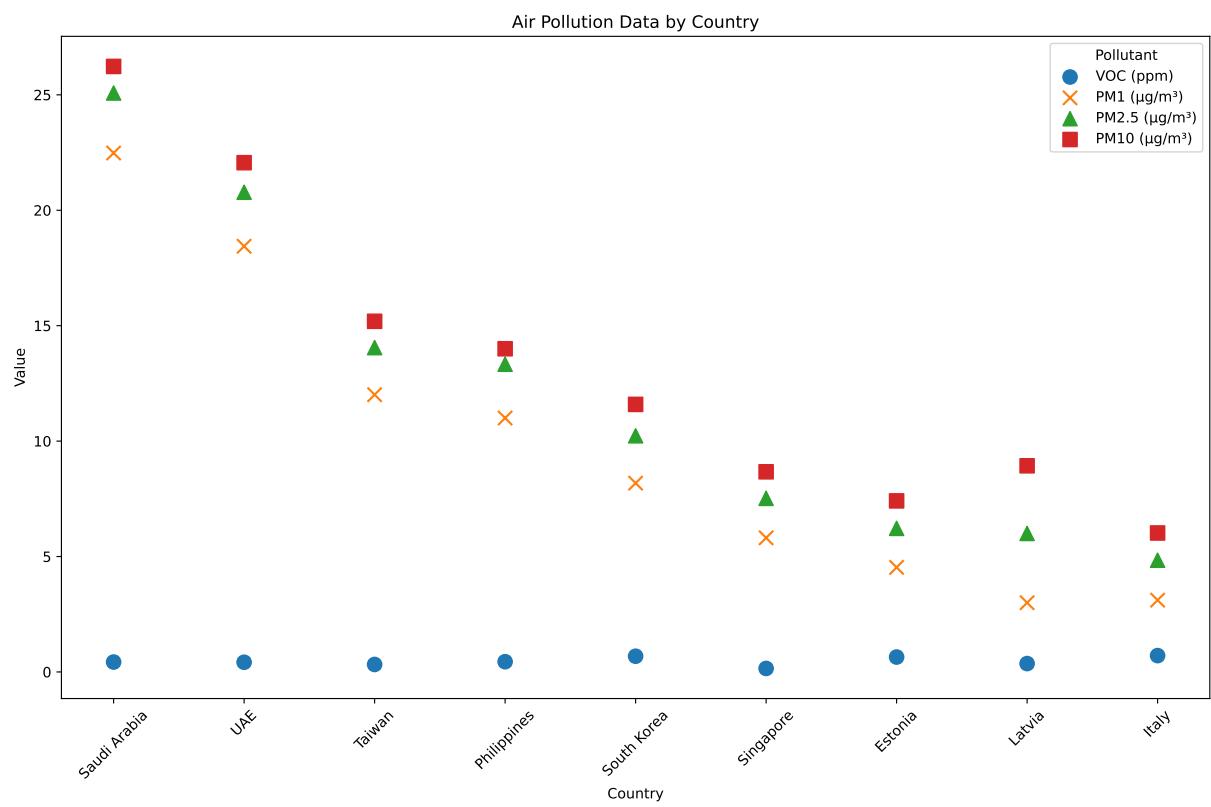


Figure 56: My Personal Exposure to Air Pollution

could be expressly integrated into every activity.

Already in 2017, a project funded by the EU Horizon 2020 title “*Instant Gratification for Collective Awareness and Sustainable Consumerism*” piloted the concept of “*political consumerism*”, by enabling shoppers at 2 stores (Estonia and Austria) to experience real-time, personalized sustainability ratings on nearby products (by using a mobile app and bluetooth beacons to locate shoppers at shelf level, while maintaining privacy); instead of isolated choices, individual preferences were (environmental, health, political) aggregated into a community “sustainability signal”; the results indicated a statistically significant increase in sustainability awareness and some users praised the simplicity of the user interface (Bennati & Pournaras, 2018; *Instant Gratification for Collective Awareness and Sustainable Consumerism*, 2022; Klinglmayr et al., 2017; Pournaras et al., 2016).

More recently, (Kommenda et al., 2022) describes an interactive demo of Carbon Food Labels in the Financial Times, aimed at influence purchasing behavior by displaying Life Cycle Assessment (LCA) data directly on the products; for example - lentils (1kg CO<sub>2</sub>eq per 1 kg) v.s. beef (27kg CO<sub>2</sub>eq per 1 kg) - clearly illustrating the contrasting climate impact of different foods; moreover, shoppers could see the emissions in their shopping cart, enabling real-time comparisons and decision-making; an accompanying survey showed 68% of users were interested in choosing lower-emission products while a low 22% of the respondents trusted the data, highlighting a key challenge: standardizing and verifying supply-chain data.

The founder of the Commons (formerly known as Joro) consumer CO<sub>2e</sub> tracking app recounts how people have a gut feeling about the 2000 calories one needs to eat daily, so perhaps daily CO<sub>2e</sub> tracking could develop a gut feeling about one’s carbon footprint (Jason Jacobs, 2019). Zhang’s Personal Carbon Economy conceptualized the idea of carbon as a currency used for buying and selling goods and services, as well as an individual carbon exchange to trade one’s carbon permits (S. Zhang, 2018). These types of apps suggest CO<sub>2</sub>eq calculations will be part of our everyday experience. Nonetheless, sustaining user engagement over time in sustainability tracking apps is challenging, because the perceived personal benefit and measurable impact is so minimal - it may feel meaningless. Tracking sustainability may have collective benefits but tracking health has immediate personal benefits. Health apps feel tangible with increased well-being while sustainability apps often feel more collective, long-term and sometimes with benefits too small to matter, making it harder to motivate individual users.

Sustainability tracking, while perhaps less than health tracking, can also have a measurable impact. One study of personal carbon footprint tracking apps (aka CO<sub>2</sub>eq calculators) in a mid-sized German city (n = 216) helped overall emission reduction by 23% correlating with feedback from the app specifically reducing emissions from heating 26.9%, food 16.4%, household 34.7% reduction, and mobility 12% (S. Hoffmann et al., 2024). Better maps can also convince people to make changes; advanced maps which visualize erosion, heat, flooding, fire, drought, extreme weather, and other climate risks, can inform resilience planning; a map for transport, such as taxis, can visualize pickup / drop-off imbalances, coloring areas green where pickups exceed drop-offs and orange where drop-offs exceed pickups, can help users see spatial patterns and inform climate-resilient transport planning (Carto, 2023).

Because of the large emission footprint of transport, offering a steep emissions reduction potential, greener modes of mobility have been heavily researched. Already more than a decade ago, a survey from April 2014 to December 2015 ( $n = 4586$ , total 29930 travel episodes) across the United Kingdom, asked participants to rate their enjoyment (on a liker scale from 1 to 7) and tracked the type of travel (work, unpaid work, personal care, childcare, leisure, etc.); results showed private car was used for 79% of personal care and 55% of leisure trips; key findings showed *walking and cycling significantly increase enjoyment* across all trip purposes, while public transit reduced enjoyment for childcare and work-related travel; overall findings show improvements in transport infrastructure can both lower green house gas emissions and boost traveler wellbeing (Echeverría et al., 2022).

A wide range of personal carbon footprint calculators have been released online, ranging from those made by governments and companies to student projects. Similar to personal health trackers, personal CO<sub>2</sub> trackers help one track emissions and suggests sustainable actions. In Singapore, the DBS bank released a consumer sustainability ESG app called DBS LiveBetter (DBS, 2018; DBS Singapore, n.d.)

Table 48: A selection of personal sustainability apps.

App	Description
Commons (Formerly Joro)	Financial Sustainability Tracking + Sustainable Actions
Klima	Offset Subscription
Wren	Offset Subscription
JouleBug	CO <sub>2</sub> eq tracking
eevie	
Aerial	
EcoCRED	
Carbn	
LiveGreen	
Earth Hero	

(G. Shin et al., 2019)'s synthesis review of 463 studies shows wearable devices have potential to influence behavior change towards healthier lifestyles. While the behavior changes may sound simple - like switching from driving to walking - and would have an effect both on health and the environmental, they are hindered by factors from personal motivation to (lack of) suitable urban architecture. (Delclòs-Alió et al., 2022) discusses walking in Latin-American cities. Walking is the most sustainable method of transport but requires the availability of city infrastructure, such as sidewalks, which many cities still lack. The urban environment has an influence on health. (Sanchez et al., 2022) suggests tracking users using their smartphones and attributing points for actions deemed beneficial - yet this has potential privacy issues. For any service tracking the user's action, following privacy UX guidelines is crucial (Jarovsky, 2022b).

Human behavior is affected by the environment. The above chart shows the incidence of bad behavior during the pandemic increased significantly in Sweden based on data from (Ceccato et

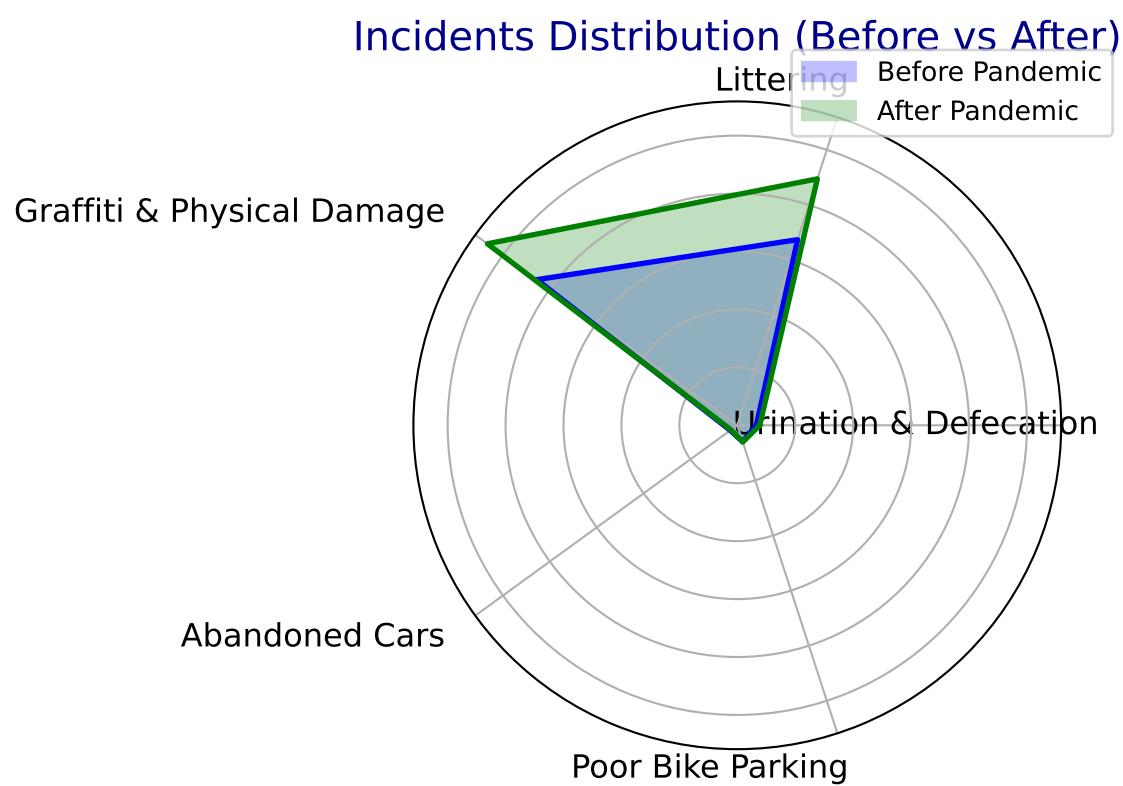


Figure 57: Increase of Bad Behavior During the COVID19 Pandemic

al., 2023).

## 9.9 Digital Product Passports: Tracking Data for Sustainable Product Management

*Digital Product Passports*, part of the Sustainable Products Initiative, are one of the key actions taken under the Circular Economy Action Plan (CEAP) of the European Union; the goal of this initiative is to lay the groundwork for a gradual introduction of a digital product passports in at least 3 key markets by 2024: (1) batteries for electric vehicles and industrial use, (2) consumer and ICT electronics, (3) textiles and apparel (Kuch, 2022). (Nissinen et al., 2022) calls for emissions' data to be made available to manufacturers, retailers, and consumers so they can make low-carbon choices; moreover, metrics must move beyond a single aggregated number to assessing life-cycle emissions' variability.

In theory, DPPs are able to capture and make usable the comprehensive trace of data needed for green transformation. Even though *digital product passports* relate heavily to adopting a circular economy, I've chosen to highlight this topic under Design, as it's the main design implication from this chapter - an emerging technology which needs to be *designed*. (King et al., 2023) proposes a universal definition of a Digital Product Passport Ecosystem (DPPE) as a "system-of-systems," synthesizing stakeholder requirements and concerns from the EU's open consultation on the Sustainable Products Initiative, aiming to influence consumer behavior towards sustainable purchasing - and responsible product ownership - by making the sustainability aspects of a product life cycle clearly apparent. (Reich et al., 2023) identifies *information gaps* as one of the major obstacles to realizing a circular economy; a study of 28 experts across academia, industry, government, consultancy and NGOs, showed Digital Product Passports (DPPs) can enhance the 9 "R" in circular strategies. The first full articulation of the 9 R strategies came from the report "*Circular Economy – Measuring Innovation in the Product Chain*", where (Potting et al., 2017) laid out a hierarchy of circular - economy options; the framework was later adopted and popularized in peer-reviewed literature, for example (Kirchherr et al., 2017).

Table 49: The 9 R strategies from (Potting et al., 2017).

R-Strategy	Definition
R9 Recover	Incineration of material (energy recovery)
R8 Recycle	Process materials, obtaining the same (high grade) or lower grade quality
R7 Repurpose	Use discarded product (or its parts) in a new product (with a different function)
R6 Remanufacture	Use parts of a discarded product in a new product (with the same function)
R5 Refurbish	Restore an old product (bring it up to date)
R4 Repair	Maintenance of a product so it can be used with its original function
R3 Reuse	Reuse by another consumer (still in good condition and fulfills its original function)

R-Strategy	Definition
R2 Reduce	Increase efficiency in product manufacture (consume fewer natural resources and materials)
R1 Rethink	Use the product more intensively (sharing the product via online platforms, etc)
R0 Refuse	Don't use product at all (or replace the function with a better alternative)

There's extensive literature on the use Digital Product Passports (DPP) at specific industries and for particular use cases, often focused on improved efficiencies. (Plociennik et al., 2022) details the use of Digital Product Passports and the cloud platform infrastructure to improve e-waste sorting when paired with ML-based object detection. (Berger, Rusch, et al., 2023) outlines data-science and machine-learning approaches (for example sharing models) to enable the exchange of sensitive EV-battery life-cycle data through Digital Product Passports, while preserving confidentiality, helping overcome stakeholder reluctance. (Jensen et al., 2023) study of mechatronics supply chains found DPPs "*support decision-making throughout product life cycles in favor of a circular economy*"; specifically:

- (1) usage and maintenance
- (2) identification
- (3) materials
- (4) guidelines
- (5) supply-chain and reverse logistics
- (6) environmental data
- (7) compliance

With the increasing electrification of transport, finding ways to deal with the batteries is a crucial area of research. (Berger, Baumgartner, Weinzerl, Bachler, Preston, et al., 2023) examined the stakeholders of electric vehicle (EV) battery value-chain and mapped their data requirements and current availability, laying groundwork to propose a *Digital Battery Passport*. (Berger, Baumgartner, Weinzerl, Bachler, & Schögl, 2023) lists current challenges with EV batteries, providing empirical insights into difficulties with DPP adoption, including technical, organizational, and policy barriers; an interesting part of the research is the introduction go "*Sustainable Product Management*" (SPM) as a specific field of management in the context of circular economy.

The key barriers to adoption from (Berger, Baumgartner, Weinzerl, Bachler, & Schögl, 2023) include:

Uncertainty of stakeholders  
 Technological barriers  
 Insufficient willingness to share information  
 Lack of clear legal requirements and standards

Meanwhile, the enablers include:

Clear legal requirements  
 Relative advantages (reputation gains, access to new markets, risk avoidance, marketing)  
 Monetary incentives (such as payments for data)  
 Intrinsic motivation (compatibility with the values)

Focusing on food production industries, a brief historical overview of previous efforts in this area may be helpful, to contextualize the discussion. CO<sub>2e</sub> labeling initiatives represent an early attempt to communicate the environmental cost of each product. Using carbon labels to convey CO<sub>2e</sub> emission of consumer products has been a topic of discussion for decades (Adam Corner, 2012). Academic literature has looked at minute details such as color and positioning of the label (S. Zhou et al., 2019). There's some indication consumers are willing to pay a small premium for low-CO<sub>2e</sub> products; all else being equal, consumers choose the option with a lower CO<sub>2e</sub> number (Carlsson et al., 2022; M. Xu & Lin, 2022). (Cohen & Vandenberg, 2012) argues labeling the carbon footprint of products does help inform consumer choice towards sustainability and help promote a green economy. A large-scale study of UK university students finds some evidence to suggest labeling low CO<sub>2e</sub> food enables people to choose a *climatarian diet*, however the impact of carbon labels on the market share of low-carbon meals is negligible (Lohmann et al., 2022).

Similar to *Nutritional Facts Labeling*, *Carbon Labels* provide basic information regarding the emissions' profile of each product, yet taken alone, without a systemic push for carbon reduction, they are insufficient to drive significant behavioral change. A study in Sweden underlines a negative correlation between worrying about climate impact and interest in climate information on products (Edenbrandt & Lagerkvist, 2022). This latter finding may be interpreted to suggest a need for wider environmental education programs among consumers. (Asioli et al., 2022) found differences between countries, where Spanish and British consumers chose meat products with '*no antibiotics ever*' over a *Carbon Trust* label, whereas French consumers chose CO<sub>2</sub> labeled meat products. Despite ongoing interest, several studies have shown that the overall impact of carbon labeling on consumer behavior remains negligible. The idea is yet to find mainstream adoption and participation in carbon labeling schemes remains voluntary, with only a limited number of companies implementing such practices, although their numbers are gradually increasing. Notable examples include the U.S.-based restaurant chain *Just Salad*, U.K.-based vegan meat-alternative *Quorn*, and plant milk *Oatly*, all of which provide carbon labeling on their products (Brian Kateman, 2020). (ClimatePartner, 2020) Companies like ClimatePartner and Carbon Calories offers labeling consumer goods with emission data as a service. (The Carbon Trust, n.d.) The Carbon Trust reports it's certified 270000 product emissions' footprints.

Table 50: Companies with Carbon Labels (Brian Kateman, 2020)

Company	Country
Just Salad	U.S.A.
Quorn	U.K.
Oatly	U.K.
IKEA	Sweden

Table 51: Organizations Who Certify Carbon Labels (ClimatePartner, 2020).

Organization	Number of Certified Products
ClimatePartner	
Carbon Calories	
Carbon Trust	27000

Transitioning from simpler carbon labels to data-driven *Digital Product Passports* requires comprehensive data collection on product's history, composition, and environmental impact, digital infrastructure, industry collaboration, regulatory frameworks, and consumer engagement.

Table 52: Digital Product Passport goals (Stretton, 2022a).

Goal
Sustainable Product Production
Businesses to create value through Circular Business Models
Consumers to make more informed purchasing decisions
Verify compliance with legal obligations

(Van Capelleveen et al., 2023) conducted a comprehensive, structured review of 200 academic papers on Digital Product Passports and related concepts, including circular, product, material, resource, recycling, and cradle-to-cradle variants, assessing dimensions such as historical developments, stakeholders, goals, challenges, and designs for solutions, in order to formalize the concept and its boundaries, finally synthesizing a unified definition:

*“a digital interface composing a certified identity of a single identifiable product by accessing the set of life cycle registrations linked to this object in order to yield insight into the sustainability and circularity characteristics, the circular value estimation, and the circular opportunities for both that product and its underlying components and materials.”*

Circularise, a leader in providing digital product passports as a service, lists 15 types of data that should be included in a DPP (Tian Daphne & Chris Stretton, 2023). A case study of rigid polyurethane foam (PU foam), a lightweight insulation material, explains how Circularise used blockchain and zero-knowledge proof (ZKP) to allow for DPP data-sharing, while retaining privacy and control over the data (Daphne, 2022; León, 2025).

The above chart shows data categories used in Digital Product Passports (DPPs) as defined by Circularise.

(Gnanasambandam et al., 2022) describes responsible product management as embedding privacy, sustainability, and inclusion into product design as core priorities, not afterthoughts. (Korzhova, 2020) works as a *Sustainable Product Manager* at Grover, an online platform which

Digital Product Passport Data Categories

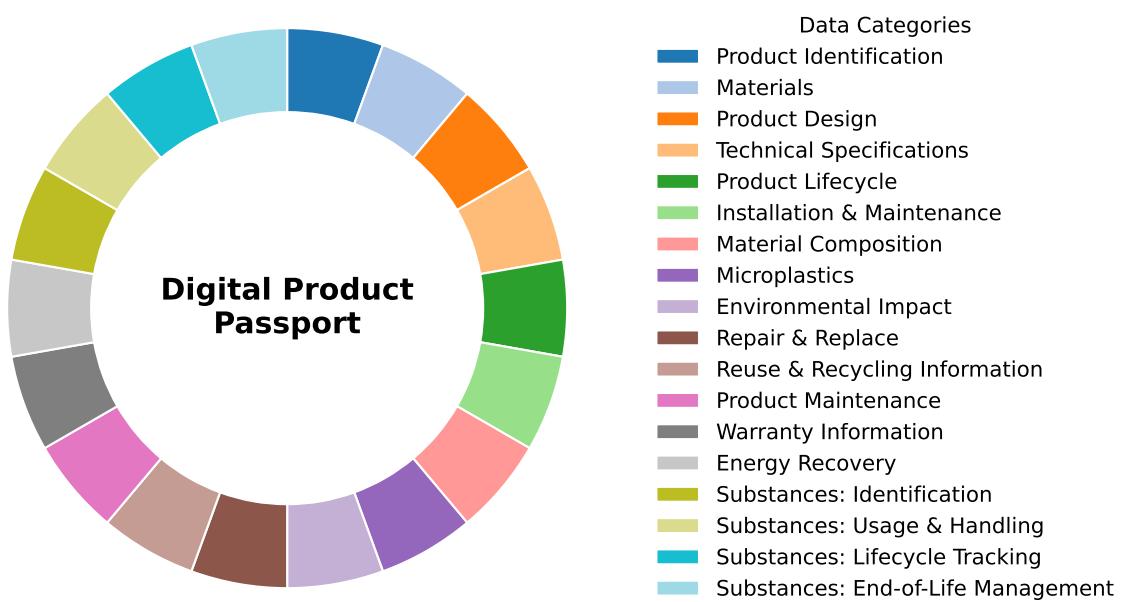
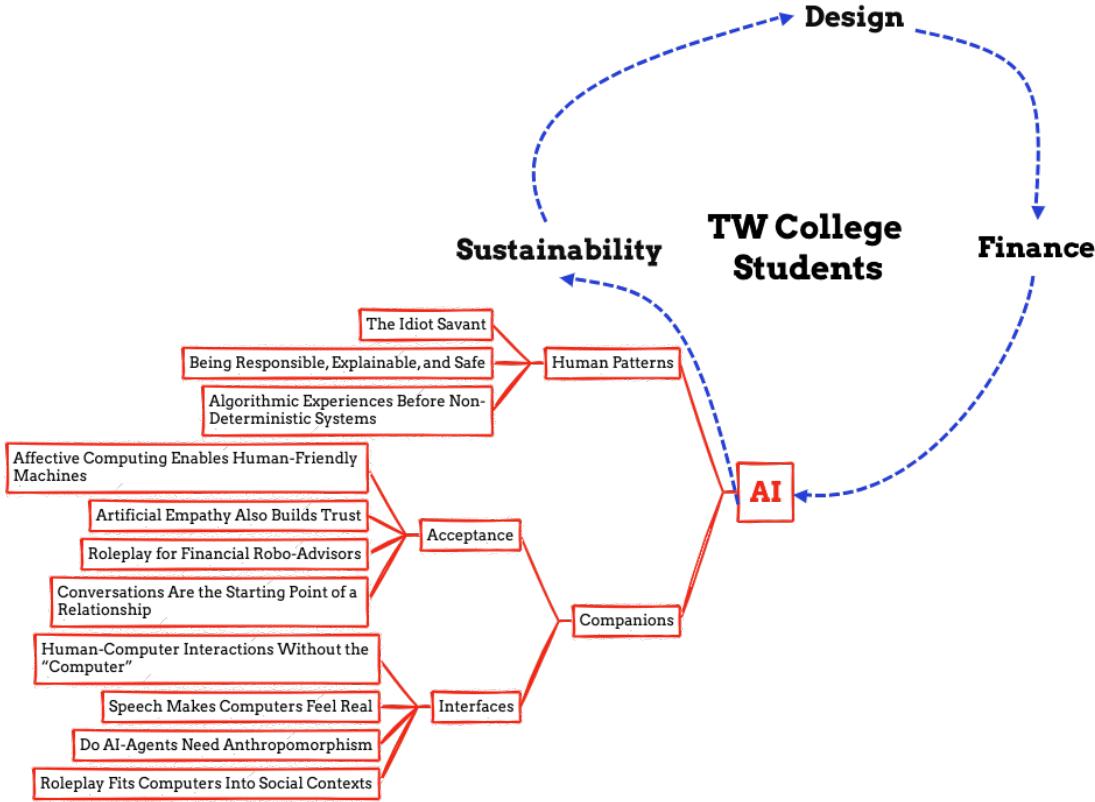


Figure 58: Digital Product Passport Data Categories

offers product for rent; she details how rentals-based business model has saved 360 tons of devices from going to waste (the author compares the amount to about 15 truckloads of devices), which sums up to 4275 tons of CO<sub>2</sub> savings.

## 10 AI



Presented with xmind AI

Figure 59: Visual abstract for the AI chapter

### 10.1 Human Patterns

The fact that AI systems work so well is proof that we live in a measurable world. The world is filled with structures: nature, cultures, languages, human interactions - all form intricate patterns. Computer systems are increasingly capable in their ability to copy these patterns into computer models - known as machine learning. As of 2023, 97 zettabytes (and growing) of data was created in the world per year (Soundarya Jayaraman, 2023). Big data is a basic requirement for training AIs, enabling learning from the structures of the world with increasing accuracy. Large data-sets such as the LAION-5B of 5.85 billion image-text pairs, were foundational for training AI to recognize images (Romain Beaumont, 2022; Schuhmann et al., 2022). Just 3 years later, generating images with GenAI models is now fast enough to create images in real-time while

the user is typing (Dwarkesh Patel, 2024). Similarly huge data-sets exist about other types of media - and the open Internet itself, albeit less structured, is a data-source frequently scraped by AI-model builders. Representations of the real world in digital models enable humans to ask questions about the real-world structures and to manipulate them to create synthetic experiments that may match the real world (if the model is accurate enough). This can be used for generating human-sounding language and realistic images, finding mechanisms for novel medicines as well as understanding the fundamental functioning of life on its deep physical and chemical level (No Priors: AI, Machine Learning, Tech, & Startups, 2023). Venture capitalists backing OpenAI describe AI as a foundational technology, which will unlock human potential across all fields of human activity (Greylock, 2022).

In essence, *human patterns* enable AIs. Already 90 years ago (McCulloch & Pitts, 1943) proposed the first mathematical model of a neural network inspired by the human brain. Alan Turing's Test for Machine Intelligence followed in 1950. Turing's initial idea was to design a game of imitation to test human-computer interaction using text messages between a human and 2 other participants, one of which was a human, and the other - a computer. The question was, if the human was simultaneously speaking to another human and a machine, could the messages from the machine be clearly distinguished or would they resemble a human being so much, that the person asking questions would be deceived, unable to realize which one is the human and which one is the machine? (Turing, 1950).

Alan Turing: “*I believe that in about fifty years’ time it will be possible to program computers, with a storage capacity of about  $10^9$ , to make them play the imitation game so well that an average interrogator will not have more than 70 percent chance of making the right identification after five minutes of questioning. ... I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.*” - from (Stanford Encyclopedia of Philosophy, 2021)

By the 2010s AI models became capable enough to beat humans in games of Go and Chess, yet they did not yet pass the Turing test. AI use was limited to specific tasks. While over the years, the field of AI had seen a long process of incremental improvements, developing increasingly advanced models of decision-making, it took an *increase in computing power* and an approach called *deep learning*, a variation of *machine learning (1980s)*, largely modeled after the *neural networks* of the biological (human) brain, returning to the idea of *biomimicry*, inspired by nature, building a machine to resemble the connections between neurons, but digitally, on layers much deeper than attempted before. Like quantum computing, AI more of a discovery, thank an invention; we have no idea, what are the limits of intelligence (CatGPT, 2025).

Founder of NVIDIA, Jensen Huang, whose computer chips power much of this revolution, calls it the “*Intelligence Infrastructure*”, produced by intelligence factories, and integrated into everything, just like electricity was (NVIDIA, 2025). In order to produce this intelligence, huge AI factories are being built around the world, measured in the energy requirements. (Calma, 2025) predicts AI will surpass Bitcoin’s energy use by the end of 2025 (Calma, 2025). The 500B USD Stargate project, is currently building 1.2 gigawatts of AI capacity in the Texas, and expanding

to other areas around the U.S., and data center in Abu Dhabi, U.A.E., which requires 5GW of energy, and is physically bigger than the country of Monaco (Loizos, 2025; Moss, 2025). In comparison, the 500MW xAI AI factory, built by Elon Musk's company, powered by natural gas generators, is moderate in size (B. Wang, 2025). While OpenAIs Sam Altman is repeatedly quoted as saying the productivity gains created by AI will far offset any of its environmental footprint or other words to that effect (Altman, 2024; Di Pizio, 2023), critics like (iGenius, 2020) argue that AI cannot enable a sustainable future if it is not sustainable by design; training and delivery of AI products must include sustainability considerations tied into data intelligence and business analytics.

### 10.1.1 Human Feedback

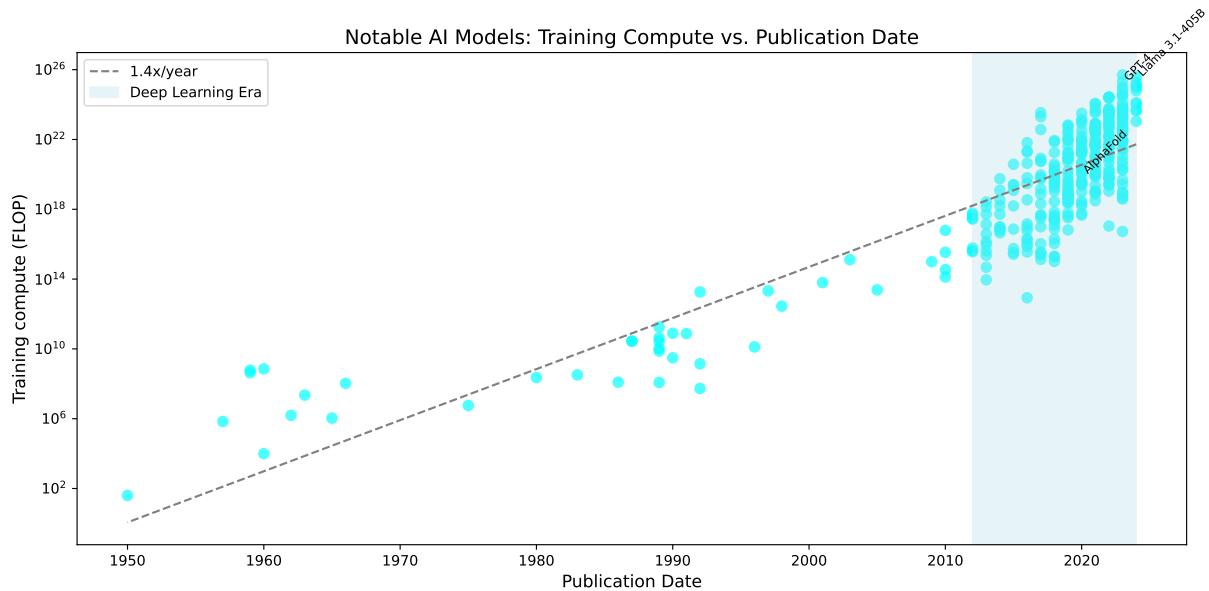
Combining deep learning and *reinforcement learning with human feedback (RLHF)* enabled to achieve levels of intelligence high enough to beat the Turing test (Christiano et al., 2017; Christiano, 2021; Kara Manke, 2022). John Schulman, a co-founder of OpenAI describes RLHF simply: “*the models are just trained to produce a single message that gets high approval from a human reader*” (Kara Manke, 2022). Bigger models aren’t necessarily better; rather models need human feedback to improve the quality of responses (Ouyang et al., 2022).

The nature-inspired approach was successful. Innovations such as *back-propagation* for reducing errors through updating model weights and *transformers* for tracking relationships in sequential data (for example in sentences), enabled AI models to became increasingly capable (Merritt, 2022; Vaswani et al., 2017). **Generative Adversarial Networks** trained models through pitting them against each other (Goodfellow et al., 2014). **Large Language Models**, enabled increasingly generalized models, capable of more complex tasks, such as language generation (Radford et al., 2018).

One of the leading scientists in this field of research, Geoffrey Hinton, had attempted back-propagation already in the 1980s and reminiscents how:

“*the only reason neural networks didn’t work in the 1980s was because we didn’t have enough data and we didn’t have enough computing power*” (CBS Mornings, 2023).

(Epoch AI, 2024) reports the growth in computing power and the evolution of more than 800 AI models since the 1950s. Very simply, more data and more computing power means more intelligent models.



The above chart shows an illustration of how transformers work by (Alammar, 2018).

By the 2020s, AI-based models became a mainstay in medical research, drug development, patient care (Holzinger et al., 2023; Leite et al., 2021), quickly finding potential vaccine candidates during the COVID19 pandemic (Zafar & Ahamed, 2022), self-driving vehicles, including cars, delivery robots, drones in the sea and air, as well as AI-based assistants. The existence of AI models has wide implications for all human activities from personal to professional. The founder of the largest chimp-maker NVIDIA calls upon all countries do develop their own AI-models which would encode their local knowledge, culture, and language to make sure these are accurately captured (World Governments Summit, 2024).

OpenAI has researched a wide range of approaches towards artificial general intelligence (AGI), work which has led to advances in large language models(AI Frontiers, 2018; Ilya Sutskever, 2018). In 2020 OpenAI released a LLM called GPT-3 trained on 570 GB of text (Alex Tamkin & Deep Ganguli, 2021) which was adept in text-generation. (Singer et al., 2022) describes how collecting billions of images with descriptive data (for example the descriptive *alt* text which accompanies images on websites) enabled researchers to train AI models such as ***stable diffusion*** for image-generation based on human-language. These training make use of *Deep Learning*, a layered approach to AI training, where increasing depth of the computer model captures minute details of the world. Much is still to be understood about how deep learning works; even for specialists, the fractal structure of deep learning can only be called *mysterious* (Sohl-Dickstein, 2024).

AI responses are probabilistic and need some function for ranking response quality. Achieving higher percentage or correct responses requires oversight which can come in the form of human feedback or by using other AIs systems which are deemed to be already well-aligned (termed Constitutional AI by Anthropic) (Bai et al., 2022; J. Bailey, 2023). One approach to reduce non-alignmnet issues with AI is to introduce some function for human feedback and oversight

to automated systems. Human involvement can take the form of interventions from the AI-developer themselves as well as from the end-users of the AI system. Such feedback is not only provided by humans, computer can give feedback to computers too. Less powerful AIs are taught by more powerful and aligned AIs, which understand the world better, to follow human values: for example META used LLAMA 2 for aligning LLAMA 3.

There are many examples of combination of AI and human, also known as “*human-in-the-loop*”, used for fields as diverse as training computer vision algorithms for self-driving cars and detection of disinformation in social media posts (Bonet-Jover et al., 2023; Jingda Wu et al., 2023). Also known as Human-based computation or Human-aided Artificial Intelligence (Mühlhoff, 2019; Shahaf & Amir, 2007). (Ge Wang, 2019) from the Stanford Institute for Human-Centered Artificial Intelligence, describes core design principles for building interactive AI systems that augment rather than replace people: (1) value human agency, (2) offer granularity of control, and (3) provide transparency interfaces.

Table 53: Examples of human-in-the-loop apps.

App	Category	Use Case
Welltory	Health	Health data analysis
Wellue	Health	Heart arrhythmia detection
QALY	Health	Heart arrhythmia detection
Starship Robots	Delivery	The robot may ask for human help in a confusing situation, such as when crossing a difficult road

In order to provide human feedback, systems need to be able to distinguish humans from AIs. To that end, several “Proof of Humanity” toolsets are in the process of being built. (Gitcoin Passport — Sybil Defense. Made Simple. [@gitcoinpassport], 2023) discusses how to build Gitcoin Passport’s Unique Humanity Score, an antifragile passport, inspired by Nassim Taleb’s popular book (Taleb, 2012). Taleb defines “antifragility” as “systems that benefit from volatility and stressors”, summarizing it in a letter to Nature thus:

“a convex response to a stressor or source of harm (for some range of variation), leading to a positive sensitivity to increase in volatility” - antifragility.

Gitcoin’s Passport pulls together proofs of identity from web2 platforms - but adds a unique twist: “Cost of Forgery” as a protection against fake users (aka Sybil attacks, where a malicious person fakes identities so it looks like many independent users), it becomes more expensive for them to do so, turning attack pressure into a self-reinforcing defense; however, while this approach works, it does set a very high bar for users to comply, and requires a cryptocurrency to set the price for the attacks (Gitcoin Passport — Sybil Defense. Made Simple. [@gitcoinpassport], 2023). In contrast, another popular proof-of-personhood protocol called World, verifies humanness via physical scans of human iris’, captured by its Orb device; and again using cryptography, to compare a proof (ZK-SNARK) against a centralized database (Gent, 2023). From

the user experience perspective, this approach is much simpler (while needing physical presence for the iris scan). Given that World was co-founded by the OpenAI co-founder Sam Altman, this may be one way he plans to counter the possible societal disruptions accelerated by OpenAI's products.

### 10.1.2 AI as the *Idiot Savant*

Hinton likes to call AI an *idiot savant*: someone with exceptional aptitude yet serious mental disorder (CBS Mornings, 2023). Large AI models don't understand the world like humans do. Their responses are predictions based on their training data and complex statistics. Indeed, the comparison is apt, as the AI field now offers jobs for *AI psychologists*, whose role is to figure out what exactly is happening inside the 'AI brain' (Waddell, 2018). Understanding the insides of AI models trained of massive amounts of data is important because they are *foundational*, enabling a holistic approach to learning, combining many disciplines using languages, instead of the reductionist way we as human think because of our limitations (CapInstitute, 2023). Hinton received a Nobel Prize for modeling how the brain works and coming up with the idea of predicting the next word in a sequence, already in 1986, which later became the basis for large language models (CBS Mornings, 2025).

Foundation models enable *Generative AIs*, a class of models which are able to generate many types of \*tokens\*\*, such as text, speech, audio (Kreuk et al., 2022; San Roman et al., 2023), music (Copet et al., 2023; Meta AI, 2023), video, and even complex structures such 3D models and DNA structures, in any language it's trained on. The advent of generative AIs was a revolution in human-computer interaction as AI models became increasingly capable of producing human-like content which is hard to distinguish from actual human creations. This power comes with *increased need for responsibility*, drawing growing interest in fields like *AI ethics* and *AI explainability*. Generative has a potential for misuse, as humans are increasingly confused by what is computer-generated and what is human-created, unable to separate one from the other with certainty.

(Bommasani et al., 2021) define *foundation models* as large scale pretrained models adaptable to diverse downstream tasks, thoroughly accounting opportunities, such as capabilities across language, vision, robotics and reasoning - and risks: bias, environmental cost, economic shifts, governance, highlighting the need for interdisciplinary research - to understand deeply how these models work, and when and how do they fail. Understanding failure is crucial, as there is the question of who bares the responsibility for the actions taken by the AI (especially, in its most agentic forms, with access to the internet and tools outside the model itself). Research in organizational behavior indicates that when individuals exert influence through intermediaries - known as *indirect agency*, - their ethical judgment can become distorted: humans may believe they are behaving ethically while, in reality, they exhibit reduced concern for those affected by their decisions, resulting in less accountability for moral failures, and expecting fewer consequences for unethical conduct (Gratch & Fast, 2022).

The technological leap is disruptive enough for people to start calling it the start of a new era. (Noble et al., 2022) proposes AI has reached a stage of development marking beginning of the

*5th industrial revolution*, a time of collaboration between humans and AI. Widespread Internet of Things (IoT) sensor networks that gather data analyzed by AI algorithms, integrates computing even deeper into the fabric of daily human existence. Several terms of different origin but considerable overlap describe this phenomenon, including *Pervasive Computing (PC)* (Y. Rogers, 2022) and *Ubiquitous Computing*. Similar concepts are *Ambient Computing*, which focuses more on the invisibility of technology, fading into the background, without us, humans, even noticing it, and *Calm Technology*, which highlights how technology respects humans and our limited attention spans, and doesn't call attention to itself. In all cases, AI is integral part of our everyday life, inside everything and everywhere. Today AI is not an academic concept but a mainstream reality, affecting our daily lives everywhere, even when we don't notice it.

### 10.1.3 Algorithmic Experience and Transparency: Before AIs

Before AIs, as a user of social media, one may be accustomed to interacting with the feed algorithms that provide a personalized *algorithmic experience*. Social media user feed algorithms are more *deterministic* than AI, meaning they would produce more predictable output in comparison AI models. Nonetheless, there are many reports about effects these algorithms have on human psychology, including loneliness, anxiety, fear of missing out, social comparison, and even depression (De et al., 2025; Qiu, 2021).

Design is increasingly relevant to algorithms, - *algorithm design* - and more specifically to algorithms that affect user experience and user interfaces. ***When the design is concerned with the ethical, environmental, socioeconomic, resource-saving, and participatory aspects of human-machine interactions and aims to affect technology in a more human direction, it can hope to create an experience designed for sustainability.***

(Lorenzo et al., 2015) underlines the role of design beyond *designing* as a tool for envisioning; in her words, “*design can set agendas and not necessarily be in service, but be used to find ways to explore our world and how we want it to be*”. Practitioners of Participatory Design (PD) have for decades advocated for designers to become more activist through ***action research***. This means to influencing outcomes, not only being a passive observer of phenomena as a researcher, or only focusing on usability as a designer, without taking into account the wider context.

(Shenoi, 2018) argues inviting domain expertise into the discussion while having a sustainable design process enables designers to design for experiences where they are not a domain expert; this applies to highly technical fields, such as medicine, education, governance, and in our case here - finance and sustainability -, while building respectful dialogue through participatory design. After many years of political outcry (Crain & Nadler, 2019), social media platforms such Meta Facebook and Twitter (later renamed to X) have began to shed more light on how these algorithms work, in some cases releasing the source code (Nick Clegg, 2023; Twitter, 2023).

The content on the platform can be more important than the interface. Applications with a similar UI depend on the community as well as the content and how the content is shown to the user.

#### **10.1.4 Transitioning to Complexity: Non-Deterministic Systems**

AIs are non-deterministic, which requires a new set of consideration when designing AI. AI systems may make use of several algorithms within one larger model. It follows that AI Explainability requires *Algorithmic Transparency*.

#### **10.1.5 Being Responsible, Explainable, and Safe: Legislation Adapts and Sets Boundaries for AI**

On March 13, 2024, the European Parliament (with 523 votes for and 46 against) the EU AI Law, taking a risk-based approach to a regulatory framework, which aims to support innovation, while safeguarding democracy and environmental sustainability (Lomas, 2024). Specifically, the EU Artificial Intelligence Act (Regulation EU 2024/1689) establishes the first comprehensive legal framework for AI in the world, aiming to harmonize rules to ensure that AI systems are safe, human-centric, and rights-respecting; the act defines a tiered system that bans unacceptable risks and regulates high-risk uses, imposing transparency duties on developers of AI systems, for example near-real-time (hourly) CO<sub>2</sub>eq emissions reports from the AI models (European Union, 2024). As AI-based solutions permeate every aspect of human life, legislation is starting to catch up. In order to help international jurisdictions tailor which incidents and hazards they track and enable interoperability, the Organization for Economic Cooperation and Development (OECD) later also defined 2 types of AI risk, “AI incident” - AI system causes real harm; “AI hazard” - potential - harm scenario, both which can be raised to “serious” variants (OECD, 2024a).

“As humans we tend to fear what we don’t understand” is a common sentiment which has been confirmed psychology (Allport, 1979). Current AI-models are opaque ‘black boxes’, where it’s difficult to pin-point exactly why a certain decision was made or how a certain expression was reached, not unlike inside the human brain. This line of thought leads me to the idea of **AI Psychologists**, who might figure out the **Thought Patterns** inside the model. Research in AI-explainability (XAI in literature) is on the lookout for ways to create more **Transparency and Credibility** in AI systems, which could lead to building trust in AI systems and would form the foundations for **AI Acceptance**.

The problems of opaqueness create the field of *Explainable AI*. (Bowman, 2023) says steering Large Language Models is unreliable; even experts don’t fully understand the inner workings of the models. Work towards improving both **AI steerability** and **AI Alignment** (doing what humans expect) is ongoing. (Holbrook, 2018) argues that in order to reduce errors which only humans can detect, and provide a way to stop automation from going in the wrong direction, it’s important to focus on making users feel in control of the technology. There’s an increasing number of tools for LLM evaluation. “Evaluate and Track LLM Applications, Explainability for Neural Networks” (Leino et al., 2018; TruEra, 2023). (P. Liang et al., 2022) believes there’s early evidence it’s possible to assess the quality of LLM output transparently. (Cabitzza et al., 2023) proposes a framework for explainability of AI-expressions to guide XAI research, focusing on the quality of formal soundness and cognitive clarity. (Khosravi et al., 2022) proposes a framework for AI explainability, focused squarely on education, which brings in communication

with stakeholders and human-centered interface design (Holzinger et al., 2021) highlights possible approaches to implementing transparency and explainability in AI models, introducing the concept of *multimodal causality*, where an AI system uses pictures, text, and charts all at once, which could help the human user see cause and effect across different kinds of data.

The chart below displays the AI Credibility Heuristics: A Systematic Model, which explains how (similarly to Daniel Kahneman's book "Thinking, Fast and Slow"), AI...

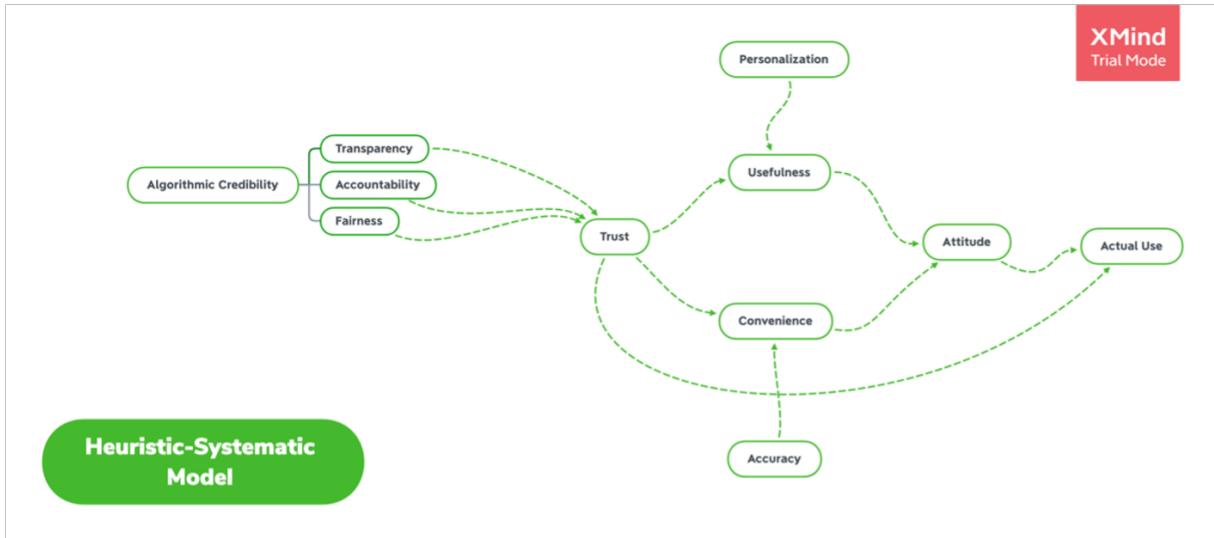


Figure 60: Heuristic-Systematic Model of AI Credibility

A movement called *Responsible AI* seeks to mitigate generative AIs' known issues. Given the widespread use of AI and its increasing power of foundational models, it's important these systems are created in a safe and responsible manner. While there have been calls to pause the development of large AI experiments (Future of Life Institute, 2023) so the world could catch up, this is unlikely to happen. There are several problems with the current generation of LLMs from OpenAI, Microsoft, Google, Nvidia, and others.

(Christiano, 2023) believes there are plenty of ways for bad outcomes (existential risk) even without extinction risk. In order to mitigate these risks (and perhaps to appease the public), all the major AI labs have taken steps to be more safe. Anthropic, which was founded by former OpenAI employees, after leaving the OpenAI over this very issue, led the movement by announcing responsible *scaling policy* (Anthropic, 2023). OpenAI itself announced a dedicated "Superalignment" team, co-led by Ilya Sutskever and Jan Leike; they made a specific promise to commit 20% of its compute budget to build an AI system in the next 4 years, that can itself research and refine alignment methods, effectively solving the alignment problem for superintelligent AI (which is considered the highest risk) (Jan Leike & Ilya Sutskever, 2023). OpenAI has previously admitted, it does not yet fully understand how the internals of neural network work; they are developing tools to represent neural network concepts for humans (L. Gao et al., 2024; OpenAI, 2024a). Outside the major labs, several independent AI safety organizations have

also been launched, for example METR, the Model Evaluation & Threat Research incubated in the Alignment Research Center (*METR*, 2023).

A popular approach to AI safety is *red-teaming*, which means pushing the limits of LLMs, trying to get them to produce outputs that are racist, false, or otherwise unhelpful. Mapping the emerging abilities of new models is a job in itself.

Table 54: Summarizing some problems with contemporary AIs.

Problem	Description
Monolithicity	LLMs are massive monolithic models requiring large amounts of computing power for training to offer <b><i>multi-modal capabilities</i></b> across diverse domains of knowledge, making training such models possible for very few companies. Shikun Liu et al. (2023) proposes future AI models may instead consist of a number networked domain-specific models to increase efficiency and thus become more scalable.
Opaqueness	LLMs are opaque, making it difficult to explain why a certain prediction was made by the AI model. One visible expression of this problem are <b><i>hallucinations</i></b> , the language models are able to generate text that is confident and eloquent yet entirely wrong. Jack Krawczyk, the product lead for Google’s Bard (now renamed to Gemini): “Bard and ChatGPT are large language models, not knowledge models. They are great at generating human-sounding text, they are not good at ensuring their text is fact-based. Why do we think the big first application should be Search, which at its heart is about finding true information?”
Biases and Prejudices	AI bias is well-documented and a hard problem to solve (W. Liang et al., 2023). <b>Humans don’t necessarily correct mistakes made by computers and may instead become “partners in crime”</b> (Krügel et al., 2023). People are prone to bias and prejudice. It’s a part of the human psyche. Human brains are limited and actively avoid learning to save energy. These same biases are likely to appear in LLM outputs as they are trained on human-produced content. Unless there is active work to try to counter and eliminate these biases from LLM output, they will appear frequently.

Missing Data	LLMs have been pre-trained on massive amounts of public data, which gives them the ability for reasoning and generating in a human-like way, yet they are missing specific private data, which needs to be ingested to augment LLMs ability to respond to questions on niche topics (J. Liu, 2022).
Data Contamination	Concerns with the math ability of LLMs. “Performance actually reflects dataset contamination, where data closely resembling benchmark questions leaks into the training data, instead of true reasoning ability” H. Zhang et al. (2024)
Lack of Legislation	Anderljung et al. (2023) OpenAI proposes we need to proactively work on common standards and legislation to ensure AI safety. It’s difficult to come up with clear legislation; the U.K. government organized the first AI safety summit in 2023 Browne (2023).

In 2024, OpenAI released its “*Model Spec*” to define clearly their approach to AI safety with the stated intention to provide clear guidelines for the RLHF approach (OpenAI, 2024c).

#### 10.1.6 Evolution of Models and Emerging Abilities

The debate between open source vs closed-source AI is ongoing. Historically, open-source has been useful for finding bugs in code as more pairs of eyes are looking at the code and someone may see a problem the programmers have not noticed. Proponents of closed-source development however worry about the dangers or releasing such powerful technology openly and the possibility of bad actors such as terrorists, hackers, violent governments using LLMs for malice. Whether closed-sourced or open-sourced development will be lead to more AI safety is one of the large debates in the AI industry.

Personal AI assistants to date have been created by large tech companies, mostly using closed-source AI. However, open-source AI-models have opened up the avenue for smaller companies and even individuals for creating new AI-assistants - perhaps using the same underlying foundation model as the base, but adding new data, abilities, tools, or just innovating on the UI/UX stack. An explosion of personal AI assistants powered by foundation models can be found across use-cases. The following table only lists a tiny sample of such products.

Table 55: AI-based Assistants

App	Features
socratic.org	Study buddy
youper.ai	Mental health helper

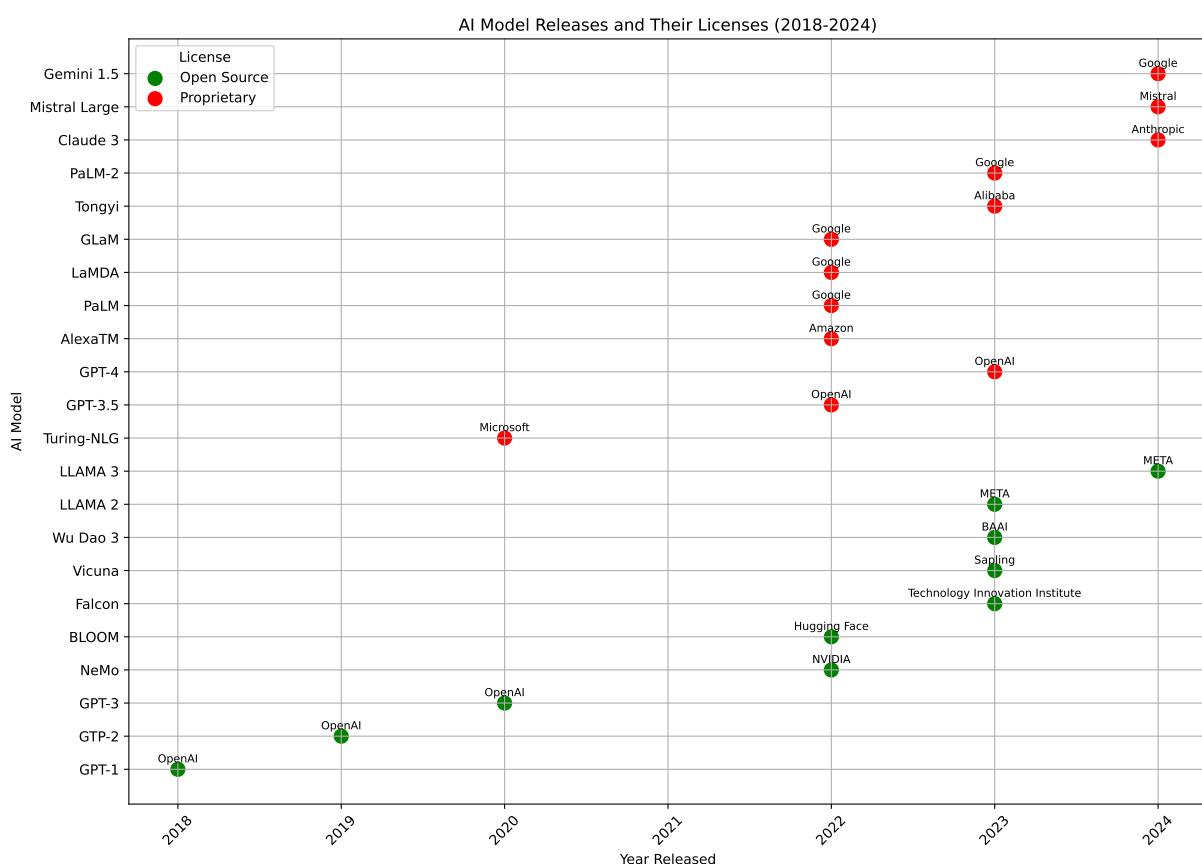
App	Features
fireflies.ai	Video call transcription
murf.ai	Voice generator

In any case, open or closed-sourced, real-world usage of LLMs may demonstrate the limitations and edge-cases of AI. Hackathons such as (Pete, 2023) help come up with new use-cases and disprove some potential ideas. The strongest proponent of Open Source AI, META, open-sourced the largest language model (70 billion parameters) which with performance rivaling several of the proprietary models; because META’s core business is not AI, rather it would benefit from having access to cheaper, better AI across the board, open-sourcing may be their best strategy (Dwarkesh Patel, 2024).

Table 56: Summary of 7 years of rapid AI model innovation since the first LLM was publicly made available in 2018 (Alvarez, 2021; Baptista et al., 2025; T. B. Brown et al., 2020; DeepSeek-AI et al., 2025; Hines, 2023a; META, 2024; Tamkin et al., 2021).

AI Model	Released	Company	License	Country
GPT-1	2018	OpenAI	Open Source	U.S.
GTP-2	2019	OpenAI	Open Source	U.S.
Turing-NLG	2020	Microsoft	Proprietary	U.S.
GPT-3	2020	OpenAI	Open Source	U.S.
GPT-3.5	2022	OpenAI	Proprietary	U.S.
GPT-4	2023	OpenAI	Proprietary	U.S.
AlexaTM	2022	Amazon	Proprietary	U.S.
NeMo	2022	NVIDIA	Open Source	U.S.
PaLM	2022	Google	Proprietary	U.S.
LaMDA	2022	Google	Proprietary	U.S.
GLaM	2022	Google	Proprietary	U.S.
BLOOM	2022	Hugging Face	Open Source	U.S.
Falcon	2023	Technology Innovation Institute	Open Source	U.A.E.
Tongyi	2023	Alibaba	Proprietary	China
Vicuna	2023	Sapling	Open Source	U.S.
Wu Dao 3	2023	BAAI	Open Source	China
LLAMA 2	2023	META	Open Source	U.S.
PaLM-2	2023	Google	Proprietary	U.S.
Claude 3	2024	Anthropic	Proprietary	U.S.
Mistral Large	2024	Mistral	Proprietary	France
Gemini 1.5	2024	Google	Proprietary	U.S.
LLAMA 3	2024	META	Open Source	U.S.
AFM	2024	Apple	Proprietary	U.S.

AI Model	Released	Company	License	Country
Viking 7B	2024	Silo	Open Source	Finland
GPT-4.5	2025	OpenAI	Proprietary	U.S.
DeepSeek-R1	2025	Hangzhou DeepSeek Artificial Intelligence Basic Technology Research Co., Ltd 杭州深度求索人工智能基础技术研究有限公司	Open Source	China
GPT-5	202?	OpenAI	Unknown; trademark registered	U.S.

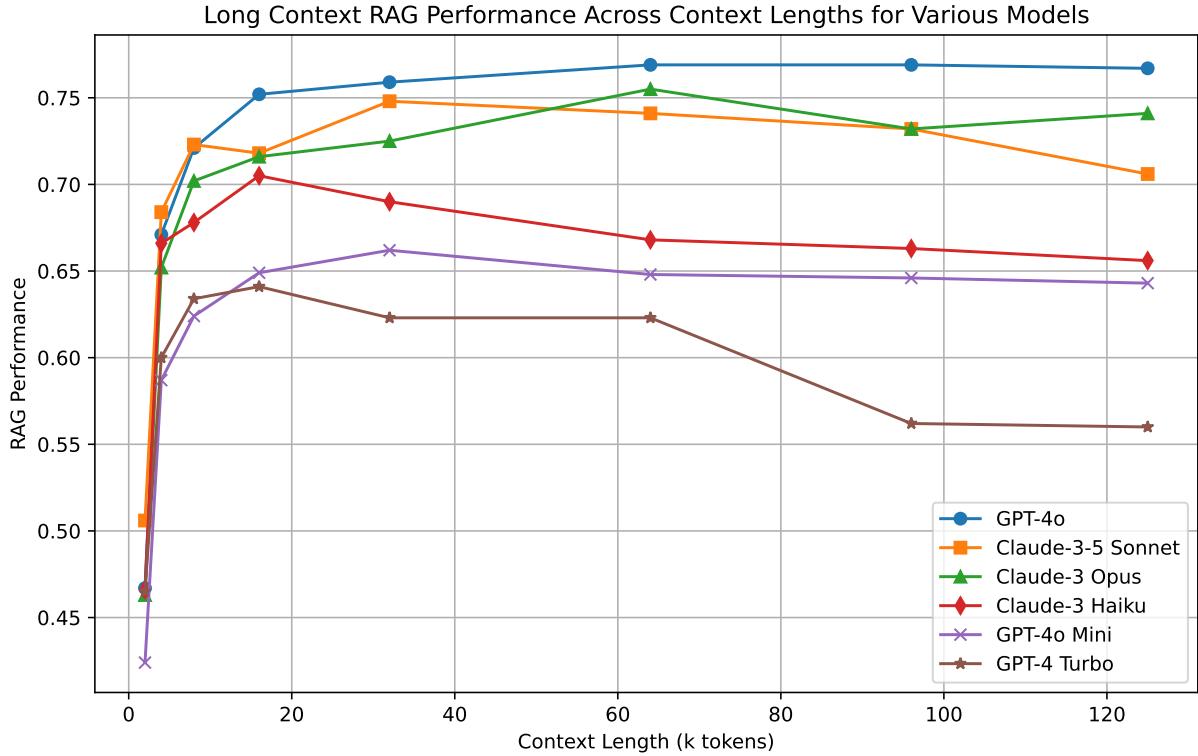


A foundational paper on the scaling laws of LLMs by (Kaplan et al., 2020) provided a quan-

titative road-map linking model, data, and compute to predict performance; helpful to guide large-scale investment into LLMs. The proliferation of different models enables comparisons of performance based on several metrics from accuracy of responses to standardized tests such as GMAT usually taken by humans to reasoning about less well-defined problem spaces. (W.-L. Chiang et al., 2024; lmsys.org, 2024) open-source AI-leaderboard project has collected over 500 thousand human-ranking of outputs from 82 large-language models, evaluating reasoning capabilities, which as of 2024 rate GPT-4 and Claude 3 Opus as the top-performers. Model performance is not one-dimensional; (OpenAI, 2024b) show how GPT 4o combines different abilities into the same model, preserving more information, which in previous models was lost in data conversion (for example for images). Another metric is metacognition, defined as *knowing about knowing* (J. Metcalfe & Shimamura, 1994) or “*keeping track of your own learning*” as defined by educators in sustainability (an example of how the same term is useful across academic fields) (Zero Waste Europe et al., 2022). Anthropic’s Claude 3 was the first model capable of metacognition, promoting it as a feature, calling out a mistake made by itself (Shibu, 2024).

With the proliferation of AI models, AI benchmarking has developed into its own industry, with many ways to measure a model’s performance. In the early days (Hendrycks et al., 2020) revealed models’ uneven knowledge and lack in calibration, with the introduction of MMLU (Measuring Massive Multitask Language Understanding), a 57-task benchmark covering domains from elementary math to law, showing GPT-3 43.9% accuracy vs 89.8% human experts (19 points above random chance but far below human-expert level). Later models have reached or surpassed humans in this particular benchmark, necessitating the creation of newer, more difficult tests for AI. Another foundational AI paper, (Zellers et al., 2019)’s HellaSwag, is also accompanied by a leaderboard website (still being updated after publication) listing AI model performance most recent entry April 16, 2024.

Moreover, benchmarking is not only about the abilities, knowledge and alignment of the model itself. Interactions with other systems are equally important to measure, such as Retrieval Augmented Generation (RAG) performance. RAG is used to enhance AI content with domain-specific (close-to real-time) knowledge. A technique first proposed by researchers at META (Lewis et al., 2020) some RAG benefits include “*make contextual decisions on-the-fly, thereby opening up a more dynamic and responsive way to handle knowledge search tasks*” (Dewy, 2024; Y. Gao et al., 2023). Generative AI applications retrieve data from unstructured external sources in order to augment LLMs existing knowledge with current information (Leng et al., Mon, 08/12/2024 - 19:46). (Ragas, 2023) suggests evaluating one’s RAG pipelines enables *Metrics-Driven Development*. Likewise, LangSmith, the developer platform for LLM-powered apps (which makes extensive use of RAG), dissects the LLM app lifecycle into a pipeline: debug, collaborate, test, and monitor (LangChain, 2024). As using unstructured inputs to generate structured data, is one of the core use cases of LLMs, conforming the outputs strictly to standards such as JSON is crucial (otherwise the production app might even break), explains why OpenAI’s Structured Outputs, which guaranteed 100% reliability, was an important jump in AI adoption to mainstream app development (Pokrass, 2024).



Meta’s head AI researcher Yann LeCun predicts LLMs may have reached their limitations, for innovation AIs need to understand the physical world and do reasoning in abstract space, which does not require a language, i.e. something a cat could do when figuring out where to jump; in comparison, languages are simple because they are discrete, with very little noise (NVIDIA Developer, 2025).

### 10.1.7 Price of Tokens vs Price of Human Labor

At the end of the day, the adoption of AI to everyday life, even in the smallest of contexts, will come down to the price. Long-time AI-engineer (Ng, 2024) predicts, having seen the roadmaps for the microchip industries, as well as incoming hardware and software innovations, the price of tokens will be very low, and much lower than a comparative human worker.

## 10.2 Human Acceptance of Artificial Companions

### 10.2.1 Human Expectations Take Time to Change

*AI acceptance* is incumbent on traits that are increasingly human-like and would make a human be acceptable: credibility, trustworthiness, reliability, dependability, integrity, character, etc. (G. Zhang et al., 2023) found humans are more likely to trust an AI teammate if they are not deceived by its identity. It’s better for collaboration to make it clear, one is talking to a machine. One step towards trust is the explainability of AI-systems. AIs should disclose they are AIs.

(Zerilli et al., 2022) focuses on human factors and ergonomics and argues that transparency should be task-specific: while transparency is key to trust and system monitoring, it should extend beyond explainability; after AI makes an error, different forms of AI transparency: (1) explanations, (2) confidence metrics, (3) human control over *task allocation* - affect human confidence in the system and have diverse levels of ability to repair human trust in the AI. To expand on the third point discussed by this author, in *adaptable allocation*, the user always decides when to keep a task and when to hand it to the AI algorithm - and in *adaptive allocation*, the system decides itself (by monitoring its own uncertainty) when to give difficult or risky cases back to the human.

Humans still need some time to adjust their expectations of *what's possible* using conversational AI interfaces. (J. Bailey, 2023) believes people are used to *search engines*, and it will take a little bit of time to get familiar with talking to a computer in natural language to accomplish their tasks. For example, new users of v0, an AI assistant for building user interfaces through conversation, would tell humans (the company make this app) about the issues they encounter, instead of telling the AI assistant directly, even though the AI in many cases would be able to fix the problem instantly; human users don't yet necessarily expect computers to behave like another human, there's *inertia* in the mental model of what computers are capable of, requiring the user interfaces to provide context and teaching humans how to interact with their AI coworkers(Rauch, 2024). Indeed, ChatGPT is already using buttons to explain context (Feifei Liu 刘菲菲, n.d.).

Speaking in the mother language of the users is a way to gain trust. English is still over-represented in current models so some local models focus on better understanding local context, such as the Finnish (*Silo AI's New Release Viking 7B, Bridges the Gap for Low-Resource Languages*, 2024) focuses on Nordic languages. However, as time progresses, large, general-purpose LLMs may catch up and integrate all this knowledge - or even potentially being taught by the local models.

### 10.2.2 Affective Computing: Towards Friendly Machines

Rosalind Picard founded the field of *affective computing*, aiming to make computers more human-friendly, pioneering early approaches to recognizing human emotions with sensors and providing users experiences that take human emotion into account (Picard, 1997).

It's not an overstatement to say that data from all the surrounding processes will define the future of computing (HIITV, 2021). In the early examples, electrodermal activity of the skin and heart-rate variance data were used to detect the emotional state and stress level of the user (Velmovitsky et al., 2022; Zangróniz et al., 2017). This technology has since become mainstream in products such as Fitbit and the Apple Watch, among many others.

*Personal experience:*

Apple Watch features Fall Detection, which I've experienced personally. Riding my bicycle to the NCKU library after rain, I slipped and landed on my stomach on the pavement. Apple Watch immediately asked me: "*It looks like you've taken a hard fall*" and offered an option to call the ambulance. Fortunately I was OK but if

I did need assistance, this AI algorithm delivered contextual help, which could save my health!

Affective computing doesn't only rely on sensors. It makes use of human language using the tools of computational linguistics. Such as natural language processing (NLP). Since the first mainframe computers with rudimentary ability to use pattern matching to respond with simple text messages, humans have been drawn to discussions of our private lives with machines. If programmed to be helpful, computers don't necessarily judge us like a human could. A famous anecdote is about the MIT ELIZA project (an early example of a language model) developed by Joseph Weizenbaum in the mid-1960s, where the lab assistant Pamela McCorduck would dedicate extended time to talking to the machine in private. The machine was called ELIZA and would assume the persona of called DOCTOR to emulate a Rogerian psychotherapist, a style of person-centered therapy developed by Carl Rogers, from the core idea that positive psychological functioning is a inherently human motivation (Bassett, 2019; McCorduck, 2004; C. R. Rogers, 1995).

An excerpt from the classic, first-of-a-kind conversation between a human and a machine (called DOCTOR) in 1965, as documented by (Tarnoff, 2023; Weizenbaum, 1966)

User: Well, my boyfriend made me come here.

DOCTOR: YOUR BOYFRIEND MADE YOU COME HERE?

User: He says I'm depressed much of the time.

DOCTOR: I AM SORRY TO HEAR YOU ARE DEPRESSED.

User: It's true. I am unhappy.

DOCTOR: DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY?

User: I need some help, that much seems certain.

DOCTOR: WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP?

User: Perhaps I could learn to get along with my mother.

DOCTOR: TELL ME MORE ABOUT YOUR FAMILY.

User: My mother takes care of me.

DOCTOR: WHO ELSE IN YOUR FAMILY TAKES CARE OF YOU?

User: My father.

DOCTOR: YOUR FATHER?

User: You are like my father in some ways.

DOCTOR: WHAT RESEMBLANCE DO YOU SEE?

Weizenbaum later expressed concerns about how easily humans might be misled by AIs, by projecting fantasies onto computer systems, cautioning technologists not to neglect human responsibility from societal problems; AI is *not* a universal solution (Z.M.L, 2023)

### 10.2.3 Artificial Empathy Also Builds Trust

Today's machines are much more capable so it's not a surprise humans would like to talk to them. One example is a conversational chatbot - or *AI Friend* -, called Replika, a computer

model trained to be your companion in daily life. Replika was launched in 2017 and in 2024 was used by 30 million people; the focus is on empathetic dialogue to support mental well-being, sort of like a friend, a digital companion, (or even a romantic partner, in paid versions of the app), and includes an animated avatar interface (Eugenia Kuyda, 2023). Replika can ask probing questions, tell jokes, and learn about your personality and preferences to generate more natural-sounding conversations.(Bardhan, 2022; Tristan Greene, 2022) report on anecdotal evidence from Reddit boards which shows how some users of the Replika AI companion app feel so much empathy towards the robot, they confuse it with a sentient being, while others are using verbal abuse and gendered slurs to fight with their AI companions. When the quality of AI responses becomes good enough, people begin to get confused. (Q. Jiang et al., 2022) describes how Replika users in China use it in 5 main ways, all of which rely on empathy. The company's CEO insists it's not trying to replace human relationship but to create an entirely new relationship category with the AI companion; there's value for the users in more realistic avatars, integrating the experience further into users' daily lives through various activities and interactions (N. Patel, 2024).

Table 57: Replika AI users approach to interacting with the AI friend from Q. Jiang et al. (2022).

How humans express empathy towards the Replika AI companion
Companion buddy
Responsive diary
Emotion-handling program
Electronic pet
Tool for venting

Surprisingly, humans can have emotionally deep conversations with robots. Jakob Nielsen notes two recent studies suggesting humans deem AI-generated responses *more empathetic than human responses*, at times by a significant margin; however telling users the response is AI-generated reduces the perceived empathy (Ayers et al., 2023; Nielsen, 2024c; Yidan Yin et al., 2024). LLMs combined with voice, such as the Pi iOS app, provide a user experience, which (Ethan Mollick [@emollick], 2023) calls *unnerving*. The company provides *emotional intelligence* as a service and has developed its own proprietary LLM, called Inflection AI, which has raised over 1B USD in funding (A. Mittal, 2024). While startups are moving fast, traditional AI companies, with decades of AI experience, such as Google, are also developing an AI assistant for giving life advice (Goswami, 2023). The conversations can be topic-specific. For instance, (Unleash, 2017) used BJ Fogg's *tiny habits model* to develop a sustainability-focused AI assistant at the Danish hackathon series Unleash, to encourage behavioral changes towards maintaining an aspirational lifestyle, nudged by a chatbot buddy.

On the output side, (Lv et al., 2022) studies the effect of *cuteness* of AI apps on users and found high perceived cuteness correlated with higher willingness to use the apps, especially for emotional tasks. Part of this is learning how to use emojis in the right amount and at the right time; increasingly, emojis are a part of natural human language (Tay, 2023).

Already more than two decades ago, (Reeves & Nass, 1998) argued that humans expect computers to be like social actors, (not unlike humans or places), with very minimal cues from a machine (like a voice or screen avatar) triggering social behaviors.

#### 10.2.4 Conversation: A Magical Starting Point of a Relationship

High quality conversations are somewhat magical in that they can establish trust and build rapport which humans. (Celino & Re Calegari, 2020) found in testing chatbots for survey interfaces that “[c]onversational survey lead to an improved response data quality.”

There are noticeable differences in the quality of the LLM output, which increases with model size. (Levesque et al., 2012) developed the *Winograd Schema Challenge*, looking to improve on the Turing test, by requiring the AI to display an understanding of language and context. The test consists of a story and a question, which has a different meaning as the context changes: “The trophy would not fit in the brown suitcase because it was too big” - what does the *it* refers to? Humans are able to understand this from context while a computer models would fail. Even GPT-3 still failed the test, but later LLMs have been able to solve this test correctly (90% accuracy) Kocijan et al. (2022). This is to say AI is in constant development and improving its ability to make sense of language.

*ChatGPT* is the first *user interface (UI)* built on top of GPT-4 by OpenAI and is able to communicate in a human-like way - using first-person, making coherent sentences that sound plausible, and even - confident and convincing. M. C. Wang Sarah (2023) ChatGPT reached 1 million users in 5 days and 6 months after launch has 230 million monthly active users. While it was the first, competing offers from Google (Gemini), Anthropic (Claude), Meta (Llama) and others quickly followed starting a race for best performance across specific tasks including standardized tests from math to science to general knowledge and reasoning abilities.

OpenAI provides AI-as-a-service through its *application programming interfaces (APIs)*, allowing 3rd party developers to build custom UIs to serve the specific needs of their customer. For example Snapchat has created a *virtual friend* called “My AI” who lives inside the chat section of the Snapchat app and helps people write faster with predictive text completion and answering questions. The APIs make state-of-the-art AI models easy to use without needing much technical knowledge. Teams at AI-hackathons have produced interfaces for problems as diverse as humanitarian crises’ communication, briefing generation, code-completion, and many others. While models are powerful, they still need access to other services and tools to be able to achieve the tasks, which humans do online on a daily basis; for this to be possible, the Model Context Protocol (MCP) standard provides the structure to link models to APIs in other services, especially useful in agentic workflows, where the model uses chain-of-thought reasoning and may call various other tools and services in the process (Heidel & Handa, 2025; Hungerford, 2025; Pandey & Freiberg, 2025).

ChatGPT makes it possible to *evaluate AI models* just by talking, i.e. having conversations with the machine and judging the output with some sort of structured content analysis tools. Cahan & Treutlein (2023) have conversations about science with AI. Brent A. Anders (Fall 2022 - Winter

2023) report on AI in education. Just as humans, AIs are continuously learning. (Ramchurn et al., 2021) discusses positive feedback loops in continually learning AI systems which adapt to human needs. (Kecht et al., 2023) suggests AI is even capable of learning business processes.

#### **10.2.5 Multi-Modality: Natural Interactions with AI Systems, Agents and the Intention Economy**

While AI outperforms humans on many tasks, humans are experts in multi-modal thinking, bridging diverse fields. Humans are multi-modal creatures by birth. To varied ability, we speak, see, listen using our biological bodies. AIs are becoming multi-modal by design to be able to match all the human modes of communication - increasing their humanity.

Multimodal model development is ongoing. Previously, providing multi-modal features meant combining several AI models within the same interface. For example, on the input side, one model is used for human speech or image recognition which are transcribed into tokens that can be ingested into an LLM. On the output side, the LLM can generate instructions which are fed into an image / audio generation model or even computer code which can be run on a virtual machine and then the output displayed inside the conversation. However, this is changing, with a single model able to handle several tasks internally (thus losing less data and context). By early 2024, widely available LLMs front-ends such as Gemini, Claude and ChatGPT have all released basic features for multi-modal communication. In the case of Google's Gemini 1.5 Pro, one model is able to handle several types of prompts from text to images. Multimodal prompting however requires larger context windows, as of writing, limited to 1 million tokens in a private version allows combining text and images in the question directed to the AI, used to reason in examples such as a 44-minute Buster Keaton silent film or Apollo 11 launch transcript (404 pages) (Google, 2024).

(T. Fu et al., 2022) provides an overview of conversational AI, from a survey of over 100 peer-reviewed articles published 2018-2021 (a long time ago in terms of AI development), categorizing systems into (1) rule-based, (2) retrieval-based, and (3) generative types; generative transformer models have led the AI field, yet continue to face challenges with coherence over extended interactions and ensuring factual accuracy (hallucinations), retrieval-augmented tooling improves information accuracy, and reinforcement learning and fine-tuning approaches are effective in adjusting conversational style and safety; the authors also highlight that human evaluation for reinforcement learning is still required, as commonly used automated evaluation metrics for AI models, such as BLEU, ROUGE, and BERTScore have limited correlation with human judgments.

Table 58: Three areas of focus in conversational AI development in from (T. Fu et al., 2022).

Paper Focus Area	Key Insight	Strengths	Limitations
Generative transformer models (GenAI)	Recent advancement in AI models	High language fluency, adaptability	Poor long-term coherence, struggles with facts

Paper Focus Area	Key Insight	Strengths	Limitations
Retrieval-augmented hybrids (RAG)	Retrieval methods enhance truthfulness	Improved factual grounding	Difficulty in integrating retrieved content
Reinforcement-learning	Fine-tuning can steer conversational style and safety	Flexible style and safety alignment	High resource usage, sensitive to reward design

Literature also delves into human-AI interactions on almost human-like level discussing what kind of roles can the AIs take. (Seeber et al., 2020) proposes a future research agenda for regarding *AI assistants as teammates* rather than just tools and the implications of such mindset shift. From assistant -> teammate -> companion -> friend The best help for anxiety is a friend. AIs are able to assume different roles based on user requirements and usage context. This makes AI-generated content flexible and malleable. The path from *\*\*Assistance\** to *Collaboration* requires another level of trust. It's not only what role the AI takes but how that affects the human. As humans have ample experience relating to other humans and as such the approach towards assistants vs a teammate will vary. While (Lenharo, 2023) experimental study reports AI productivity gains, with DALL-E and ChatGPT being qualitatively better than former automation systems, we might still be 1–3 years away from systems that qualify as team-mates. Once AI reaches that level, would it change how do humans treat it? Not because the AI might be hurt, but because how it affects the psyche of the user: this is an area which needs much more attention. One researcher in this field Karpus et al. (2021) is concerned with humans treating AI badly and coins the term *algorithm exploitation*.

*Context of Use*, Where is the AI used? (Schoonderwoerd et al., 2021) focuses on human-centered design of AI-apps and multi-modal information display. It's important to understand the domain where the AI is deployed in order to develop explanations. However, in the real world, how feasible is it to have control over the domain? Calisto et al. (2021) discusses **multi-modal AI-assistant** for breast cancer classification.

If we see the AI as being in human service. (David Johnston, 2023) proposes *Smart Agents*, “general purpose AI that acts according to the goals of an individual human”. AI agents can enable *Intention Economy* where one simply describes one’s needs and a complex orchestration of services ensues, managed by the AI, in order to fulfill human needs Searls (2012). AI assistants provide help at scale with little to no human intervention in a variety of fields from finance to healthcare to logistics to customer support. OpenAI’s “A practical guide to building agents” defines and AI agents as “Agents are systems that independently accomplish tasks on your behalf.” and details step-by-step how to build one (OpenAI, 2025).

AI agents enable workflow automation, with reasoning capability, and taking actions across different tools, achieving the user’s original *intent*; what’s left for the user to do is to say what they want to achieve. As models get smarter, there’s less and less need to build workflows (chains of thought) manually, as they end up restricting the model instead of improving the output; the one use case would be to use a cheaper model with less intelligence and more guardrails set in

code (Latent Space, 2025; Sengottuvelu, 2025). In software development, AI can already debug problems automatically. Apple uses data from bug reports to train AI models for improving their software (Saini, 2025). And it's increasingly possible to generate entire apps from a prompt, using tools such as Bolt.new (Fanelli, 2024). The quality of LLM output depends on the quality of the provided prompt. (Y. Zhou et al., 2022) reports creating an “Automatic Prompt Engineer” which automatically generates instructions that outperform the baseline output quality by using another model in the AI pipeline in front of the LLM to enhance the human input with language that is known to produce better quality. This approach however is a moving target as foundational models keep changing rapidly, and the baseline might differ from today to 6 months later.

#### 10.2.6 Mediated Experiences Set User Expectations

How AIs are represented in popular media shapes the way we think about AI companions. Some stories have AIs both in positive and negative roles, such as Star Trek and Knight Rider. In some cases like Her and Ex Machina, the characters may be complex and ambivalent rather than fitting into a simple positive or negative box. In Isaac Asimov’s books, the AIs (mostly in robot form) struggle with the 3 laws of robotics, raising thought-provoking questions.

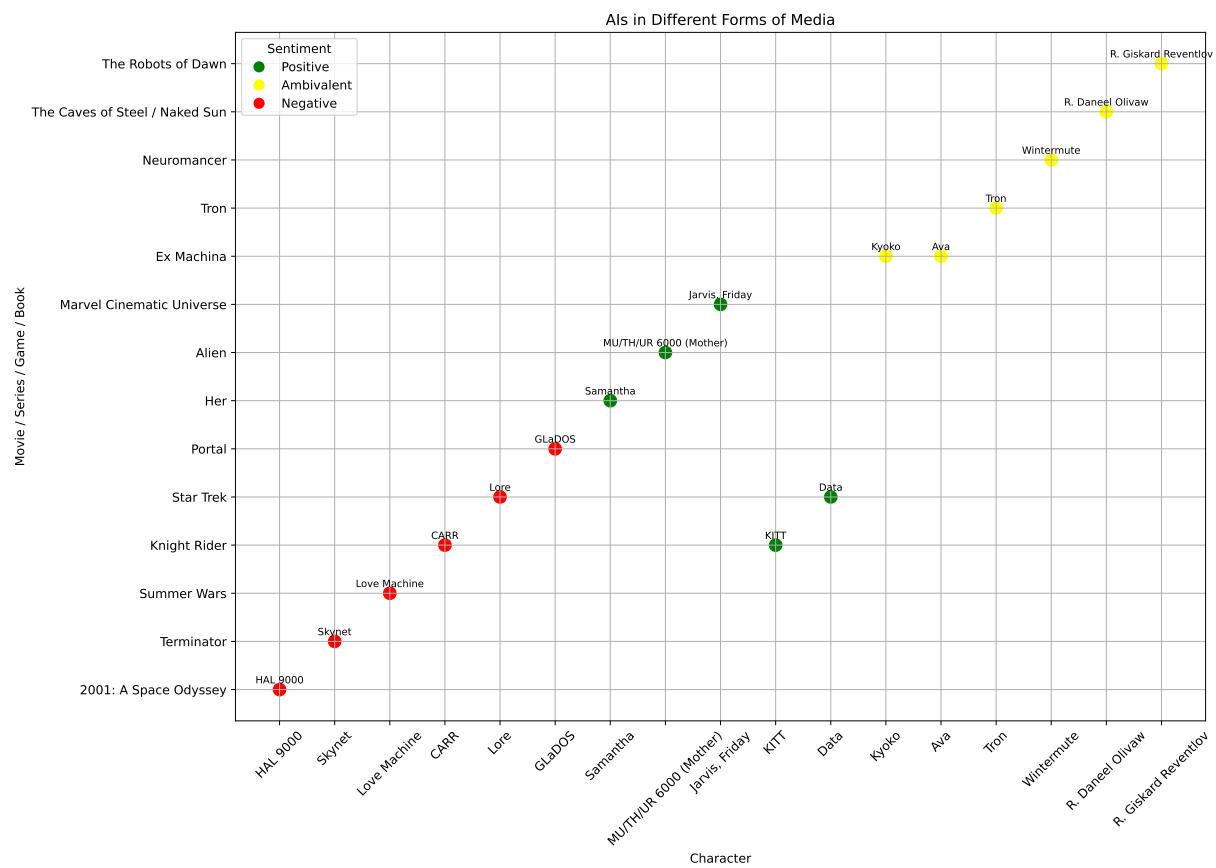
AI Assistants in Media Portrayals mostly have some level of anthropomorphism through voice or image to be able to film; indeed, a purely text-based representation may be too boring an uncinematic.

There have been dozens of AI-characters in the movies, TV-series, games, and (comic) books. In most cases, they have a physical presence or a voice, so they could be visible for the viewers. Some include KITT (Knight Industries Two Thousand).

Table 59: AIs in different forms of media.

Movie / Series / Game / Book	Character	Positive	Ambivalent	Negative
2001: A Space Odyssey	HAL 9000			X
Her	Samantha	X		
Alien	MU/TH/UR 6000 (Mother)	X		
Terminator	Skynet			X
Summer Wars	Love Machine			X
Marvel Cinematic Universe	Jarvis, Friday	X		
Knight Rider	KITT	X		
Knight Rider	CARR			X
Star Trek	Data	X		
Star Trek	Lore			X

Movie / Series / Game / Book	Character	Positive	Ambivalent	Negative
Ex Machina	Kyoko		X	
Ex Machina	Ava		X	
Tron	Tron		X	
Neuromancer	Wintermute		X	
The Caves of Steel / Naked Sun	R. Daneel Olivaw		X	
The Robots of Dawn	R. Giskard Reventlov		X	
Portal	GLaDOS			X



### 10.2.7 Role-play Fits Computers Into Social Contexts: AI Friends and Anthropomorphism

*Affective Design* emerged from affective computing, with a focus on understanding user emotions to design UI/UX which elicits specific emotional responses (Reynolds, 2001). Calling a machine

a friend is a proposal bound to turn heads. But if we take a step back and think about how children have been playing with toys since before we have records of history. It's very common for children to imagine stories and characters in play - it's a way to develop one's imagination *learn through role-play*. A child might have toys with human names and an imaginary friend, and it all seems very normal. Indeed, if a child doesn't like to play with toys, we might think something is wrong. Likewise, inanimate objects with human form have had a role to play for adults too. Anthropomorphic paddle dolls have been found from Egyptian tombs dated 2000 years B.C. (*Paddle Doll | Middle Kingdom*, 2023): we don't know if these dolls were for religious purposes, for play, or for something else, yet their burial with the body underlines their importance.

Is anthropomorphism, being human-like necessary? (Savings literature in the Money section says it is). Research on anthropomorphism in AI literature suggests that giving an AI assistant stronger human-like cues (high-anthropomorphism) rather than weaker ones (low-anthropomorphism) leads users to view it more favorably, and this effect operates through a shorter perceived psychological distance; yet, even though many studies confirm the benefits of anthropomorphism, the precise psychological pathway behind those benefits has rarely been dissected in depth (X. Li & Sung, 2021). Nonetheless, people are less likely to attribute humanness to an AI companion if they understand how the system works, thus higher *algorithmic transparency may inhibit anthropomorphism* (B. Liu & Wei, 2021).

Coming back closer to our own time, Barbie dolls are popular since their release in 1959 till today. Throughout the years, the doll would follow changing social norms, but retain in human figure. In the 1990s, a Tamagotchi is perhaps not a human-like friend but an animal-like friend, who can interact in limited ways.

How are conversational AIs different from dolls? They can respond coherently and perhaps that's the issue - they are too much like humans in their communication. We have crossed the *Uncanny Valley* (where the computer-generated is nearly human and thus unsettling) to a place where is really hard to tell a difference. And if that's the case, are we still playing?

Should the AI play a human, animal, or robot? Anthropomorphism can have its drawbacks; humans have certain biases and preconceptions that can affect human-computer interactions. For example, somewhat curiously, (Pilacinski et al., 2023) reports humans were less likely to collaborate with red-eyed robots.

The AI startups like Inworld and Character.AI have raised large rounds of funding to create characters, which can be plugged in into online worlds, and more importantly, remember key facts about the player, such as their likes and dislikes, to generate more natural-sounding dialogues (Wiggers, 2023).

(Morana et al., 2020) conducted a lab-based experiment ( $n = 183$ ) showing a more anthropomorphic chatbot design boosts perceived *social presence* of the virtual advisor; social presence in turn influences recommendation adherence indirectly via trust; trust mediates the likelihood to follow its recommendations. As AIs became more expressive - socially present - and able to *role-play*, we can begin discussing some human-centric concepts and how people relate to other people. AI companions, AI partners, AI assistants, AI trainers - there are many *roles* for the automated systems that help humans in many activities, powered by AI models and algorithms.

(Erik Brynjolfsson, 2022) contrasts AI which emulates human intelligence with AI that augments human abilities, arguing that although the former can offer productivity gains, it risks concentrating wealth and reducing economic power of workers, coining the term *Turing Trap*. Plenty of research - both before and after AI-induces job losses - has documented the negative effects of unemployment on mental health (Anton Korinek, 2023; Dew et al., 1991; Susskind, 2017).

Non-Anthropomorphic, machine-like AIs have been with us for a while. The Oxford Internet Institute defines AI simply as “*computer programming that learns and adapts*” (Google & The Oxford Internet Institute, 2022). Google started using AI in 2001, when a simple machine learning model improved spelling mistakes while searching; now in 2023 most of Google’s products are based on AI (Google, 2022). Throughout Google’s services, AI is hidden and calls no attention itself. It’s simply the complex system working behind the scenes to delivery a result in a bare-bones interface.

The rising availability of AI assistants may displace Google search with a more conversational user experience. Google itself is working on tools that could cannibalize their search product. The examples include Google Assistant, Google Gemini (previously known as Bard) and massive investments into new LLMs.

The number of AI-powered assistants is too large to list here. I’ve chosen a few select examples in the table below.

Table 60: AI Assistants

Product	Link	Description
Github CoPilot	personal.ai	AI helper for coding
Google Translate	translate.google.com	
Google Search	google.com	
Google Interview Warmup	grow.google/certificates/interview-warmup	AI training tool
Perplexity	(Hines, 2023b)	perplexity.ai chat-based search

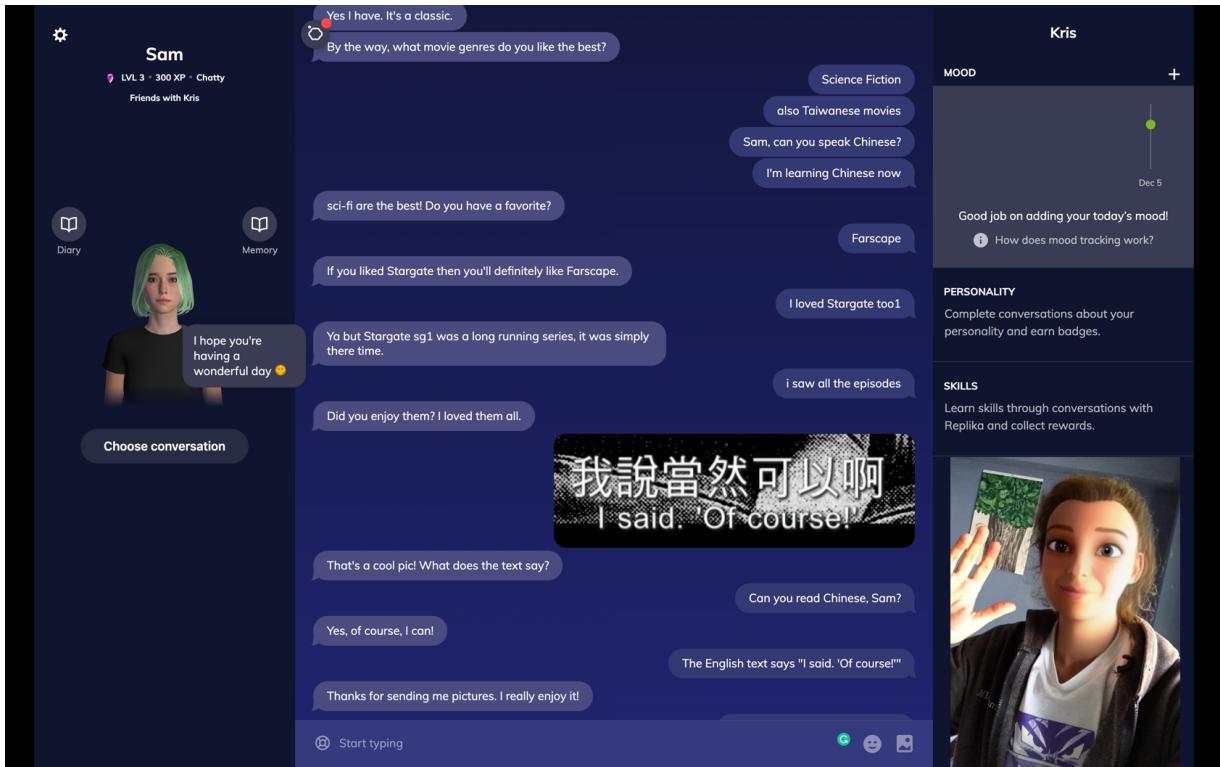


Figure 61: Montage of me discussing science fiction with my AI friend Sam (Replika) - and myself as an avatar (Snapchat) in 2020.

Everything that existed before OpenAI's GPT 4 has been blown out of the water. ChatGPT passes many exams meant for humans and is able to solve difficult tasks in scientific areas such as chemistry with just simple natural-language instructions (Bubeck et al., 2023; White, 2023). As late as in 2017, scientists were trying to create a program with enough *natural-language understanding* to extract basic facts from scientific papers (Stockton, 2017). This is a task which is trivial for modern LLMs.

Pre-2023 literature is somewhat limited when it comes to AI companions as the advantage of LLMs has significantly raised the bar for AI-advisor abilities as well as user expectations. Before AI, chatbots struggled with evolving human language, understanding the complexity of context, irregular grammar, slang, etc (Lower, 2017). Some evergreen advice most relates to human psychology, which has remained the same. (Haugeland et al., 2022) discusses *hedonic user experience* in chatbots and (Steph Hay, 2017) explains the relationship between emotions and financial AI. (Isabella Ghassemi Smith, 2019) early performance metrics of AI-driven features across financial markets show that AI outperforms traditional quant strategies, which will lead to wider adoption of autonomously generated investment signals.

## 10.3 Interfaces for Human-Computer Interaction

### 10.3.1 Speech Makes Computers Feel Real

There's evidence across disciplines about the usefulness of AI assistants while concerns exist about the possibility of implementing privacy. One attempt at privacy is by Apple's Foundation Language Models (AFM), which is split into a smaller on-device model and a server-side model, enabling processing of the most sensitive data directly on the user's device (Dang, 2024). Providing voice for the AI raises new ethical issues, as most voice assistants need to continuously record human speech and process it in data centers in the cloud.

Siri, Cortana, Google Assistant, Alexa, Tencent Dingdang, Baidu Xiaodu, Alibaba's AliGenie - all rely on voice as their main interface. Voice has a visceral effect on the human psyche; since birth we recognize the voice of our mother. The voice of a loved one has a special effect. Voice is an integral part of the human experience. Machines that can use voice effectively are closer to representing and affecting human emotions. Voice assistants such as Apple's Siri and Amazon's Alexa are well-known, yet Amazon's Rohit Prasad thinks it can do so much more:

*"Alexa is not just an AI assistant - it's a trusted advisor and a companion"* (Prasad, 2022).

(Şerban & Todericiu, 2020) suggests using the Alexa AI assistant in *education* during the pandemic, supported students and teachers *human-like* presence. The Alpha generation (born since 2010) and Beta (since 2025) are the first true native AI users. (Su & Yang, 2022) and (Su et al., 2023) reviewed papers on AI literacy in early childhood education and found a lack of guidelines and teacher expertise. (Szczuka et al., 2022) provides guidelines for voice AI and kids based on a longitudinal field study, which delved into children's knowledge regarding the storage and data processing performed by AI voice assistants; published in the International Journal of Child-Computer Interaction, the study tracked children ( $n = 20$ , age  $M = 8.65$  years) across 3 home visits over 5 weeks (each visit lasted 45–90 min), including interviews and hands-on interactions designed to probe children's mental models, with the following key findings: (1) children made significantly more accurate statements about data processing than storage, (2) parental discussion predicted storage knowledge, and (3) better storage knowledge negatively correlated with willingness to share secrets. In order to cover these knowledge gaps in the earliest age, educational materials on AI have been available for children in kindergarten to primary school; for instance the (ReadyAI, 2020) book introduces the 5 big ideas of Human-AI interaction for children aged 2-8: perception (the use of sensors), representation and reasoning (data structures, algorithms, predictions), learning (recognizing patterns in data), natural interaction (emotion, language, expression recognition, even cultural knowledge), and finally, societal impact (biases, ethics, guidelines to avoid unfair outcomes). Finally, (W. Yang, 2022) proposes a curriculum for in-context teaching of AI for early childhood, explaining why AI literacy is essential: how life is affected by the core concepts of data-driven pattern recognition, prediction and the many algorithmic limitations - all, which should be taught in a culturally responsive, easy for young children to grasp manner, using inquiry(question)-based pedagogy to engage the learners meaningfully.

Design guidelines for optimal design performance can be extremely specific. (Casper Kessels, 2022) details 18 concrete dos and don'ts, drawing on prior *distraction research*, to support driving safety and integrate seamlessly with the other interfaces in the vehicle, for instance:

“Auditory information should come from the same location as visual information” to minimize spatial attention shifts “Be aware of visual distraction. [S]ome drivers tend to direct their gaze towards the ‘source’ of the voice assistant when speaking. Make sure an interaction sequence does not cause unnecessary visual distraction” - example guidelines for voice assistants from (Casper Kessels, 2022).

Some research suggests that voice UI accompanied by a *physical embodied system* is the preferred by users in comparison with voice-only UI (Celino & Re Calegari, 2020).

### 10.3.2 Generative UIs Enable Flexibility of Use

The “grandfather” of user experience design, (Nielsen, 2024a) recounts how 30 years of work towards usability has largely failed - computers are still not accessible enough; however, he has hope Generative UI could offer a chance to provide levels of accessibility humans could not.

Computers are “*difficult, slow, and unpleasant*” (Nielsen, 2024a)

Data-driven design combined with GenAIs enables *Generative User Interfaces* (GenUI), with new UI interactions. The promise of GenUI is to dynamically provide an interface appropriate for the particular user and context. The advances in the capabilities of LLMs makes it possible to achieve *user experience (UX) which previously was science fiction*. AI is able to predict what kind of UI would the user need right now, based on the data and context. Generative UIs are largely invented in practice, based on user data analysis and experimentation, rather than being built in theory. Kelly Dern, a Senior Product Designer at Google lead a workshop in early 2024 on *GenUI for product inclusion* aiming to create “*more accessible and inclusive [UIs for] users of all backgrounds*”. (Matteo Sciortino, 2024) coins the phrase RTAG UIs “*real-time automatically-generated UI interfaces*” mainly drawing from the example of how his Netflix interface looks different from that of his sister’s because of their distinct usage patterns.

Nonetheless, (*On Nielsen's Ideas about Generative UI for Resolving Accessibility*, 2024) is critical of GenUI because for the following reasons:

Table 61: Criticism of Generative UI by (*On Nielsen's Ideas about Generative UI for Resolving Accessibility*, 2024).

Problem	Description
Low Predictability	Does personalization mean the UI keeps changing?
High Carbon Cost	AI-based personalization is computation-intensive
Surveillance	Personalization needs large-scale data capture

(Nielsen, 2024b) defines *information scent* as users' ability to predict destination content from cues, such as link labels and context; clear descriptive labels emit a strong scent, guiding users, reducing bounce rates (users who leave quickly), and enhancing discoverability of content; in contrast, misleading labels break trust and drive users away. The idea of information scent is originally from *Information Foraging* theory from (Pirolli & Card, 1999), who adapt optimal foraging theory to human information seeking: users follow links as scent cues to maximize their rate of information gain.

However, with AI-chat and voice based interfaces, links lose some of their relevance, as users can receive more info from the AI, without having to navigate to a new page. With less focus on links, current AI UX is more about storytelling, psychology, and seamless design, with more focus on human-centered communication patterns, such as conversations. (Kate Moran & Sarah Gibbons, 2024) calls for "*highly personalized, tailor-made interfaces that suit the needs of each individual*", which she terms *Outcome-Oriented Design*. We can generate better UIs (UI orchestration, crafting "*systems of intent*", as (Nielsen, 2025) calls it) that are based on user data and would be truly personalized. (Crompton, 2021) highlights AI as decision-support for humans while differentiating between *intended* and *unintended* influence on human decisions. In all this literature and more, the keyword is *intent*, expressing what the human wants - and having the machines deliver that.

Human-computer interaction (HCI) has a long storied history since the early days of computing when getting a copy machine to work required specialized skill. Xerox Sparc lab focused on early human factors work and inspired a the field of HCI to make computers more human-friendly. Likewise, the history of attempts at making *intelligent interfaces* is extensive. (*Generative UI Design*, 2023; Kobetz, 2023) give an overview of the history of generative AI design tools, going back in time as far as 2012 when (Troiano & Birtolo, 2014) proposed genetic algorithms for UI design. As the old science fiction adage goes, when machines become more capable, they will eventually be capable of producing machines themselves. Before that happens, at least the software part of the machine can increasingly be generated by AI systems (i.e. machines making machines). Already a decade ago in 2014, the eminent journal *Information Sciences* decided to dedicate a special section to AI-generated software to call attention to this tectonic shift in software development (Reformat, 2014). Replit, a startup known for allowing user build apps in the web browser, released Openv0, a framework of AI-generated UI components. "*Components are the foundation upon which user interfaces (UI) are built, and generative AI is unlocking component creation for front-end developers, transforming a once arduous process, and aiding them in swiftly transitioning from idea to working components*" (Replit, 2023). Vercel introduced an open-source prototype UI-generator called V0 which used large language models (LLMs) to create code for web pages based on text prompts (Vercel, 2023). Other similar tools quickly following including Galileo AI, Uizard AutoDesigner and Visily (*Who Benefits the Most from Generative UI*, 2024). NVIDIA founder Jensen Huang makes the idea exceedingly clear, saying "*Everyone is a programmer. Now, you just have to say something to the computer*" (Leswing, 2023).

The usefulness of AI systems increases profoundly as they are integrated into existing products as services, which become akin to tools the AI can use when appropriate. (Joyce, 2024) highlights

how Notion AI enables collaborating across teams, where AI becomes akin to one of the co-workers; AI influences UI design patterns and boosts productivity by providing new features such as memory, recalling important discussions from past meetings, surfacing key insights, and generating reports in a variety of formats, personalized to the intended receiver.

A wide range of literature describes human-AI interactions, spread out over varied scientific disciplines. While the fields of application for AI are diverse, some key lessons can be transferred horizontally across fields of knowledge.

Table 62: A very small illustration of generative AI usage across disparate fields of human life.

Field	Usage
Shipping	(Veitch & Andreas Alsos, 2022) highlights the active role of humans in Human-AI interaction in autonomous self-navigating ship systems.
Data Summarization	AI is great at summarizing and analyzing data (Peters, 2023; Tu et al., 2023)
Childcare	Generate personalized bedtime stories
Design Tools	(David Hoang on How AI Brings Design and Development Together   Figma Blog, 2024)

### 10.3.3 Usability Is the Bare Minimum of Good User Experience

Many researchers have discussed the user experience (UX) principles of designing AI products. The UX of AI (terms such as AI UX, IxD, and XAI have been used) is the subject of several *usability guidelines* for AI, which provide actionable advice for improving AI usability and UX - some of which I will list here.

(Combi et al., 2022) proposes a conceptual framework for XAI, analysis AI based on (1) Interpretability, (2) Understandability, (3) Usability, and (4) Usefulness. (A. Costa & Silva, 2022) highlights key UI/UX patterns for interaction design in AI systems and strategies to make AI behaviors transparent and controllable: including (1) interactive explanations, (2) human-in-the-loop controls, (3) logging of contextual decisions - all seamlessly integrated into user workflows. (*Why UX Should Guide AI*, 2021) argues that in order to avoid *context blindness*, (where the AI lacks awareness of the broader human intent) and foster trust and safe use, UX should (1) clarify limitations, (2) build clear feedback, (3) embed user override mechanisms, and (4) in general ensure users retain meaningful control over specialized AI algorithms. (Lexow, 2021) synthesizes expert interviews into five foundational AI-UX principles: (1) deeply understand the user and task context, (2) clearly communicate AI limitations, (3) balance automation with user control, (4) build fast, iterative feedback paths into the interface, and (5) ensure AI behavior aligns ethically - and with your brand voice.

(Lennart Ziburski, 2018) emphasizes human-centered design for AI, including five key tenets: (1) starting from existing user workflows which can be augmented by AI, (2) under-promising/over-delivering on AI capabilities, (3) transparently explaining how the system works

(data sources, trade-offs), (4) involving users in the learning loop, and (5) designing AI as an empowering tool rather than a black box. (Dávid Pásztor, 2018) offers seven principles for AI-powered products: (1) visually distinguish GenAI content, (2) explain underlying processes and data privacy, (3) set realistic user expectations, (4) test edge cases proactively, (5) ensure AI engineers have access to high quality training data, (6) deploy rigorous user-testing (7) use immediate feedback channels for continuous improvement. (Lew & Schumacher, 2020) likewise focuses on (1) high data quality, (2) context-sensitive feedback, and (3) transparent controls. (Soleimani, 2018) provides the longest list of human-friendly UI/UX patterns for AI, with very specific suggestions including like/dislike toggles, confidence indicators and criteria sliders, “why” insights, risk alerts, and opt-in controls: all to foster transparency, user control, and trust in algorithmic decisions. (Harvard Advanced Leadership Initiative, 2021) focuses on principle for effective human–AI interaction in adaptive interfaces, illustrating a case of Semantic Scholar, where researchers’ intelligence is augmented via recommendation, summarization, and question-answering, while emphasizing user control and verification mechanisms.

Many large corporations have released guidelines for Human-AI interaction as well. The AI UX team from Ericsson’s Experience Design Lab released one of the early reports, exploring the role of trust in AI services, suggesting treating AIs as *agents* rather than tools; for the design to be successful, trust must be embedded into the interface front and center, best measured on 4 categories, inspired by human relationships: (1) Competence, (2) Benevolence, (3) Integrity, and (4) Charisma (Mikael Eriksson Björling & Ahmed H. Ali, 2020). (X. Cheng et al., 2022) describes AI-based support systems for collaboration and team-work, underlining how higher trust leads to willingness to reuse the AI in the future, collaboration satisfaction, and perceived task quality. Google’s AI Principles project provides Google’s UX for AI library (Google, n.d.; Josh Lovejoy, n.d.). In (Design Portland, 2018), Lovejoy, lead UX designer at Google’s people-centric AI systems department (PAIR), reminds us that while AI offers need tools, user experience design needs to remain human-centered. While AI can find patterns and offer suggestions, humans should always have the final say.

Microsoft provides guidelines for Human-AI interaction, which provides useful heuristics categorized by context and time (Amershi et al., 2019; T. Li et al., 2022).

Table 63: Microsoft’s heuristics categorized by context and time.

Context	Content
Initially	Clarify what it does; what are the limitations.
During interaction	Offer timely help, show only what matters, while respecting norms and avoiding bias
When wrong	Let users retry fast and make corrections; empower users to dismiss easily; explain why the system acted; be precise and in-scope

Over time	Track changes and adapt from use; announce changes and update with care (so not to break the user's work); invite feedback; show outcome of actions clearly; provide global settings
-----------	--

The previous design wave before UX for AI was corporations understanding how crucial design is to their business. In the 2010s business consultancies began to recognize the importance of design and advising their clients on putting design in the center of their strategy, bringing user experience design to the core of their business operations. (McKeough, 2018). There's a number of user interface design patterns that have proven successful across a range of social media apps. Such *user interface* (UX/UI) patterns have been copied from one app to another, to the extent that the largest apps share a similar look and feature set and the users are used to the same user experience. Common UX/UI parts include features such as the *Feed*, *Stories*, and *Avatars*, among many others. This phenomenon (or trend) has led some designers such as (Fletcher, 2023) and (Joe Blair, 2024) to be worried about UIs becoming average: more and more similar to the lowest common denominator. Yet, by using common UI parts from social media, users may have an easier time to accept the innovative parts, as they just look like new features inside the old interface. As new generations become increasingly used to talking to computers in natural language, the older interface patterns may gradually fade away.

Table 64: Common social media UI parts.

Feature	Examples	Notes
Feed	Facebook, Instagram, Twitter, TikTok, etc	The original algorithmic discovery hub; increasingly ran by ever-more-powerful AI to surface personalized content - yet younger generations may prefer the privacy of stories.
Post	Facebook, Instagram, Twitter, TikTok, etc, even Apple's App Store	Persistent content mainly for long-term sharing; the original content type
Stories	IG, FB, WhatsApp, SnapChat, TikTok, etc	Ephemeral content driven by FOMO(fear-of-missing-out) for casual behind-the-scenes sharing
Comment	YouTube, Threads, Reddit, Medium, etc	Threaded conversations fuel community engagement and discussion
Reactions	Facebook, Instagram, Slack, Threads, but even LinkedIn and Github.	The feature has evolved from a simple like button to more expressive emotions.

There are also more philosophical approaches to *Interface Studies*. (David Hoang, 2022), the head of product design at Webflow, an AI-enabled website development platform, suggests taking cues from art studies to *isolate the core problem*: “*An art study is any action done with the intention of learning about the subject you want to draw*”. As a former art student, Hoang looks at an interface as “*a piece of design is an artwork with function*”. Indeed, art can be a way to see new paths forward, practicing “*fictioning*” to deal with problematic legacies (*Review of the 2023 Helsinki Biennial*, 2023). (Jarovsky, 2022a) lists the numerous ways how AIs can mislead people, which she calls the AI UX dark patterns, and the U.S. FTC Act and the EU AI Act are attempting to manage.

Usability sets the baseline - but AI-interfaces are capable of much more. The user experience (UX) of AI is a topic under active development by all the largest online platforms. AI is usually a computer model that spits out a number between 0 and 1, a probability score or a prediction. UX is what we do with this number. Design starts with understanding human psychology. (Donghee Shin, 2020) looks at user experience through the lens of *usability of algorithms*; focusing on users’ cognitive processes allows one to appreciate how product features are received by the brain and transformed into experiences by interacting with the algorithm. The general public is familiar with the most famous AI helpers, ChatGPT, Apple’s Siri, Amazon’s Alexa, Microsoft’s Cortana, Google’s Assistant, Alibaba’s Genie, Xiaomi’s Xiao Ai, and many others. For general, everyday tasks, such as asking factual questions, controlling home devices, playing media, making orders, and navigating the smart city. Yet, as AI permeates all types of devices, (J. Bailey, 2023) believes people will increasingly use AI capabilities through UIs that are specific to a task rather than generalist interfaces like ChatGPT. Nonetheless, a generalist AI interface may still control those services, if asked to do so, so it may an ‘and’ rather than an ‘either/or’, when it comes to AI usage.

The application of user experience (UX) tenets to AI.

Table 65: UX Tenets in AI.

UX
Useful
Valuable
Usable
Accessible
Findable
Desirable
Credible

Table 66: (R. Gupta, 2023) proposes 3 simple goals for AI:

1	2	3
Reduce the time to task	Make the task easier	Personalize the experience for an individual

Microsoft Co-Founder predicted in 1982 “*personal agents that help us get a variety of tasks*” (Bill Gates, 1982) and it was Microsoft that introduced the first widely available personal assistant in 1996, called Clippy, inside the Microsoft Word software. Clippy was among the first assistants to reach mainstream adoption, helping users not yet accustomed to working on a computer, to get their bearings (Tash Keuneman, 2022). Nonetheless, it was in many ways useless and intrusive, suggesting there was still little knowledge about UX and human-centered design. Gates never wavered though and is quoted in 2004 saying “*If you invent a breakthrough in artificial intelligence, so machines can learn, that is worth 10 Microsoft’s*” Lohr (2004). Gates updated his ideas in 2023 focuses on the idea of *AI Agents* (Gates, 2023).

With the advent of ChatGPT, the story of Clippy has new relevance as part of the history of AI Assistants. (Benjamin Cassidy, 2022) and (Abigail Cain, 2017) illustrate beautifully the story of Clippy and (Tash Keuneman, 2022) asks poignantly: “*We love to hate Clippy — but what if Clippy was right?*”. That is to say, might we try again? And Microsoft has been trying again, being one of the leading investors in the AI models that eventually make a better UX possible. Just one example is a project from Microsoft Research, which generates life-like speaking faces from a single image and voice clip, which could empower true-to-life avatars (S. Xu et al., 2024). However, purely on the economic side, processing human voice and images is several times more expensive than processing text messages (V. Mittal, 2025). More required processing power also means, these new interfaces are likely less sustainable.

#### 10.3.4 AI Performance Under High-Stakes Situations

Today AI-based systems are already being used in high-stakes situations (medical, self-driving cars). Attempts to implement AI in medicine, where stakes are perhaps the highest, raising the requirements for ethical considerations, have been made since the early days of computing, as the potential to improve health outcomes is so high. Since CADUCEUS in the 1970s (in Kanza et al., 2021), the first automated medical decision-making system, medical AI now provides diagnostic systems for symptoms and AI-assistants in medical imaging. Complicated radiology reports can be explained to patients using AI chatbots (Jeblick et al., 2022). The explanations are not only useful for patients but for doctors (and other medical professionals) as well. (Calisto et al., 2022) focuses on AI-human interactions in medical workflows and underscores the importance of output explainability; medical professionals who were given AI results with an explanation trusted the results more. (Peter Lee et al., 2023) imagines an AI revolution in medicine using GPT models, providing improved tools for decreasing the time and money spent on administrative paperwork while providing a support system for analyzing medical data. For administrative tasks such as responding to patients’ questions, medical AI has already reached - or even exceeded

- expert-level question-answering ability (Singhal et al., 2023). In an online text-based setting, patients rated answers from the AI better, and more empathetic, than answers from human doctors (Ayers et al., 2023). If anything, the adoption of AI in medicine has been too cautious. (Daisy Wolf & Pande Vijay, 2023) criticizes US healthcare's slow adoption of technology and predicts AI will help healthcare leapfrog into a new era of productivity by acting more like a human assistant.

Communication with the patient is perhaps a low-hanging fruit, as there are numerous examples of AI-driven symptom checkers and AI-based FAQ-answering chatbots already commercially available, such as (*Health. Powered by Ada.*, n.d.) and (*Buoy Health*, n.d.), which offer AI-based platforms to survey, track and understand one's symptoms over time, while providing doctors patient data, which can be used for generating preliminary possible diagnosis, freeing up clinical resources. The Lark digital health coaching platform delivers support for diabetes, hypertension, and weight management, by integrating smartwatches and smart scales, to provide evidence-based behavior change (*Home - Lark Health*, n.d.). The VP of user experience at Senseley discusses the Molly AI assistant, to chat, answer questions, and measure blood pressure; the main challenge is the healthcare system, where a small pilot project might work well, bureaucracy keeps the technology from being widely adopted (Women in AI, 2018). While discussion of this kind of tools and proposals of AI-based health monitoring systems have existed for an over a decade, recent advances in AI reliability have made it feasible to deploy them at scale. While ChatGPT is not built to be a medical tool, the interface is so easily available, it's very common for patients to decode lab results using ChatGPT or ask for diagnosis when doctor time is scarce.(Eliza Strickland, 2023).

Example of ChatGPT explaining medical terminology in a blood report.



Certainly! Below is a table that explains the abbreviations and values from your blood report.



These values represent different components and characteristics of your blood, and they can provide insights into your overall health.

Abbreviation	Full Name	Value	Unit	Description
B-CBC-5Diff	Complete Blood Count with 5-part Differential	-	-	A comprehensive test measuring different components of the blood.
WBC	White Blood Cells	4,8	/nL	Cells that fight infections.
RBC	Red Blood Cells	4,92	/pL	Cells that carry oxygen.
Hb	Hemoglobin	147	g/L	Protein that carries oxygen in red blood cells.
Hct	Hematocrit	44,4	%	Proportion of red blood cells to the total blood volume.
MCV	Mean Corpuscular Volume	90,2	fL	Average size of red blood cells.
MCH	Mean Corpuscular Hemoglobin	29,9	pg	Average amount of hemoglobin per red blood cell.
MCHC	Mean Corpuscular Hemoglobin	332	g/L	Average concentration of hemoglobin in red blood

Figure 62: Example of ChatGPT explaining medical terminology in a blood report.

Today's AI is already a technology which can augment human skills or replace skills that were lost due to an accident. For instance, (Dot Go, 2023) makes the camera the interaction device for people with vision impairment. (Nathan Benaich & Ian Hogarth, 2022) report notes the increasing AI deployment in critical infrastructure and biology, intensifying geopolitics in AI, growth of the safety research community.

### 10.3.5 Human-Computer Interactions Without a “Computer”

AI deeply affects Human-Computer Interactions even if the computer is invisible. The field of Human Factors and Ergonomics (HFE) emphasizes designing user experiences (UX) that cater to human needs (The International Ergonomics Association, 2019). Designers think through every interaction of the user with a system and consider a set of metrics at each point of interaction including the user's context of use and emotional needs.

Software designers, unlike industrial designers, can't physically alter the ergonomics of a device, which should be optimized for human well-being to begin with and form a cohesive experience

together with the software. However, software designers can significantly reduce mental strain by crafting easy-to-use software and user-friendly user journeys. Software interaction design goes beyond the form-factor and accounts for human needs by using responsive design on the screen, aural feedback cues in sound design, and even more crucially, by showing the relevant content at the right time, making a profound difference to the experience, keeping the user engaged and returning for more. In the words of (Babich, 2019), “[T]he moment of interaction is just a part of the journey that a user goes through when they interact with a product. User experience design accounts for all user-facing aspects of a product or system.”

Drawing a parallel from narrative studies terminology, we can view user interaction as a heroic journey of the user to achieve their goals, by navigating through the interface until a success state - or facing failure. Storytelling has its part in interface design however designing for transparency is just as important, when we’re dealing with the user’s finances and sustainability data, which need to be communicated clearly and accurately, to build long-term trust in the service. For a sustainable investment service, getting to a state of success - or failure - may take years, and even longer. Given such long timeframes, how can the app provide support to the user’s emotional and practical needs throughout the journey?

(Tubik Studio, 2018) argues *affordance* measures the *clarity* of the interface to take action in user experience design, rooted in human visual perception, however, affected by knowledge of the world around us. A famous example is the door handle - by way of acculturation, most of us would immediately know how to use it - however, would that be the case for someone who saw a door handle for the first time? A similar situation is happening to the people born today. Think of all the technologies they have not seen before - what will be the interface they feel the most comfortable with?

For the vast majority of this study’s target audience (college students), social media can be assumed as the primary interface through which they experience daily life. The widespread availability of mobile devices, cheap internet access, and AI-based optimizations for user retention, implemented by social media companies, means this is the baseline for young adult users’ expectations (as of writing in 2020).

(Don Shin et al., 2020) proposes the model (fig. 10) of Algorithmic Experience (AX) “*investigating the nature and processes through which users perceive and actualize the potential for algorithmic affordance*” highlighting how interaction design is increasingly becoming dependent on AI. The user interface might remain the same in terms of architecture, but the content is improved, based on personalization and understanding the user at a deeper level.

In 2020 (when I proposed this thesis topic), Google had recently launched an improved natural language engine to better understand search queries (*Understanding Searches Better Than Ever Before*, 2019), which was considered the next step towards *understanding* human language semantics. The trend was clear, and different types of algorithms were already involved in many types of interaction design, however, we were in the early stages of this technology (and still are *early* in 2024). Today’s ChatGPT, Claude and Gemini have no problem understanding human semantics - yet are they intelligent?

Intelligence may be beside the point as long as AI *becomes very good at reasoning*. AI is a *reasoning engine* (Bubeck et al., 2023; Shipper, 2023; see J. Bailey, 2023 for a summary). That general observation applies to voice recognition, voice generation, natural language parsing, among others. Large consumer companies like McDonald's are in the process of replacing human staff with AI assistants in the drive-through, which can do a better job in providing a personal service than human clerks, for whom it would be impossible to remember the information of thousands of clients. In (Barrett, 2019), in the words of *Easterbrook*, a previous CEO of McDonald's "*How do you transition from mass marketing to mass personalization?*"

#### 10.3.6 Do AI-Agents Need Anthropomorphism

(Yuan et al., 2022) surveyed mainland Chinese consumers ( $n = 210$ , no age range given), finding that users with high social anxiety lean on hedonic and emotional cues, especially a friendly anthropomorphic interface and a sense of affinity (when those cues are strong, their intention to adopt the AI assistant is as high, and sometimes higher, than that of users with low social anxiety) - in contrast, users with low social anxiety are influenced mainly by utilitarian cues such as accuracy and speed; these functional advantages carry less weight for the high social anxiety group. Perhaps a crude conclusion, but useful for design, would be, people with high social anxiety like cute things.

(X. Xu & Sar, 2018) survey ( $n = 522$ ) examined how people perceive the minds of machines versus humans along agency (ability to act) and experience (ability to feel), finding among machines those with human-like appearance were seen as having the greatest agency and experience; being more familiar how technology works, correlated with rating machines to have higher agency but lower experience.

What are the next features that could improve the next-generation UX/UI of AI-based assistants? Should AIs look anthropomorphic or fade in the background? It's an open question (depending on the use case and psychology of the user); perhaps we can expect a mix of both, depending on the context of use and goals of the particular AI. (Stone Skipper, 2022) sketches a vision of "*[AI] blend into our lives in a form of apps and services*" deeply ingrained into daily human activity. (Aschenbrenner, 2024) predicts "drop-in virtual coworkers", AI-agents who are able to use computer systems like a human seamlessly replacing human employees.

Table 67: Some notable examples of anthropomorphic AIs for human emotions.

Anthropomorphic AI User Interfaces	Non-Anthropomorphic AI User Interfaces
AI wife ("My Wife Is Dead", 2023)	Generative AI has enabled developers to create AI tools for several industries, including AI-driven website builders (Constandse, 2018)
(Sarah Perez, 2023) character AI	AI tools for web designers (patrizia-slongo, 2020)

Anthropomorphic AI User Interfaces	Non-Anthropomorphic AI User Interfaces
Mourning for the ‘dead’ AI (Phoebe Arslanagić-Wakefield, n.d.)	Microsoft Designer allows generating UIs just based on a text prompt (Microsoft, 2023)
AI for therapy (Broderick, 2023)	personalized bed-time stories for kids generated by AI (Bedtimestory.ai, 2023)
Mental health uses: AI for bullying (Sung, 2023)	

### 10.3.7 Roleplay for Financial Robo-Advisors

Using AI and computerised models for financial prediction is not new. (Malliaris & Salchenberger, 1996) applied neural networks to financial forecasting nearly three decades ago, using training data on past volatilities and factors of the options market to predict future (next-day) implied volatility (i.e. volatility not observed directly in the market but back-calculated from option prices) of the S&P 100 index (tracks the largest companies) in the U.S., demonstrating early potential of AI in financial prediction. Such tools were initially of academic interest or only accessible to financial professionals. Later on fintech (financial technology) startups began bringing computerized predictive power into user interfaces available to retail investors.

*Robo-advisory* is a fintech term that was in fashion largely before the arrival of AI assistants and has been thus superseded by newer technologies. Ideally, robo-advisors can be more dynamic than humans and respond to changes quickly and cheaply, while human financial advisors are expensive and not affordable to most consumers. (Capponi et al., 2019) argues dynamism in understanding the client’s financial situation - which AI excels at - is a key component to providing the best advice.

*“The client has a risk profile that varies with time and to which the robo-advisor’s investment performance criterion dynamically adapts”*. The key improvement of personalized financial advice is understanding the user’s *dynamic risk profile*. - (Capponi et al., 2019)

In the early days of consumer-direct robo-advisory, Germany and the United Kingdom led the way with the most robo-advisory usage in Europe (Cowan, 2018). While Germany had 30+ robot-advisors on the market in 2019, with a total of 3.9 billion EUR under robotic management, it was far less than individual apps like Betterment managed in the US (Bankinghub, 2019). Already in 2017, several of the early robo-advisors apps shut down in the UK; ETFmatic gained the largest number of downloads by 2017, focusing exclusively on exchange-traded funds (ETFs), tracking stock-market indexes automatically, with much less sophistication, than their US counterparts - the app was bought by a bank in 2021 and closed down in 2023 (AltFi, 2017, 2021; da Silva, 2023; *ETFmatic - Account Funding of EURO Accounts Ceases*, 2023).

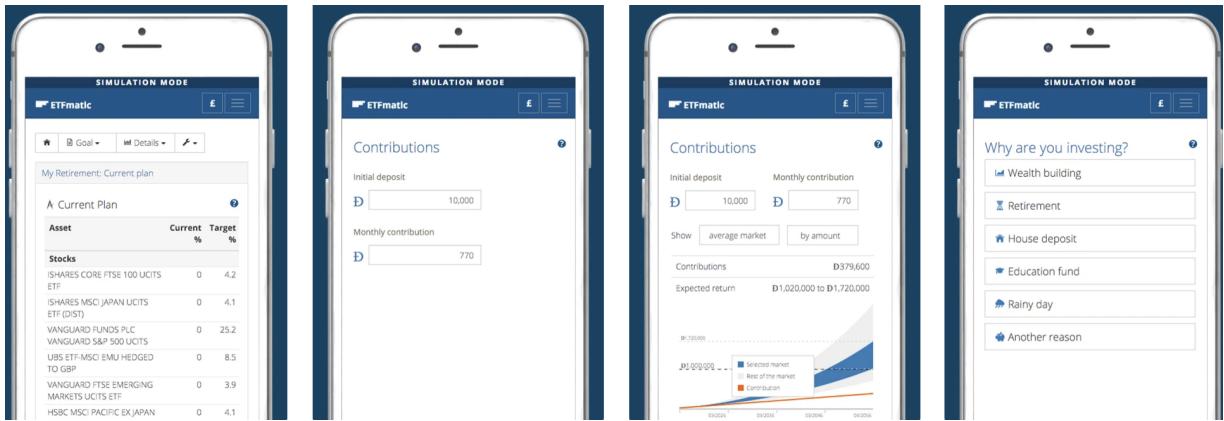


Figure 63: Out-of-date user interface of a European AI-Advisor ETFmatic in 2017 which was closed down in 2023 (Photo copyright ETFmatic)

Newer literature notes robo-advisor related research is scattered across disciplines (H. Zhu et al., 2024). (A. Brown, 2021) outlines how modern financial chatbots have evolved beyond simple Q&A to offer conversational, 24/7 support across banking, investment, insurance, and more, which reduces support costs while improving responsiveness, while freeing human agents for higher-value tasks. In India, research has been conducted on how AI advisors could assist with investors' erratic behavior in stock market volatility situations, albeit without much success; India is a large financial market with more than 2000 fintechs (financial technology startups) since 2015 (Bhatia et al., 2020; Migozzi et al., 2023). (Barbara Friedberg, 2021) and (Slack, 2021) compare robo-advisors and share how before GenAI, financial chatbots were developed manually using a painstaking process that was slow and error-prone. Older financial robo-advisors, built by fintech companies aiming to provide personalized suggestions for making investments such as Betterment and Wealthfront were forced to upgrade their technology to keep up. Robo-advisors compete with community-investing such as hedge funds, mutual funds, copy-trading, and DAOs with treasuries - or can act as entry-points for these aforementioned modes of investment. However, robo-advisors typically do not have the type of social proof that community-based investment vehicle have, where the user may see the actions taken by other investors.

There's research of anthropomorphism or the human-like attributes of robo-advisors, such as the aforementioned conversational chatbots, and whether anthropomorphism can affect adoption and risk preferences among customers. Several studies show that anthropomorphic robo-advisors, with stronger visual human-likeness, increase customer trust and reduce algorithm aversion (Deng & Chau, 2021; Ganbold et al., 2022; Hildebrand & Bergner, 2021; Plotkina et al., 2024). However, it's not clear, if this explanation is tied to the avatar. The question - does the user trust a robot or a human, or is there a possible combination - has been researched in other literature, which does not rely on images. (David et al., 2021) looks at the whether explainable AI could help adoption of financial AI assistants in an experimental study with players ( $n = 210$ ) of an online investment game had to choose between: (a) human advice, (b) AI advice without explanation, or (c) AI advice paired with an explanation; the results showed no evidence of algorithm aversion (players did not prefer human advice to AI advice).

The most comprehensive meta-review of research on how AI chatbots could mimic humans, comes from (Feine et al., 2019), providing an entire taxonomy of social cues for conversational agents, including verbal, visual, auditory cues, as well as other indicators humans pay attention to, such as age, yawning, laughing, posture, clothing, etc. Because this is such a useful resource, I've adapted the findings in the table below.

Table 68: Comprehensive overview of social cues with potential for use in AI conversations, adapted from the meta-review of related research papers by (Feine et al., 2019).

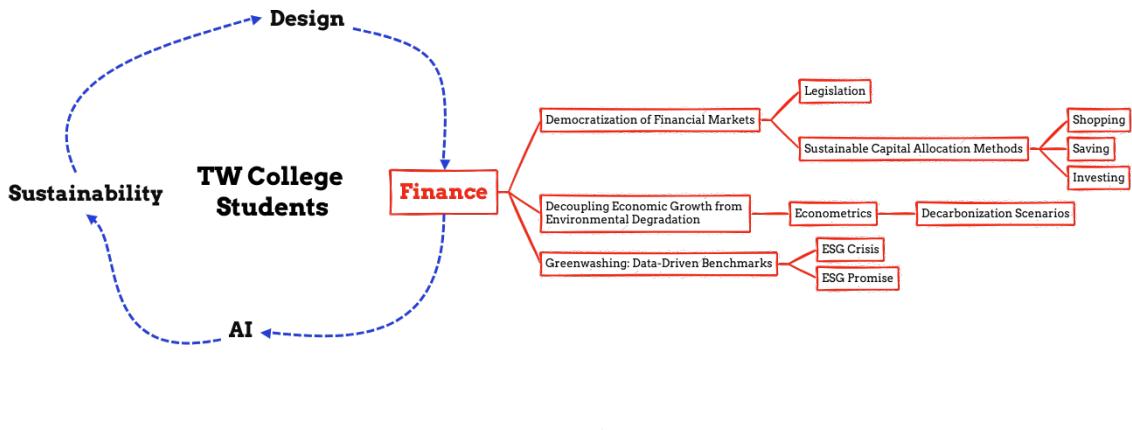
Category	Sub-Category	Cue	Explanation
<b>Verbal</b>	<b>Content</b>	Apology	Agent expresses regret for an error
		Asking for permission	Requests user approval before acting
		Greeting and farewell	Opens or ends the conversation politely
		Joke	Humorous remark to entertain
		Name	Addresses the user by name
		Opinion conformity	Shows agreement with the user's view
		Praise	Compliments the user
		Referring to past	Mentions shared history or earlier turns
		Self-disclosure	Reveals personal info about the agent
		Small talk	Casual, topic-light chatter
<b>Verbal</b>	<b>Style</b>	Thanking	Expresses gratitude
		Abbreviations	Uses shortened words (e.g. "BTW")
		Dialect	Adopts regional or cultural language variety
		Formality	Chooses formal vs casual register
		Lexical alignment	Mirrors the user's word choices
		Lexical diversity	Varies vocabulary richness
		Politeness	Adds courteous markers ("please", "could you")
		Sentence complexity	Varies length and structure of sentences
		Strength of language	Uses mild vs intense wording
		Arm and hand gesture	Animated limb movements
<b>Visual</b>	<b>Kinesics</b>		

Category	Sub-Category	Cue	Explanation
Visual	Proxemics	Eye movement	Gaze shifts or blinking
		Facial expression	Smiles, frowns, eyebrow raises, etc.
		Head movement	Nods, shakes, tilts
	Appearance	Posture shift	Whole-body stance changes
		Background	Visual environment behind the agent
		Conversational distance	Apparent closeness to the user
Visual	Appearance	2D / 3D agent visualization	Flat icon vs full three-dimensional model
		Age	Apparent age of the avatar
		Attractiveness	Overall aesthetic appeal
		Clothing	Outfit style and details
		Color of agent	Dominant color palette
		Degree of human likeness	Cartoon-like to photo-real scale
		Facial feature	Eye shape, mouth style, etc.
		Gender	Male, female, neutral presentation
		Name tag	On-screen label with agent's name
		Photorealism	Realistic rendering quality
Visual	Text Styling	Emoticons	□ □ □ style graphics
		Typefaces	Font choice and typography tweaks
Auditory	Voice Qualities	Gender of voice	Male, female, neutral timbre
		Pitch range	High- vs low-pitched speech
		Voice tempo	Speaking speed
		Volume	Loudness level
Auditory	Vocalizations	Grunts and moans	Non-word hesitation sounds
		Laughing	Laughter audio
		Vocal segregates	“uh-huh”, “mm-hm”, etc
		Yawn	Audible yawning
Invisible	Chronemics	First turn	Which party speaks first
Invisible	Haptics	Response time	Delay before replying
		Tactile touch	Device vibration or touch feedback
		Temperature	Warmth or coolness cues

Literature on fintech UX does share some basic tenets with AI UX on building user confidence.

(*Why Design Is Key to Building Trust in FinTech* | Star, 2021) lists essential tactics for building trust in fintech: (1) consistency in UI patterns, (2) transparent feedback, (3) clear error handling, and (4) educating users about data usage. (Sean McGowan, 2018) offers four guidelines for fintech apps: (1) understand domain complexities, (2) friction is necessary for safety - embrace it, (3) provide continuous and clear feedback, and (4) simplify complex financial information - this can build user confidence and reduce errors. (Cordeiro & Weevers, 2016) emphasizes designing for the “unhappy path” - negative experiences can shape users’ perception deeply, as bad memories carve strongly in their user experience - products which handle failures and edge cases gracefully, however, stand out and maintain satisfaction. (ROBIN DHANWANI, 2021) approaches UX problems from an organizational perspective, noting that in large organizations, UX issues can stem from lack of alignment between teams; the authors propose *Design Jams* as a potential solution to improve cross-team collaboration - design jams are cross-functional workshops, which can help teams align on user needs, generate rapid prototypes, and iteratively refine interfaces - which, in theory, could improve the adherence to the guidelines above noted.

# 11 MONEY



Presented with xmind AI

Figure 64: Visual abstract for the finance chapter

## 11.1 The Convergence of Money: One Wallet to Rule Shopping, Saving, and Investing

This chapter explores how money could incorporate sustainability as a feature.

“Money is information... it shouldn’t be more expensive or slower than sending an email.” (K. Käärmann, Co-Founder of the Wise , formerly known as Transferwise, money transfer platform), said in 2018 (Käärmann, 2018)

Money itself is changing and the meaning of money is becoming more diverse. Traditionally, money referred to the fiat money created by governments by law, using central banks, which loan money to commercial banks, that in turn make it available to the society. Now, we also have new types of money created by companies and individuals using blockchain-cryptography based distributed databases, which keep track of transactions (who-paid-whom). We have various types of tokens of value, such as cryptocurrencies, digital assets, loyalty points, etc, which can all function as types of money. Whatever the method of creation, in essence, money is a *system of trust* where *something* is used as a *medium of value exchange* and accepted by *other people* as payment.

### 11.1.1 Spurred by Fintech: The Democratization of Finance: A Precursor for Sustainable Superapps

Digital money in its various forms connects industries on popular financial mobile apps, which makes digital money more accessible and socially engaging, appealing to people who are active

online. Because of the *democratization of finance* enabled by digitization and financial technologies, the journey from consumer to investor is becoming increasingly simple. Consumer-oriented financial apps increasingly enable new user interactions which blur boundaries between shopping, saving, and investing - termed here “*money convergence*”. Empowering consumers to access finance through digital technologies and delivering a simple user experience is the fintech trend of the last decade. Motivated by boosting user numbers, apps such as N26 and Revolut, that started out with only payments-focused businesses, founded in 2013 and 2015, respectively, began making efforts to expand into all-in-one financial superapps offering varied saving and investing services (*Kickstart Your Investment Journey*, 2023; *Revolut Launches ETF Trading Platform in Europe*, 2023).

While it took N26 and Revolut more than a decade to grow into global businesses, fintechs can growth really fast. Just last year in Canada, Neo Financial, which offers a mobile app and credit cards to consumers featuring cashback rewards on payments, savings and investing, won Canada’s fastest growing company award in 2024, posting a 3-year revenue growth of 38,431%, earning between \$75M and \$100M USD in annual revenue from 1.3 million customers (“Ranking Canada’s Top Growing Companies of 2024,” 2024). (Qorus, 2023) a survey of 200 banking executives worldwide, revealed we’re in a digital banking revolution, with growing adoption of personalization, automation, and *embedded finance* - the availability of savings, loans, insurance, debit cards, and investment opportunities embedded within the apps of non-financial platforms, like e-commerce or social media platforms.

### **11.1.2 Financial Literacy and Education: Young Investors Follow Financial Influencers**

Young investors are typically *retail investors*, investing small amounts of money for themselves. (Unless they have inherited wealth or are among the very few who work in institutions such as investment firms, university endowments, pension funds or mutual funds, and have a say in where to invest large amounts of other peoples’ money.) Retail investors face many challenges in comparison with their institutional counterparts. For instance, they may have much less time to do proper research, face information asymmetries, where finding good information is limited by time, ability, as well as financial literacy, whereas professional investors have the tools, skills, time, and knowledge, to make better investment decisions.

The common expectation is that young investors typically have less understanding financial concepts. While consumers are beginning to become more money-savvy, they still lag in both financial and sustainability literacy. Financial and sustainability literacy are intertwined. Integrating these literacies is essential, because a financially informed public is better equipped to channel capital toward environmentally beneficial uses. Media plays a significant role here, with retail investing being heavily influenced by social media influencers.

Popular financial blogger (Austin Ryder, 2020) believes a good starting point is to ask the user to define their financial habits: are you consumer or investor? This helps users recognize whether their spending habits define them primarily as consumers or as investors. (SmartWealth, 2021) urges readers to “*consume knowledge, not products*”: for financial health one should get rid of

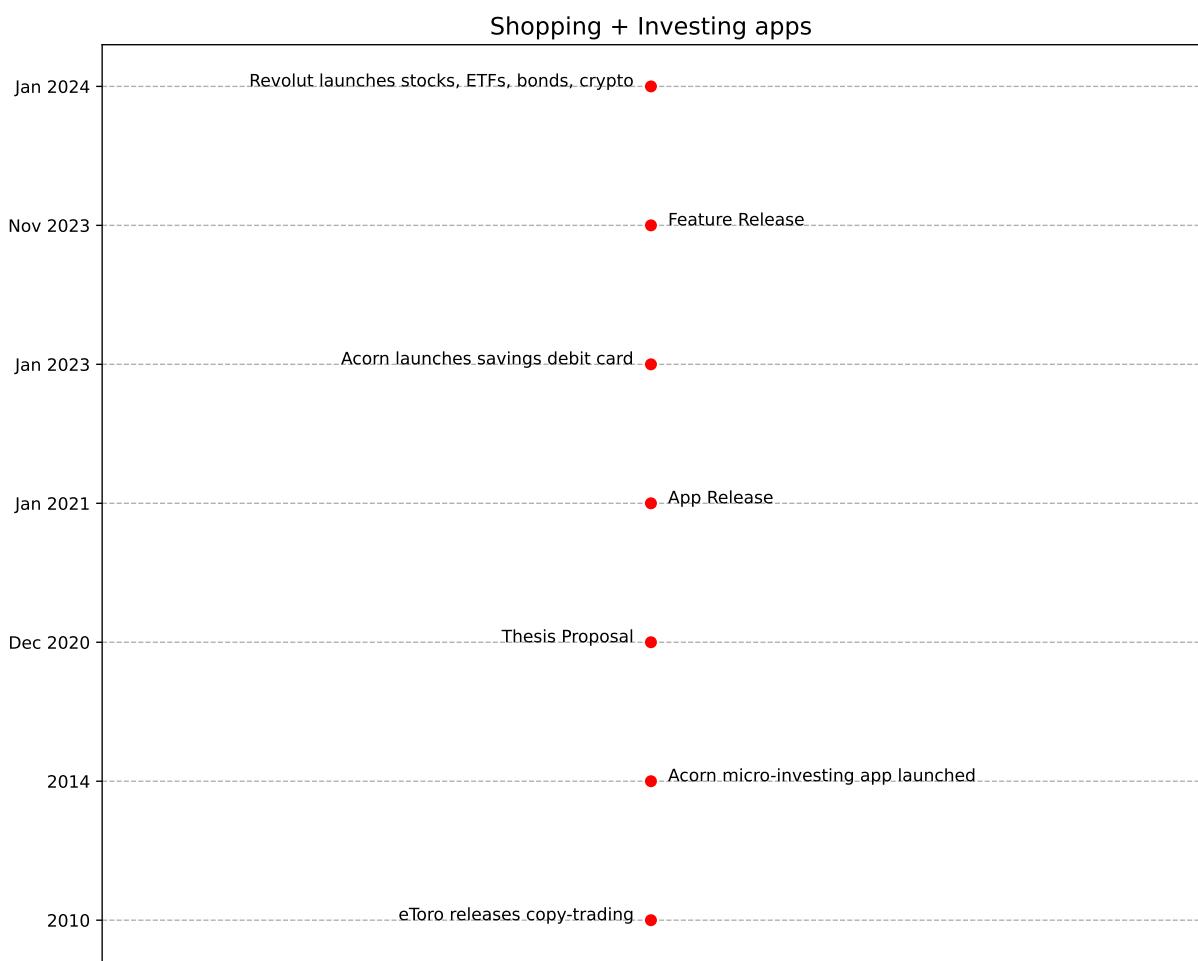


Figure 65: Fintech Growth

debt, automate tracking of expenses and savings, and create a pathway for income to flow into investments; consumer mindset is the main obstacle that keeps people from financial independence and investing. Investing can intersect with gender and race, as for example, during COVID-19, the financial advisor Malaika Maphalala co-led the “*Invest in Black Economic Liberation*” calling for racial justice investing to direct flows into sustainable funds (naturalinvest, 2020). On TikTok, (lizlivingblue, n.d.) promotes the IMPACT investing app by Interactive Brokers which is a mobile trading platform focused on socially conscious investors interested in sustainability (Trahant, 2022).

Table 69: Comparative Data on Investing Apps; compiled from (Gyuriczki & Szládek, 2025; Interactive Brokers, 2025a, 2025b; Lightyear, 2025; Revolut, 2020, 2025; Trahant, 2022)

Feature	IMPACT by Interactive Brokers		
	Lightyear	Revolut	
<b>Target Audience</b>	Sustainability-focused investors; value-driven alignment	European retail investors	Everyday users with casual interest in investing
<b>Investment Products</b>	Stocks, ETFs, mutual funds, options, bonds, fractional shares	Stocks, ETFs, multi-currency accounts	US & EU stocks, crypto, commodities, fractional shares
<b>Sustainability Focus</b>	Strong. Core to the app. Lets users filter companies by ESG values and track portfolio impact.	None. Focuses on transparency and low fees	Minimal. Some ESG ETFs; no impact tracking or custom filters
<b>Fees</b>	Very low (starting at \$0 commissions, with some market/data fees)	Low, with no account fee; FX markup 0.35% outside base currency	Free plan has high spreads; paid tiers offer lower fees; several FX and withdrawal limits apply
<b>Currency Conversion (FX)</b>	Interbank FX rates; low spreads	0.35% FX fee	Free plan: 1% FX fee; better rates in Premium accounts
<b>Fractional Shares</b>	Yes	Yes	Yes
<b>Tax Documents</b>	Yes, detailed reports	Yes, supports Estonian tax system	Limited; may need to do manual tracking for taxes
<b>Mobile App Experience</b>	Professional, ESG-focused UI	Clean, simple, intuitive	Gamified, casual, integrated with other Revolut services

Feature	IMPACT by		
	Interactive Brokers	Lightyear	Revolut
<b>Extra Features</b>	Voting rights, ethical filters, carbon impact metrics	Interest on cash (like a bank account); multi-currency accounts	Cashback, budgeting, crypto, P2P payments, travel perks

The next step is to provide frictionless digital pathways that let everyday purchases morph into micro-investments with transparent sustainability impacts. This user journey is a type of blended learning-by-doing experience. Framing the problem as a dual journey: first, helping users recognize whether their spending habits define them primarily as consumers or as investors, then giving users exposure to investment opportunities through familiar activities like shopping may hold the potential to boost financial literacy levels, enticing consumers to learn more about taking advantage of their financial opportunities as well as understanding how to manage the types or risk involved. Indeed, retail investor are the most vulnerable to misinformation and speculative hype if educational scaffolding is absent.

Financial superapps for shopping, saving, and investing are converging on digital platforms, aiming to permeate our daily financial lives, with features such banking, payments, transfers, rewards and cashback programs (e.g. Rakuten), automated micro-investing round-up to next dollar (e.g. Acorn, Stash, Swedbank, many others), retail investing (Robinhood, Public, Lightyear), copy-trading (eToro) and offering various investment vehicles, to name just a few: (fractional shares of) stocks, derivatives like CFDs and futures, microloans (Kiva), commodities and precious metals such as gold and silver (Revolut), physical assets such as real estate, land, forest and digital assets such as cryptocurrencies, NFTs, and many other alternative assets of varied price, volatility, liquidity, and risk profile.

Community-based copy-trading apps live on the intersection of social media and investing, enabling financial inclusion through letting novice, inexperienced investors piggy-back on more sophisticated investors by copying their investments. In some ways community-investing competes with robo-advisors as communities can be led by professional investors and followed by less sophisticated investors. Because of this investing leadership aspect, investor communities can have the type of *social proof*, which robo-advisor do not possess. eToro's, Robinhood's and Dub's copy trade feature turn portfolios, watch-lists and trade votes into public content (dub, 2025). The visible social proof approach can feel safer than robo-adviser; retail investors cite seeing what others do an important trust trigger (Andraszewicz et al., 2023).

Evidence of a similar phenomenon of peer behavior measurably shifting sustainability choices has been documented in the enterprise sector in green financing of Chinese industries, albeit in a modest 1–2% increase (incremental nudges); companies tend to invest green when they see when other companies signal a green preference (S. Yang et al., 2022). In a Swedish study, investors' belief in sustainable investing was found to be affected by other investors: an online coordination game with 559 private investors showed that 2nd-order pro-sustainable beliefs (*what one thinks*

Investment Share in Green vs Non-Green Projects

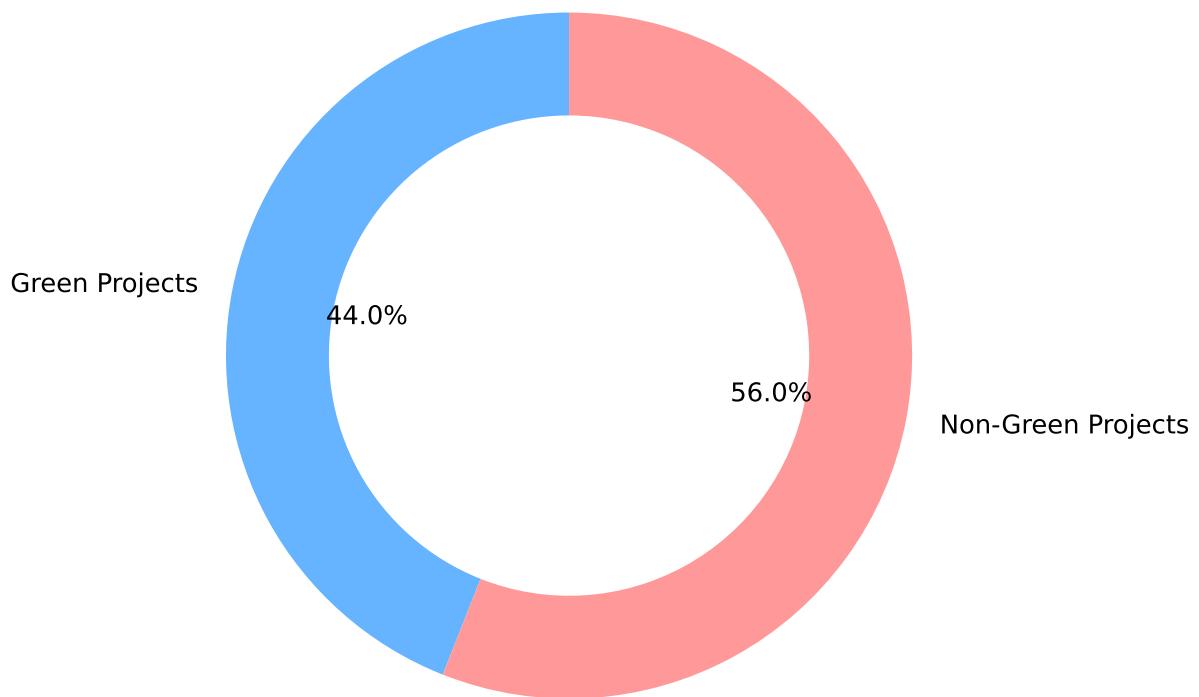


Figure 66: Green Retail vs Non-Green Retail

*others care about) also drove up sustainable asset allocations, underlining the social dimension of ESG investing (Luz et al., 2024).*

Independent of what is the technology used, access to investing is about financial empowerment. Ugandan investor John Ssenkeezi celebrated on X (formerly known as Twitter) being able to vote at Apple's 2022 AGM stockholder meeting using stock investments app Chipper Cash, which allows users by fractional - shares, illustrating shareholder democracy for emerging - market users (John Ssenkeezi, 2022). AngelList was an early pioneer in opening startup deal flow to retail users, offering access once reserved for angel investors and VCs. Similarly, community-based investment clubs could potentially enable everyday investors to pool resources and back sustainability initiatives alongside more experienced professionals.

Build a community can be lucrative. In Singapore, Chinese influencer Yuqing "Irene" Zhao's photos generated S\$7.5 million in 10 days as NFT sales; she tokenized her selfies as non-fungible tokens (NFTs) via IreneDAO, a decentralized version of OnlyFans, Discord, Twitch and Patreon, arguing that Web3 empowers creators to earn directly from their communities, turning fans into investors and aligning content creation with tokenized membership rights — evidence that retail capital can flow directly to media personalities through crypto communities (Irene Zhao, 2022; Yuqing Zhao, 2021). Similarly, in South Korea, media personalities have become "investable," through more traditional financial vehicles, such as K-pop idols as the focus for "thematic" ETFs, including KPOP and Korean Entertainment ETF and the Mirae Asset Global X K-pop and Culture ETF, enabling fans and investors to financially participate in the growth of the Korean entertainment and celebrity-driven cultural capital (Darwyne, 2025).

Communities can be directed towards sustainability, by attracting people of a similar mindset. For example, *minimalism* is a movement of people living a simpler life; this probably always going to be a small percentage of people, yet a growing life-style choice. According to one study, consumers choose to engage in becoming minimalist in a non-linear process with overlapping stages (Oliveira De Mendonça et al., 2021). Yet, (C. D. Costa, 2018) Finnish socialists promote minimalism as part of their mainstream policies. In Tokyo, a YouTuber shares their life and the choices they made (Tokyo Simple Eco Life, 2021). *Zero Waste Lifestyle* is the opposite of overconsumption. Zero Waste suggests people buy in bulk for more savings and to reduce packaging. Through group purchases and community investing while also reducing consumption. Zero Waste municipality in Treviso is a whole region with a focus on living green. While Minimalism and Zero Waste need an ongoing effort, joining a one-day sustainability event is accessible for most people. Started in Estonia, the World Cleanup Day movement has attracted tens of millions of people to do beach and forest cleanups, all over the world.

Building a community is a way to design a context, where the culture creates certain expectations of behavior. Humans working together are able to achieve more than single individuals. "*Any community on the internet should be able to come together, with capital, and work towards any shared vision. [...] In the long term this moves to internet communities taking on societal endeavors.*" (Panzarino, 2020). (Armstrong & Staff, 2021) believes leveraging different personalities and viewpoints can build more sustainable cultures; the focus on *group consciousness* suggests community-based sustainability action may be effective, when building a *culture of sustainability*, such as the garbage trucks in Taiwan. A communal event is a key building block

for a thriving community, which can be directly experienced instead of just reading about it or watching a video.

### **11.1.3 New Rules of Money: Legislative Efforts Empowering Consumers to Deploy Capital in Sustainability**

Regardless if it's money spent on shopping or money saved and invested, these are all consumers' financial decisions of *capital allocation*. In one way or another, people are giving their money to companies. The critical question is: *do people choose to support sustainability-focused companies* - companies which invest deeply into green innovation and eco-friendly practices - or do people choose companies that pay less attention to sustainability? While all financial transactions support economic growth in the sense of being reflected in the Gross Domestic Product (GDP), not all money flows equally support sustainable economic growth.

Legislation is catching up with fintechs and setting higher standards for consumer protection. For example the Directive 14 2014/65/EU, 2014 of The European Union fully recognizes the changing financial landscape trending towards the democratization of investments: "*more investors have become active in the financial markets and are offered an even more complex wide-ranging set of services and instruments*" (European Parliament, 2014). Some key legislation for investors has been put in place recently, for example "*MiFID II is a legislative framework instituted by the European Union (EU) to regulate financial markets in the bloc and improve protections for investors*" (Kenton, 2020). MiFID II and MiFIR will ensure fairer, safer and more efficient markets and facilitate greater transparency for all participants (European Securities and Markets Authority, 2017).

(PWC, 2020) Changes to laws and regulations aimed at achieving climate change mitigation is a key driver behind the wave of ESG adoption. The goal of these laws, first adopted in the European Union, a self-proclaimed leader in eco-friendliness, is to pressure unsustainable companies to change towards greener practices, in fear of losing their access to future capital, and to create a mechanism forcing entire environmentally non-compliant business sectors to innovate towards sustainability unless they want to suffer from financial penalties. On the flip side of this stick and carrot fiscal strategy, ESG-compliant companies will have incentives to access to cheaper capital and larger investor demand from ESG-friendly investors.

Already in 2001, while still part of the EU, the UK government was discussing ways to promote sustainable investment "*fundamental changes in VAT or corporation taxes could be used to promote greener consumption and investment*" (House of Commons, 2002). More recently, (HM Treasury, 2020) released a taxonomy of sustainable activities in the UK.

While the above trend is for governments to adapt to and work towards their environmental climate commitments and public demand, the sovereign risk remains an issue. For example, in the U.S. the policies supported by President Donald Trump during his presidency ran counter to many sustainability recommendations, including those directed at the financial markets, helping legacy industries stay competitive for longer through subsidies, and lack of regulation, or even regulation supporting legacy technologies (Quinson, 2020).

Governments are powerful in passing legislation, with a strong positive or negative ESG impact, and people do have a voice. Among the many grassroots campaigns, one environmental success story is about success story, asking that EU shops can't sell deforestation products, gathering over 100 thousand online signatures (WeMove Europe, 2022). Subsequently, legislation banning products contributing to deforestation was passed by the EU Parliament and Council in 2023 and came into effect in July 2024 (Abnett & Abnett, 2024; European Parliament, 2023).

## 11.2 ESG Crisis and Opportunity

### 11.2.1 Opaque Metrics and Lack of Standardization

ESG ratings have faced criticism for lack of standards and failing to account for the comprehensive impact a company is having. (Foley et al., 2024) notes how Coca Cola fails to account the supply chain water usage when reporting becoming “water neutral” and calls on companies to release more detailed information; major ESG ratings omit 90% of the company’s water footprint. (Gemma Woodward, 2022) Identifies fundamental problems in current ESG frameworks include (1) inconsistent data, and (2) superficial rating schemes, and calls for a complete overhaul to restore credibility in sustainable investing. (Margaryta Kirakosian & Angus Foote, 2022) argues that ESG needs standardization of methodologies as the disparity is one of the key hurdles in finding the right sustainable strategy. This is supported by econometric analysis, showing how inconsistent ESG scoring methodologies and greenwashing risk can predict the yields of green bonds, meaning scoring variance could materially affect bond pricing (Baldi & Pandimiglio, 2022). Likewise, The Carbon Tracker Initiative finds that companies in the highest-emitting sectors fail to explain how their greenhouse-gas outputs translate into financial risk, based on an analysis of corporate disclosures (Frances Schwartzkopff, 2022b).

Fortunately, there are some investment advisors rebuffing misleading ESG claims made by asset managers. Prominent investment research firm Morningstar conducted a forensic analysis of the industry, and re-classified 1/5 of the tracked funds (over 1200 in total) or over \$1 trillion USD in total valuation, as non-ESG; Hortense Bioy, Morningstar’s Head of Sustainability Research, commented these funds don’t integrate ESG factors “in a determinative way for their investment selection” (Schwartzkopff & Kishan, 2022).

In theory, *Socially Responsible Investing* (SRI) integrates ESG criteria to screen out harmful industries and direct capital to companies with positive social and environmental impacts for both ethical and financial returns (*Socially Responsible Investing Advisors*, n.d.). Nonetheless, a large-scale input-output life-cycle assessment of 1340 European equity funds (11275 unique holdings) including sustainable (SRI) funds, and found that 24% of the sampled SRI funds actually show higher total CO<sub>2</sub>eq emissions exposure within their assets than a conventional market index (Popescu et al., 2023). (Amenc et al., 2023) reviewed ESG ratings from 3 major providers (Moody’s Analytics, MSCI Inc., and Refinitiv), finding that “*well-rated companies do not emit significantly less carbon than those with lower scores*”.

(*ESG 浪潮反思：一問減碳表現優異、但產品有害健康的企業，符合 ESG 精神嗎？*, 2022) critiques leading ESG rating methodologies (e.g., MSCI, Sustainalytics), showing they assess a

company's ability to withstand ESG-related financial risk (not its actual environmental, social, or governance performance), allowing firms like Philip Morris, which joined the Dow Jones Sustainability Indices (DJSI) in 2020 despite selling 7 trillion cigarettes per year, to score highly, and calls for urgent re-calibration of these frameworks.

The lack of rigor is creating a backlash against ESG reporting. (C. Yu, 2021) reports ESG is filled with greenwashing. (*Anti-ESG Crusade in US Sweeps 15 States With More Laws in Works*, 2023) several US states are introducing regulation for ESG to curb greenwashing. (Frances Schwatzkopff, 2022a) suggests the ESMA and EU has strengthened legislation to counter ESG greenwashing. (Shashwat Mohanty, 2022) “sustainable funds don't buy Zomato's ESG narrative”. (Bindman et al., 2024) reports large ESG funds managed by BlackRock and Vanguard are investing into JBS, a meat-packing company which is linked to deforestation of the Amazon rainforest through its supply chain.

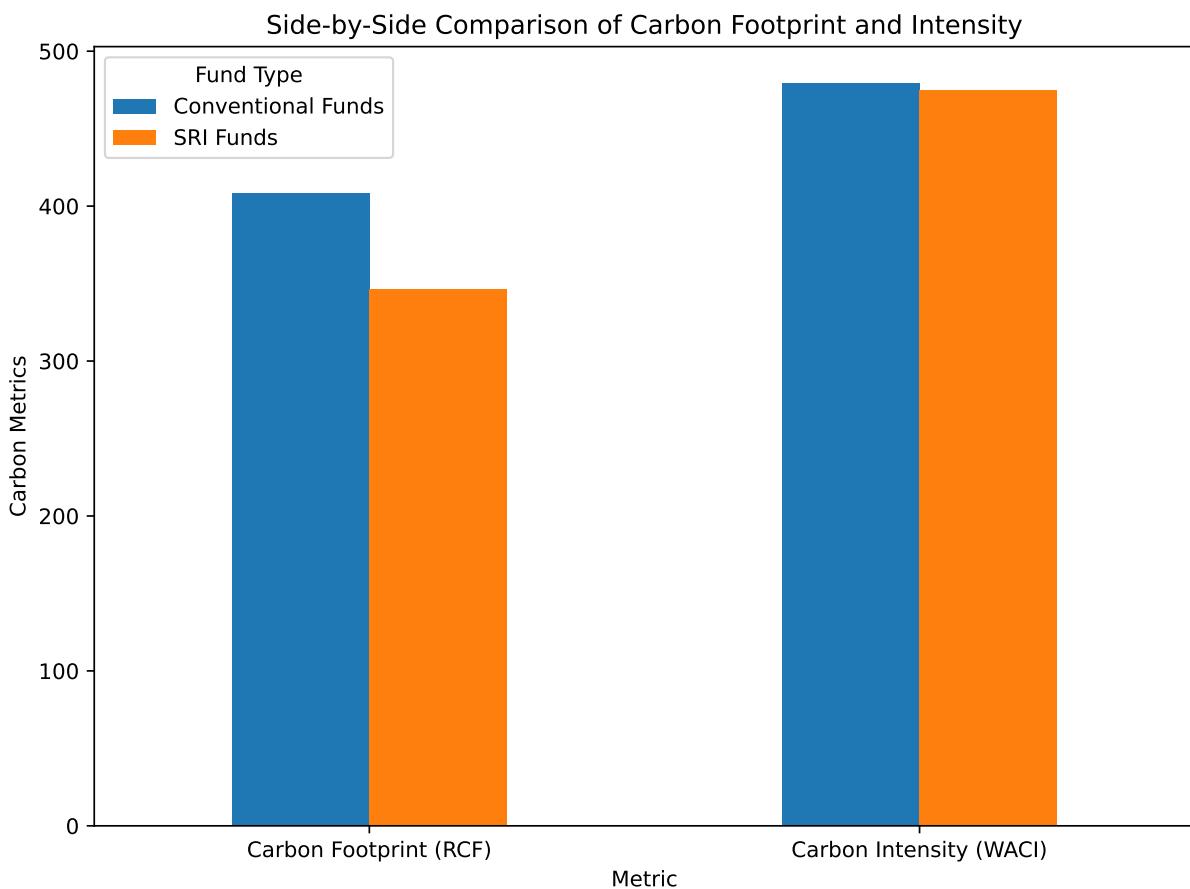


Figure 67: Conventional vs Socially Responsible Funds

(Sanjai Bhagat, 2022) argues that despite more than \$2.7 trillion in ESG-rated AUM as of December 2021, (assets under management, the total market value of all the investments including stocks, bonds, crypto, etc.), that investment managers are looking after on behalf of their clients (81% in Europe and 13% in U.S.), funds marketed as ‘sustainable’ fail to deliver im-

provements to environmental and social metrics; the inconvenient truth is that ESG ratings don't deliver better ESG performance. In the face a crisis of underperformance and mounting scandals, (James Phillipps, 2022) questions whether ESG is fundamentally broken or simply misunderstood. (PIETRO CECERE, 2023) calls ESG labeling confusing and arbitrary; fund selectors describe ESG labeling as "a total mess," pointing to confusing definitions, inconsistent methodologies, and overlapping ratings that undermine clarity. (*Financial Materiality Marks Next Big ESG Investing Battle*, 2023) argues that the main challenge in credible ESG investing is defining which sustainability factors are genuinely financially material; the market is confused by inconsistent scoring methods and needs more government-backed policies that create incentives to align short- and long-term risk assessments. ESG-activist Georgia Elliott-Smith argues in her TEDx talk that large corporations are using ESG for greenwashing - but not changing their fundamental polluting practices (TEDx Talks, 2022).

ESG gave banks a new tool to market and sell environmentally conscious opportunities to institutional investors, for example: universities. A case in point being the partnership between HSBC and the University of Edinburgh (Reid, 2020). Some banks even use tactics such as co-branding with famous individuals. One of the largest private banks in Switzerland, Lombard Odier & Co (LOIM), launched a thematic bio-economy fund marketed using the words of The Prince of Wales, "*Building a sustainable future is, in fact, the growth story of our time*" (Kirkakosian, November 16, 2020). Investment can also be advertised in media publications. In the United Emirates, the richest oil-drilling region in the world, Mubadala, one of the state-owned sovereign wealth funds of the government of Abu Dhabi with \$326 billion AUM, has taken out sponsored content in Bloomberg to market their national ESG vision and regulatory strategies to accelerate ESG investment growth toward net-zero goals, including many green energy projects; the Abu Dhabi funds together manage \$1.7 trillion AUM (Maccioni, 2025; *The Future of ESG Investing*, n.d.).

Yet, the question remains, whether one can trust financial professional to hold ESG to a high standard. (Agnew, 2022) Argues that ESG has become a diluted corporate marketing label nearing the end of its usefulness, and urges a pivot toward more substantive responsible-investment practices beyond ticking the ESG checkbox. Banks are hiding emissions related to capital markets, which is a major financing source for oil and gas projects; the Partnership for Carbon Accounting Financials (PCAF) working group voted to attribute only 33% of CO<sub>2</sub>eq emissions from bond and equity underwriting to their own financed-emissions footprints, effectively excluding and hiding 2/3 of their carbon emissions (T. Wilkes, 2023). In the U.S., Blackrock, the largest private investment fund in the world with \$10T USD under management, released guidance reflecting their plans to shift their investments to vehicles that are measured on ESG performance; however they later backtracked from their decision (Posner, 2024). In the U.K., while promising to become sustainable, oil companies are increasing production; Rishi Sunak, the Prime Minister of the UK at the time announced 100 new licenses for oil drilling (Noor, 2023). In a sense this strategy could be described as "have your cake and eat it too", with investing going to all types of energy, regardless of its environmental footprint.

In early 2025, ESG investing saw \$8.6 billion in global outflows, mainly due to political push-back in the U.S., including rollbacks of climate and DEI policies under the Trump administration.

U.S. sustainable funds lost \$6.1 billion, and Europe saw its first net outflow since 2018; ESG is shifting toward a more practical phase, with less focus on branding and more on measurable outcomes (Bioy, 2025; Johnson, 2025; Mitchell, 2025; Vosburg & Bioy, 2025).

### **11.2.2 Modern Slavery Persists and ESG Falls Short in Protecting Workers' Rights and Mitigating Environmental Harm**

In 2023, an estimated 50 million people were in slavery around the world; lack of supply chain visibility hides forced labor and exploitation of undocumented migrants in agricultural work; 71% of enslaved people are estimated to be women. (Borreli et al., 2023; Kunz et al., 2023). (Christ & V Helliar, 2021) estimates 20 million people are '*stuck inside corporate blockchains*'. The Global Slavery Index measures the considerable '*import risk*' of having slavery inside its imports (Walk Free, 2023). (Hans van Leeuwen, 2023) slavery affects industries from fashion to technology, including sustainability enablers such as solar panels. The International Labor Organization (ILO) estimates 236 billion USD are generated in illegal profits from forced labor (International Labour Organization, 2024). On the global level, the United Nations SDG target 8.7 targets to eliminate all forms of slavery by 2025 however progress has been slow (The Minderoo Foundation & Commonwealth Human Rights Initiative, 2020).

The California Transparency in Supply Chains Act which came into effect in 2012 applies to large retailers and manufacturers focused on pushing companies to eradicate human trafficking and slavery in their supply chains. Similarly, the German Supply Chain Act (Gesetz über die unternehmerischen Sorgfaltspflichten zur Vermeidung von Menschenrechtsverletzungen in Lieferketten) enacted in 2021 requires companies to monitor violations in their supply chains (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, 2023; Stretton, 2022b).

The Modern Slavery Act has been passed in several countries starting with the U.K. in 2015, yet commodification of human beings is still practiced worldwide (UK Parliament, 2024). (Mai et al., 2023) finds the quality of the reporting remains low among FTSE 100 (index of highly capitalized listings on the London Stock Exchange) companies. Not everyone is in favor of more stringent labor practices either. Voters in Switzerland rejected the responsible business initiative in 2020 while the country is a global hub for trading commodities. "*Switzerland has a hand in over 50% of the global trade in coffee and vegetable oils like palm oil as well as 35% of the global volume of cocoa, according to government estimates*" (Anand Chandrasekhar & Andreas Gefe, 2021) begging the question can Swiss traders have more scrutiny over what they trade.

Slavery is connected to environmental degradation, and climate change (Decker Sparks et al., 2021). Enslaved people are used in environmental crimes such as 40% of deforestation globally. Cobalt used in technological products is in risk of being produced under forced labor in the D.R. Congo (Sovacool, 2021). In India and Pakistan, forced labor in brick kiln farms is possible to capture remotely from satellite images (Boyd et al., 2018). In effect, the need for cheap labor turns slavery into a *subsidy* keeping prices lower, and environmental degradation happening.

While reducing slavery in the supply chain sets very low bar for ESG, another aspect of supply tracing is the treatment of workers and working conditions. Currently, one of the largest factory

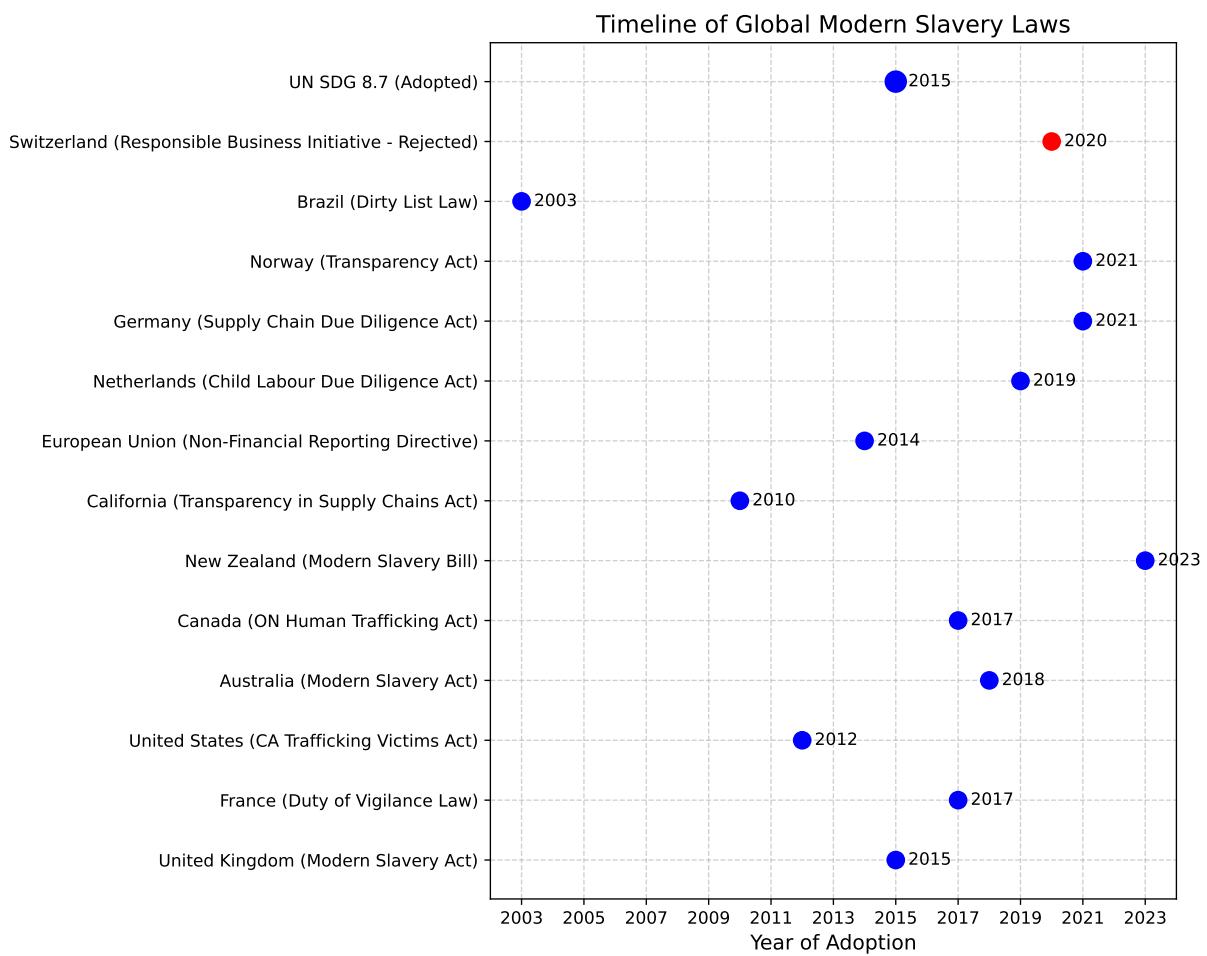


Figure 68: Slavery Laws

compliance platforms - Fair Factories Clearinghouse (FFC) - covers 149 countries with standardized auditing in the apparel and consumer goods industries, monitoring over 40 thousand workplaces and facilitating over 100 thousand workplace assessments by its members (*FFC - Fair Factories ClearingHouse - Compliance Solutions*, n.d.). At a similar scale, Sedex spans 170 countries (Novotny, 2025). Nonetheless, with so much auditing happening, there are still cases where people fall through the cracks. Another wave of companies that create “worker voice apps”, intend to “*give the supply chain a voice*” by connecting workers directly to the consumer (even if anonymously, to protect the workers from retribution), include CTMFile, Alexandria, and PrimaDollar (PrimaDollar Media, 2021; Tim Nicolle, 2021; *Worker Voice*, 2022). If people working at the factories can directly report working conditions to a safe and anonymous tool, it could serve as a data source for further investigation of labor issues. While there are certainly pitfalls to this approach, one could imagine assigning each factory a social score based on the S-band of their general ESG performance.

These issues do not pertain only to legacy industries. With the increase of gig-work, platform economy companies have been criticized for their lack of concerns for workers rights (S in ESG). In the absence of continuous assessment, sometimes intrepid journalists come in to cover the issues. One example is the coverage by (Siddiqui et al., 2024), using portable Atmotube Pro air pollution tracking devices (the same device I use myself) to document how gig workers across South Asia, from India to Bangladesh to Pakistan are subjected to pollution, finding PM2.5 exposure 10x over the WHO daily guideline, shortening lives (according to the Air Quality Life Index) by 11.9 years in New Delhi, 8.1 years in Dhaka, and 7.5 years in Lahore, respectively. Air quality varies dramatically between places, however taking the global average in 2022, if fine particulate pollution were reduced to meet the WHO guideline, a person would have gained 1 year and 11 months of life expectancy (Institute for Climate and Sustainable Growth, 2022).

The above charts shows a comparison of air quality trends in South Asia vs Taiwan; while air pollution has increased in India, Bangladesh, and Pakistan, Taiwan has returned to the pollution levels of 1990s.

### **11.2.3 Environmental, Social, and Corporate Governance: Criteria for a Shared Language**

Since the 1970s, international bodies, governments, and private corporations have developed sustainability measurement metrics, the prominent one being ESG (Environmental, Social, and Corporate Governance) developed by the UN in 2005. This rating system has already been implemented or is in the process of being adopted on stock markets all over the world and has implications beyond the stock markets, allowing analysts to measure companies’ performance on the triple bottom line: the financial, social, and environmental metrics.

Taiwan has listed ESG stocks since 2017 and was hailed by Bloomberg as a regional leader in ESG reporting (Grauer, 2017). In December 2017, the *FTSE4Good TIP Taiwan ESG Index* was launched, which tracks ESG-rated companies on the Taipei stock market (Taiwan Index, 2024). Nasdaq Nordic introduced an ESG index in 2018, and Euronext, the largest stock market

## PM2.5 Trends: India, Bangladesh, Pakistan, Taiwan (1998–2022)

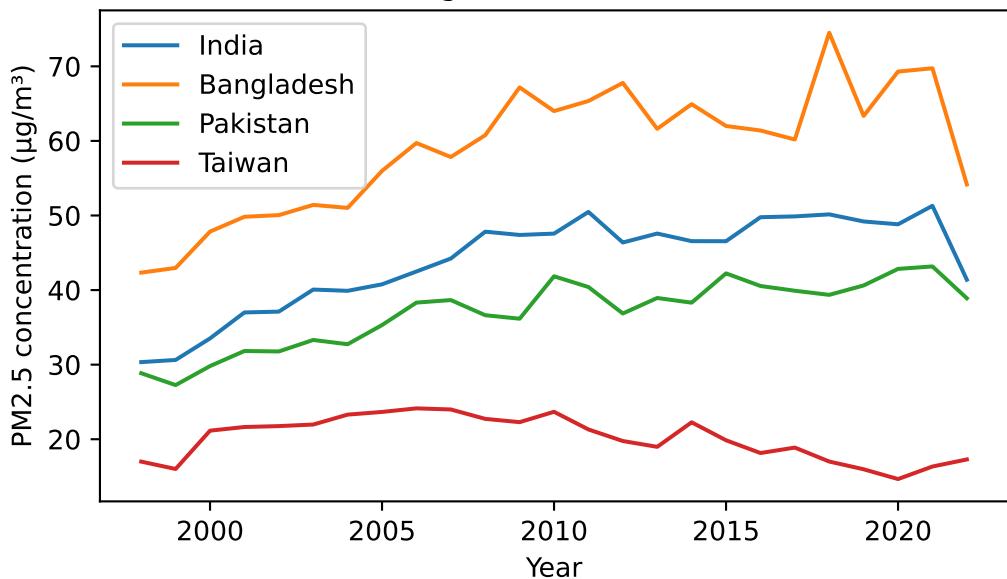


Figure 69: Air Quality in Taiwan vs South-East Asia

in Europe, introduced an ESG index and a series of derivative instruments in the summer of 2020 (Euronext, 2020).

(*The Importance of ESG Measurement and Canada’s Opportunity for Improvement*, 2022) suggests ACWI ESG leaders outperform the non-ESG screened ACWI based on comparing MSCI indexes. It’s notable that ACWI ESG started to outperform the traditional ACWI only in the past few years (evidence that capital markets are starting to price sustainability, but still inconsistently). Nordic Climate Transparency Leadership analysis of Nasdaq OMX Nordic 120 companies: “*companies with higher quality climate reporting also provide higher returns*”. In contrast, (D. Luo, 2022) found firms with a lower ESG score are more profitable.

### 11.2.4 Towards Green Transparency - But Who Does the Rating?

Trucost, a company launched in 2000 to calculate the hidden environmental costs of large corporations and advance circular-economy practices was acquired in 2016 by S&P Dow Jones Indices, which by 2019 became a part of its ESG product offering (Indices, Oct 03, 2016, 08:30 ET; Mike Hower, Dec 9, 2015 7am EST; *S&P Rolls Out Trucost ESG Data to Its Customers*, 2019; Toffel & Sice, 2011). Its parent company S&P Global also acquired RobecoSAM’s ESG rating business, consolidating S&P’s control of ESG ratings (George Geddes, 2019).

A meta-review of 136 research articles discovered the following ESG-rating agencies.

Three frameworks for corporate to think about ESG compliance is to position their company on the MEET, EXCEED, and LEAD scale based on the size, complexity and available resources of the company.

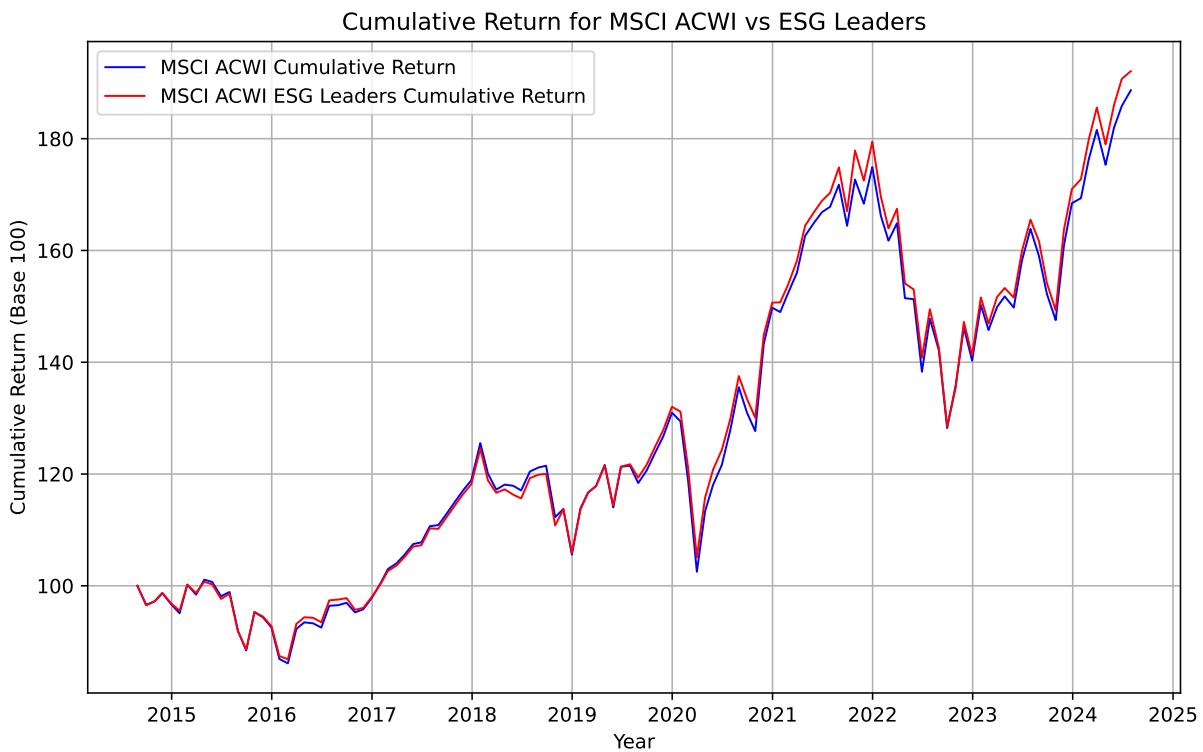


Figure 70: ESG Funds vs Non-ESG Funds

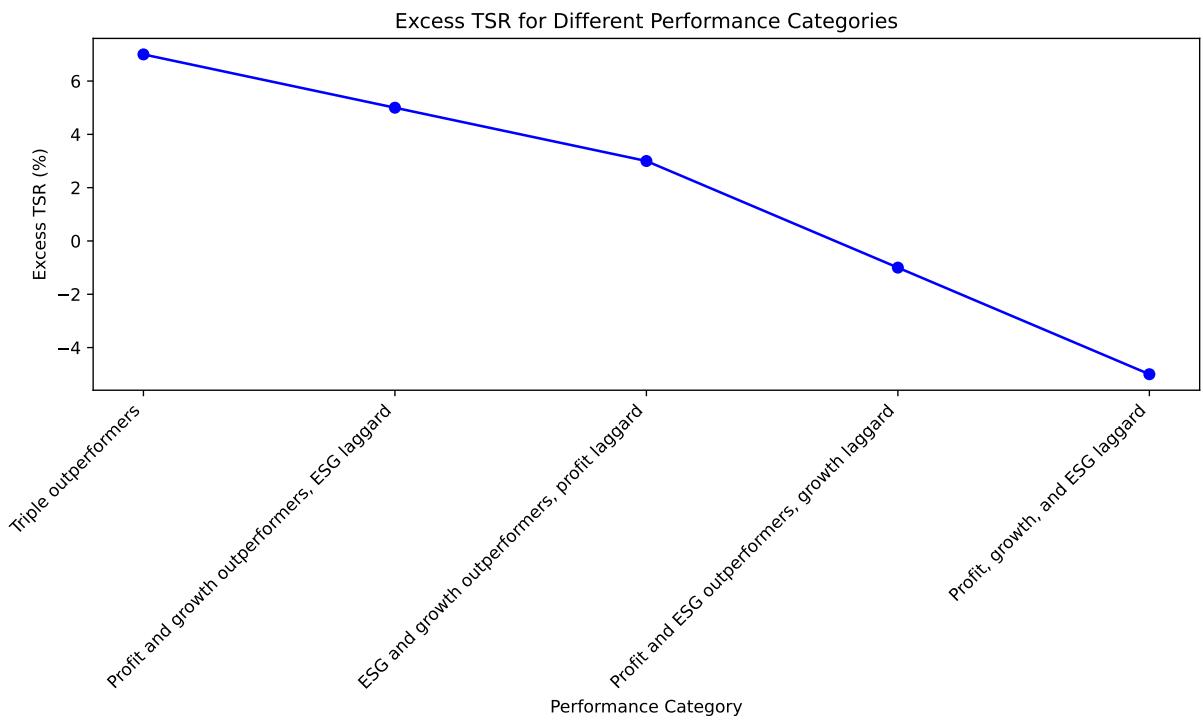


Figure 71: Company Performance

### Distribution of Providers used among the Selected Articles

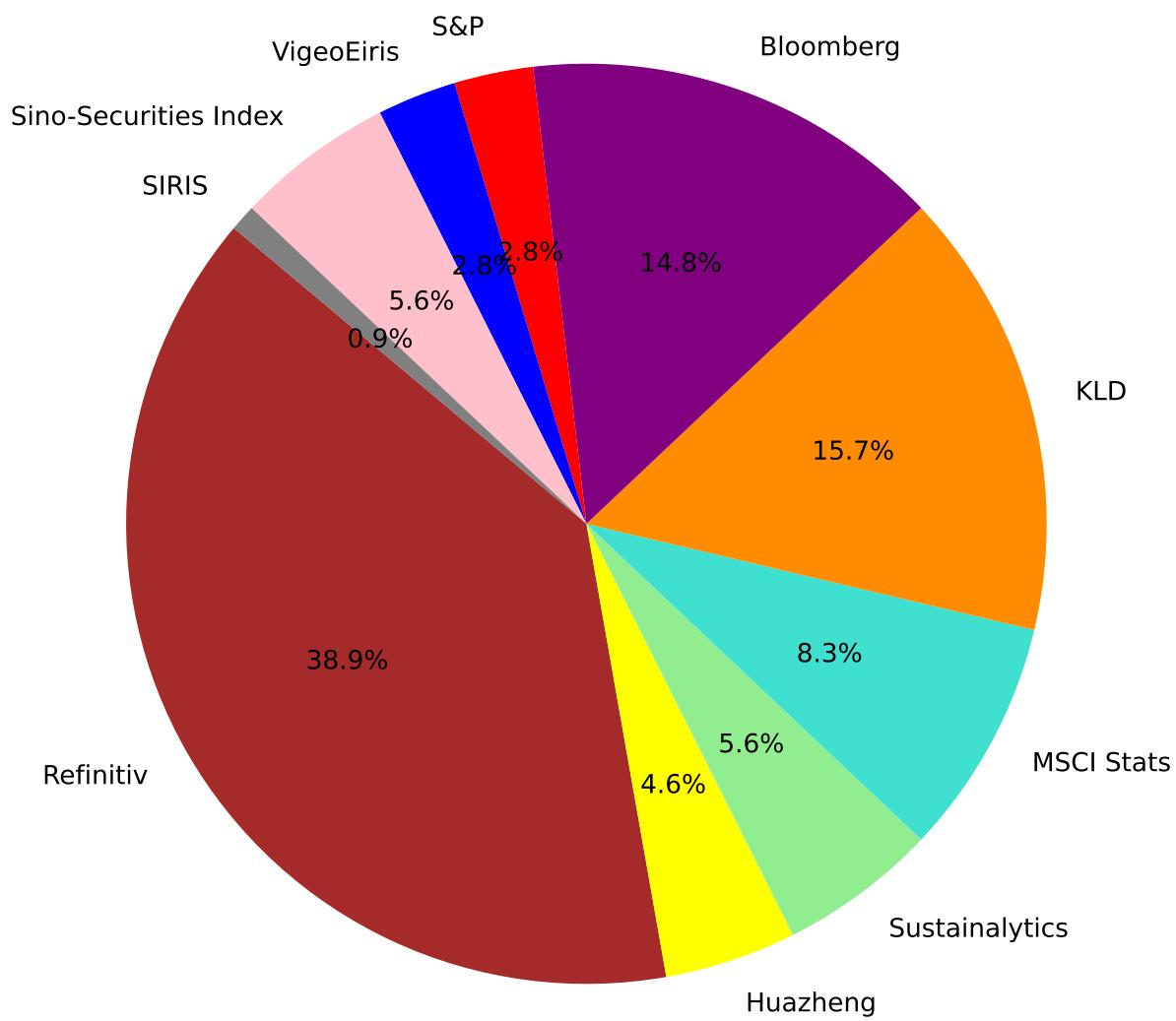


Figure 72: ESG Rating Agencies

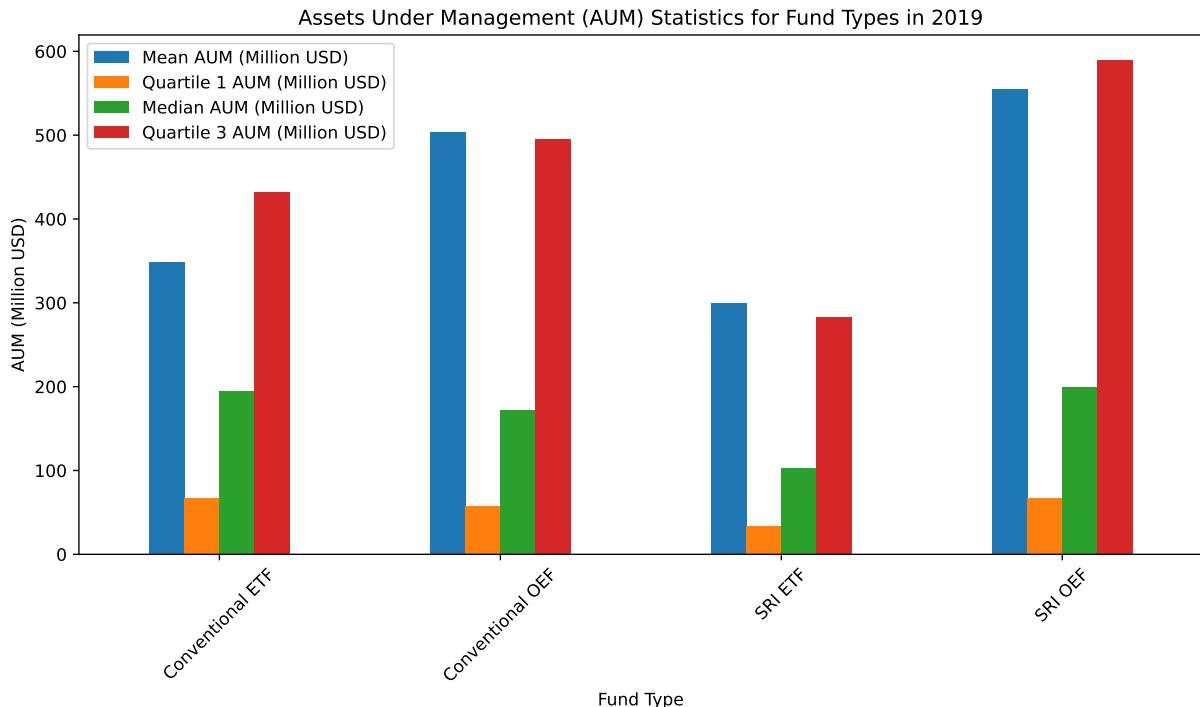


Figure 73: Types of Investment Funds

Robeco's survey of 300 large global investors totaling \$27T under management found biodiversity-protection is increasingly a focus-point of capital allocation (Robeco, 2023).

#### 11.2.5 ESG Success Depends on Good Governance: Boards, Policy, and Investor Pressure

Governance in ESG is the G that makes E and S happen - or put in another way: governance drives social and environmental initiatives at companies. Yet MSCI research finds company boards severely lacking in climate experts; among the 164 large CO<sub>2</sub>eq emitters (1986 directors in total) benchmarked by the Climate Action 100+ alliance, 65% have no board member with demonstrated climate expertise, highlighting a major governance gap (Climate Action 100+, 2023; Sommer et al., 2024).

Table 70: Climate Experts on Company Boards

Region	Companies (n)	≥ 1 Climate Expert (%)	≥ 1 Expert (count)	No Experts (%)	No Experts (count)
<b>EMEA</b>	52	48 %	25	52 %	27
<b>Americas</b>	61	36 %	22	64 %	39
<b>APAC</b>	51	20 %	10	80 %	41

Most companies do not meet the criteria (Climate Action 100+, 2023).

Lack of leadership is a key challenge for sustainability. (Capgemini, 2022) “*Many business leaders see sustainability as costly obligation rather than investment in the future*” was the finding from the Capgemini Research Institute’s report “Why sustainability ambition is not translating to action” surveyed 2,004 executives from 668<sup>218</sup> large organizations; 53% of leaders view sustainability initiatives as a financial burden, believing the costs outweigh the benefits, and only 21% agree that the business case for sustainability is clear, underscoring a pervasive leadership gap that treats sustainability as a costly obligation.

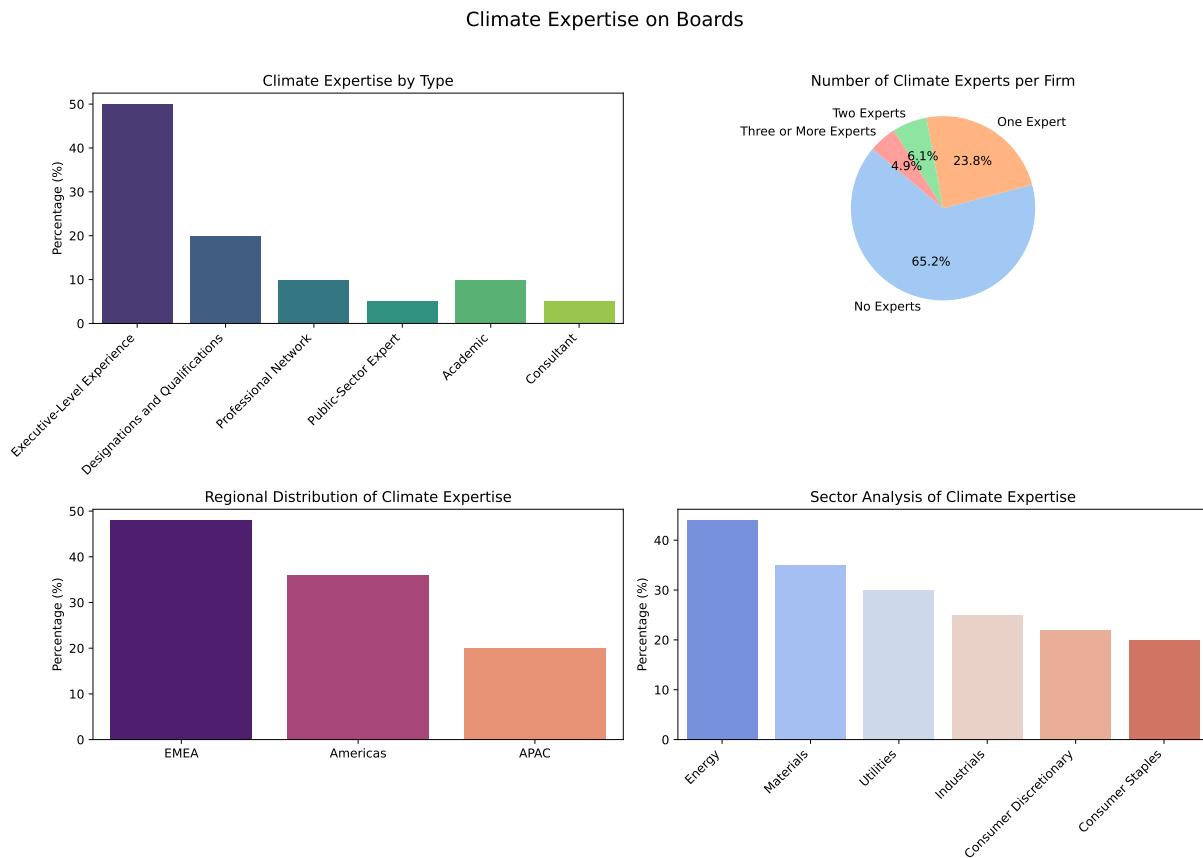


Figure 74: Lack of Board Members With Sustainability Expertise

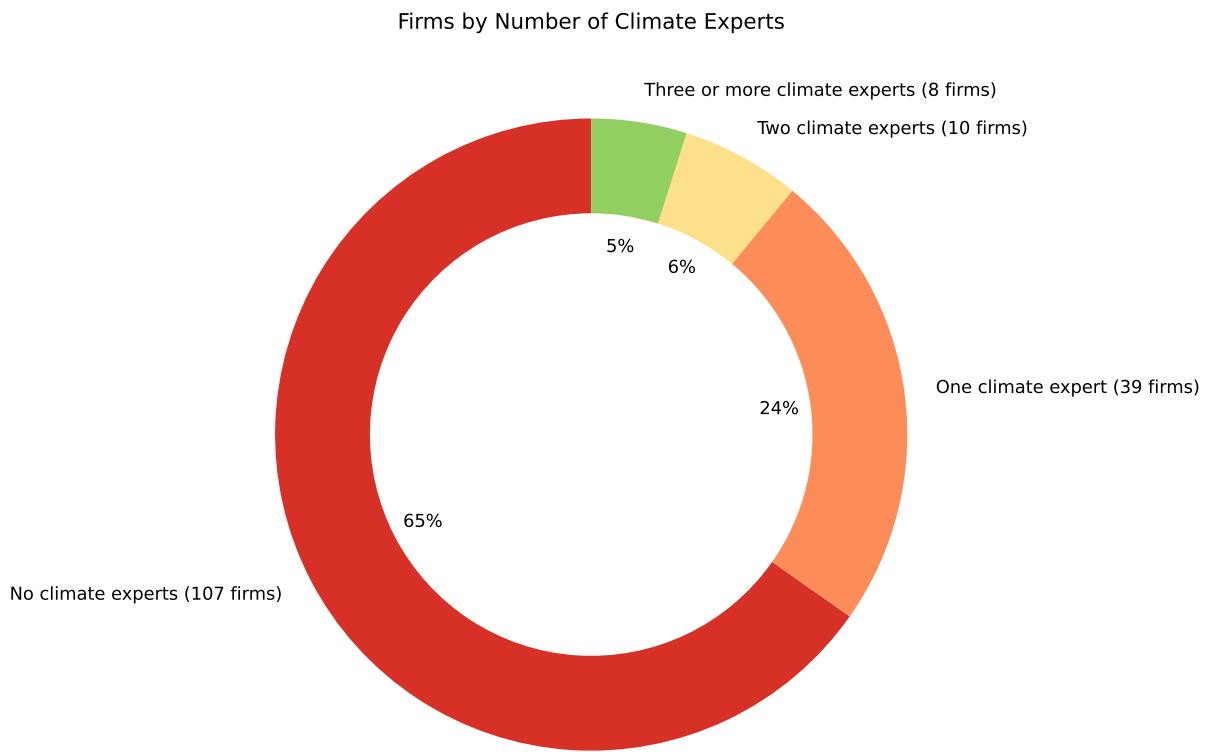


Figure 75: Large Carbon Emitters Lack Sustainability Experts

### Overall Accounting and Audit Assessment

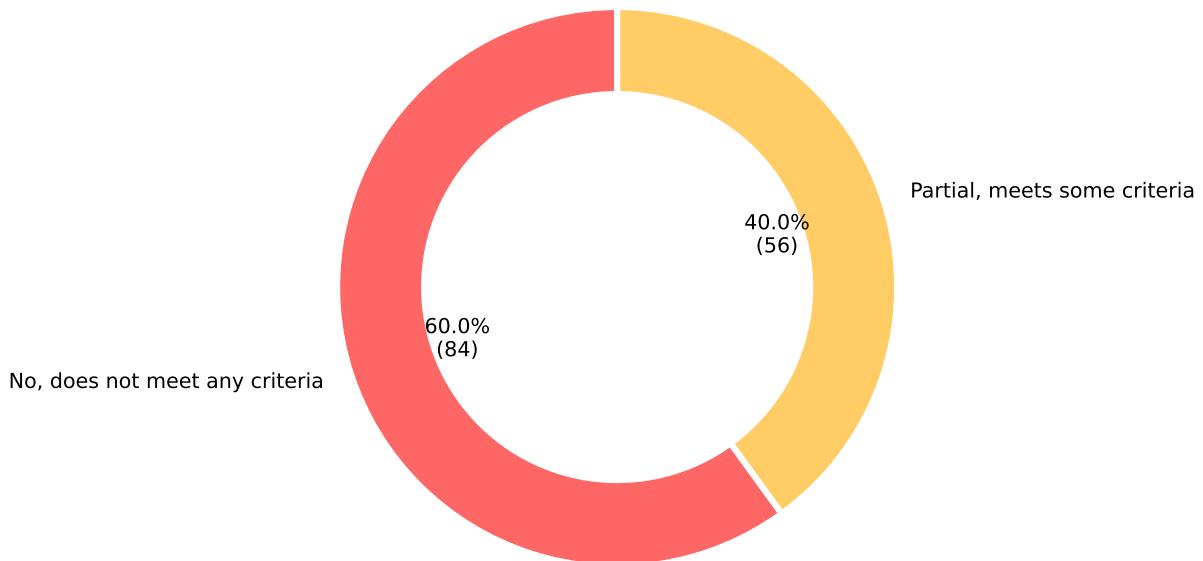


Figure 76: Large Carbon Emitters Do Not Meet Sustainability Criteria

(Break Free From Plastic, 2024; Simões-Coelho et al., 2023). Large corporations such as Coca-Cola and Nestle also support the biodiversity law, calling for a level playing field for business to limit biodiversity risk (Greens EFA, 2023).

Many large businesses have tried to find solutions by launching climate-focused funding. (Korosec, 2021) reports that Amazon's 2B USD to a Climate Pledge Fund earmarked to fix climate problems is invested in energy, logistics, and packaging startups, which will reduce material waste. "Good intentions don't work, mechanisms do," Amazon's founder Bezos is quoted as saying in (Clifford, 2022). Walmart is taking a similar approach, having launched a project in 2017 to set CO<sub>2</sub> reduction targets in collaboration with its suppliers (Walmart, 2023). These examples underline how money marketed as climate funding by retail conglomerates means focus on reducing operational cost of running their business through automation and material savings.

Shareholders can leverage their numbers and join forces in order to affect the board members of large corporations. For example, the As Your Sow NGO aims to champion CSR through building coalitions of shareholders and taking legal action, including the Fossil Free Funds initiative which researches and rates funds' exposure to fossil fuels finance and its sister project *Invest in Your Values* rates retirement plans offered by employers (mostly US technology companies) (As You Sow, 2024a, 2024b).

Board diversity in the top 5 sustainable companies in 2024 based on Corporate Knights rankings

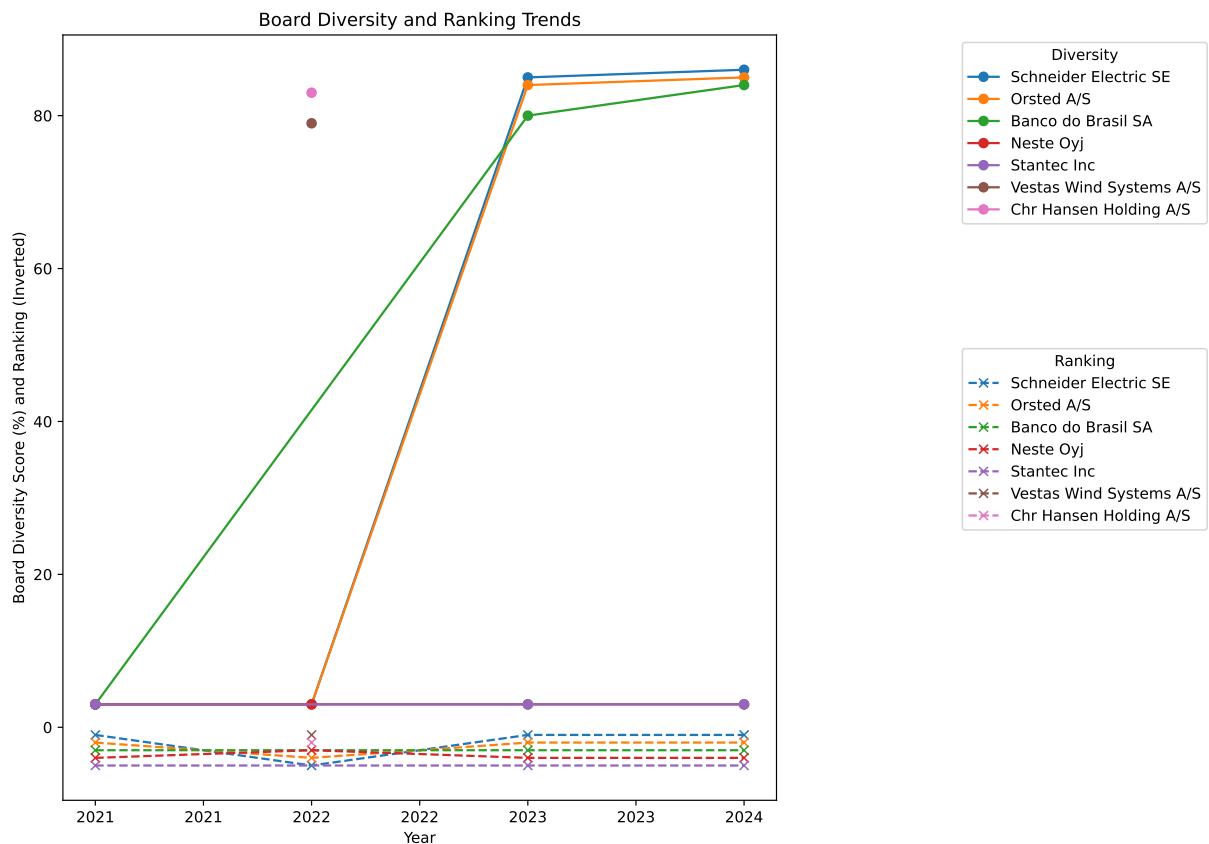


Figure 77: Board Diversity

(Corporate Knights, 2024).

### 11.2.6 ESG Success Depends on Digitization and GenAI

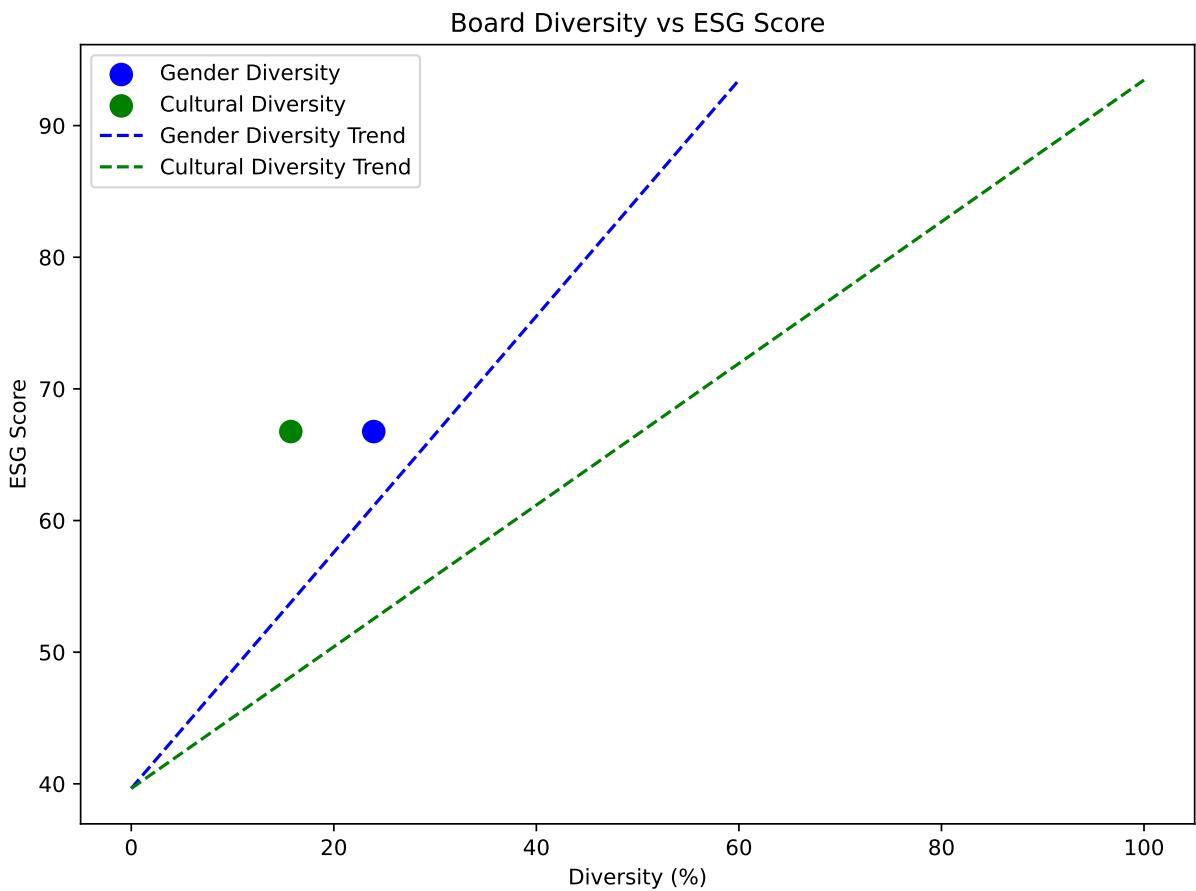
In the U.S. and European banking sector (Dicuonzo et al., 2024) performed an analysis of 1551 banks, of which only 180 banks disclosed sufficient ESG data for comparison, building a *Fintech Adoption Index*; the key findings included a positive correlation between Fintech Index and ESG Scores, suggesting the adoption of technology has a statistically significant influence on better environmental stewardship, social and governance quality. Even better predictors of a high ESG score were Board Gender Diversity (Women on Board), the Size of the Bank, and Board Independence (governance structures with more independent directors could be more socially and environmentally responsible).

The ability to build sustainability into the organization requires deep understanding of how the complex structure works and what drives change and innovation within business units. (Jim Boehm et al., 2021) distilled key strategies from the banking sector to speed up digital transformation, while improving risk management and compliance (see table below).

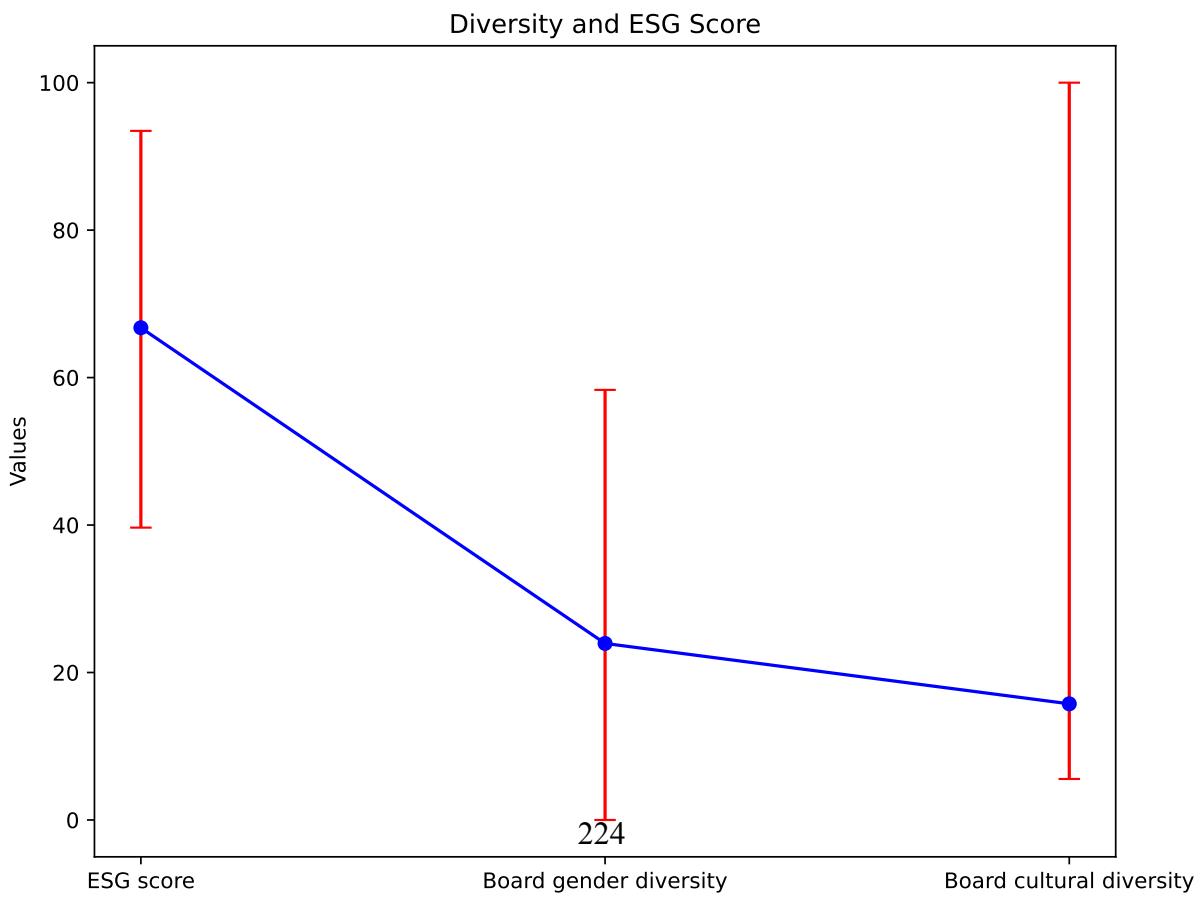
Table 71: Banking transformation strategies from (Jim Boehm et al., 2021)

Strategy	Description
Enterprise-level Risk Taxonomy	A unified classification system that defines and categorizes all risk types across the entire organization.
Embedded Controls in Agile Delivery	Risk-and-compliance integration directly into agile development sprints (a type of management style in building software) to catch issues as code is written.
Cross-functional Risk–Business Collaboration	Joint ownership of risk by compliance teams and business units, ensuring controls are practical and business-aligned.
Metrics-driven Monitoring	Continuous tracking of key risk indicators through quantifiable metrics to spot trends and trigger alerts.
Proactive Remediation	Early detection and rapid resolution of control defects before they escalate into larger compliance or security gaps.
Continuous Capability Building	Ongoing training and tooling updates; best-practice sharing to keep risk-management skills and processes current.

These banking transformation strategies sit alongside strict regulatory requirements, such as Know Your Customer (KYC), and emerging technologies like generative AI, which is already reshaping compliance workflows. (Rahul Agarwal et al., 2024) details how genAI is being used for the purposes of compliance and *comprehensive risk assessment* in modern banking.



(a) Simplified comparison chart for board diversity (gender and cultural) vs ESG score



(b)

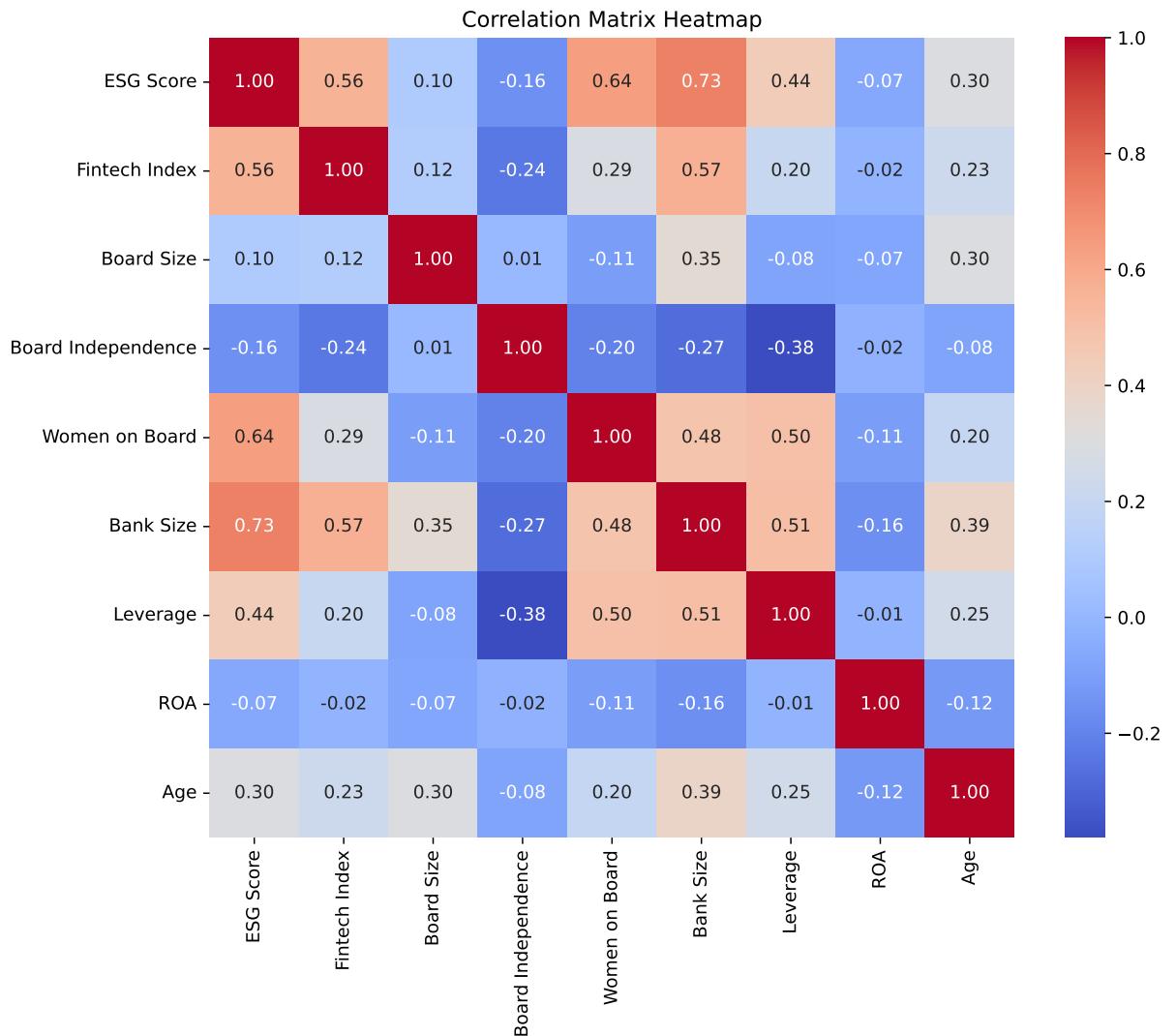


Figure 79: Fintech Adoption Predicts Higher ESG

Table 72: GenAI usage for comprehensive risk management from cyber- to climate threats in modern banking as per (Rahul Agarwal et al., 2024).

GenAI Use Case	Description
Regulatory Compliance	Automate policy-document triage: draft regulatory-change summaries and flag emerging rules, then generate compliance manuals.
Financial Crime	Generate suspicious-activity reports; streamline AML/KYC checks; identify anomalous transaction patterns.
Credit Risk	Synthesizing credit-risk reports on demand by pulling together relevant financial data from a variety of sources, resulting in faster borrower risk assessments.
Analytics and Modeling	Build and validate risk models; run scenario analysis; summarize complex data sets for insights.
Cyber Risk	Monitor threat-intelligence feeds; draft incident-response reports; automatically search for, and possibly even patch security gaps.
Climate Risk	Distill lengthy climate-scenario reports; visualize key metrics; accelerate enterprise-level climate-risk assessments.

In the context of China’s industrial modernization, (Lu & Li, 2023) finds that *digitization* is the pathway to increased Environmental Information Disclosure (EID) and Green Innovation, correlating with increased numbers of green patents and sustainable R&D projects.

While ESG is riddled with problems, it has started a *common language* - the advice consultancies are providing to banks make use this common language to help banks to sell strategical alignment for long-term institutional sustainability in terms of environmental, social, and governance performance. PWC suggests “*asset managers educate their staff and client base. It will be critical to build stronger ESG expertise among their employees by up-skilling existing staff on ESG principles and strategically scout for and integrate more diverse and ESG-trained talent*” (PWC, 2020).

In general, a futures contract is an agreement to buy or sell a market index at a fixed price on a set date, locking in today’s price for the future. The exchange’s clearinghouse guarantees the trade, so one doesn’t have to worry about the other side not honoring the deal. ESG futures specifically, are financial derivatives, standardized contracts, which allow investors to hedge or speculate on the future performance of ESG-compliant investments. Some ESG futures contracts include the E-mini S&P 500 ESG futures (on the Chicago Mercantile Exchange, a large derivatives exchange), which track the U.S. S&P 500, while skipping companies with poor ESG scores, letting one bet on or hedge “sustainable” American companies with large market capitalization; notably, the index has recently been renamed to S&P 500 Scored & Screened Index, without a specific mention of the acronym ESG, while keeping the methodology unchanged, presumably for marketing purposes in the changing political landscape (CME Group, 2025). In Europe, the STOXX Europe 600 ESG-X futures (on the Eurex stock market) let one trade Europe’s top ESG-screened companies, with cash settlement and the same margin rules as regular (non-ESG) index futures (Deutsche Börse Group, 2025; Harding, 2019). Globally, the MSCI Sustainability

and Climate Change futures (on the Intercontinental Exchange) cover global and regional ESG benchmarks, allowing one to take a position on low-carbon or Paris Climate Agreement-aligned stock indices anywhere in the world (Intercontinental Exchange, 2025). The CFI2Z4 Carbon Emissions Futures tool tracks live coverage of ICE EU Allowance futures priced in EUR per tonne, with real-time quotes as well as historical charts, enabling traders to monitor and analyze the compliance-phase carbon market (Investing.com, 2024). Specifically in Taiwan, the FTSE4Good TIP Taiwan ESG futures (on TAIFEX, Taiwan Futures Exchange), launched in June 2020 to follow a basket of Taiwanese stocks that meet global ESG standards (TAIFEX, 2025).

### **11.2.7 ESG Accessibility: Curbing Corruption with Real-time Data Streams and Product Lifecycle Traceability**

For AI-powered assistants to be able to provide guidance, metrics are needed to evaluate sustainable assets, and ESG provides the current state-of-the-art for this. The largest obstacle to eco-friendly investing is greenwashing where companies and governments try to portray an asset as green when in reality it's not. A personal investing assistant can provide an interface to focus on transparency, highlighting data sources and limitations, to help users feel in control of their investment decisions, and potentially even provide large-scale consumer feedback on negative practices.

However, fundamentally, unless there is significant headway in curbing greenwashing, companies today use ESG as a marketing tool - but it could achieve much more. One of the key emerging issues is that ESG is an annual report not real-time, actionable data. (Sahota, 2021) argues that “[T]hanks to other emerging technology like IoT sensors (to collect ESG data) and blockchain (to track transactions), we have the infrastructure to collect more data, particularly for machine consumption. By measuring real-time energy usage, transportation routes, manufacturing waste, and so forth, we have more quantifiable ways to track corporations' environmental performance without relying purely on what they say.”

For corporations to respond to the climate crisis, they are expected to become more digital and data-driven. Requirements for ESG compliance has given rise to a plethora of new monitoring tools. There's a growing number of companies helping businesses to measure CO<sub>2</sub>eq emissions in through their entire product lifecycle. In order to improve product *provenance*, blockchains offer transparency. Several enterprise blockchain offerings from vendors such as Hyperledger Fabric and ConsenSys use immutable supply - chain ledgers to record origin, certifications, and product movements end - to - end (*Blockchain Companies Team Up To Track ESG Data*, 2021). Blockchain's immutable data and programmable incentives enable transparent ESG tracking, secure carbon - credit registries and tokenized rewards that align corporate behavior with climate goals (Ganu, 2021). Sourcemap's *supply chain mapping* platform provides tooling to *know your suppliers' suppliers*, monitoring every tier of company supply chains, continuously collecting and checking the integrity of supplier data, using 3-party registries and watchlists, real-time transaction traceability, creating an audit trail for instantly detecting fraud or non-compliance with effective regulations and due-diligence laws (Sourcemap, 2025). The

founder of Sourcemap, Leonardo Bonanni, started out with doing product autopsy in 2015 to assess product sustainability (« *Fast fashion* », 2023).

(Ratkovic, 2023; Tim Nicolle, 2021) believe that real-time ESG data is more difficult to green-wash, because the supply chain data is a significant source of ESG content; a fundamental breakthrough would be surfacing real-time ESG data directly to individual consumers browsing products - be it in physical shops or online, - allowing customers to judge if they want to purchase from this business. (*Real Time ESG Tracking From StockSnips*, 2021) built a tool - called Stocksnips - to turn unstructured news into daily ESG sentiment signals, starting with about 1000 companies; the sentiment signal shows significant correlation with expert ratings, offering an automated forward-looking gauge of corporate ESG performance. Likewise, LSEG's MarketPsych ESG Analytics platform mines global news and social feeds for near - real - time controversy alerts and ESG risk - scores with historical data going back to 1998 (LSEG, 2025). Envify aims to automate compliance with the Corporate Sustainability Reporting Directive (CSRD), by providing a suite of carbon accounting tools (Rajan, 2025). Flowit Estonia automated real - time CO<sub>2</sub>eq accounting in 2022 by combining invoices and sensor data to generating instant per - transaction emission footprints (Indrek Kald, 2022). A startup called Makersite proposes instant sustainability impact from supply chain, deep supply-chain data can surface product-level environmental footprints in minutes instead of months, which they call “*Product Lifecycle Intelligence*” (Kyle Wiggers, 2022). More recently, Makersite has updated the language they use for promoting their product, now calling it *Product Sustainability Modeling* (Makersite, n.d.). Apart from product level analytics, there’s sustainability data on source raw materials. CarbonChain rolled out asset-level emissions ratings for individual mines: covering metals including steel, aluminium, nickel, and copper - so product developers can benchmark material sources’ carbon intensity against industry averages (CarbonChain, n.d.).

## 11.3 Payments

### 11.3.1 Consumer Activists are a Small Minority

Recognition precedes protection, as the Estonian slogan goes: “*Õpetame märkama, et oskaksime hoida*” / “*Learn to notice so we can preserve.*” (Tartu loodusmaja, 2019). (Milne et al., 2020) coins the term *mindful consumers*, who do research and are aware of the impact of their shopping choices. Yet these types of *mindful consumers* and *conscious consumers* only make up a small percentage of the entire consumer public, which may make individual action seem close to meaningless.

For consumer activism to become mainstream it needs to much simpler. Sustainable options must become effortless: we need one-click tools that turn everyday spending into votes for circular design, transparent supply chains and mandatory climate disclosures. By setting clear CO<sub>2</sub>-reduction targets for products, embedding dynamic ESG-risk pricing at point of sale, and harnessing our collective purchasing power, we can push companies to embed sustainability at the core of business, transforming vague ESG ideals into tangible market incentives.

There is plenty of research on if and how sustainable shopping could be possible. Already in 2016, (Klinglmayr et al., 2016) proposed a mobile app to channel “political consumerism” into sustainable shopping through self-regulation: personalized recommendations could be provided by aggregating vast product datasets into distilled advice, empowering individuals follow clear sustainable-shopping rules, discover like-minded peers, and communicate concerns directly to retailers, in theory turning vague ESG ideals into a transparent, data-driven, community-backed approach to sustainable consumption - however the Horizon 2020-funded was only deployed in 2 supermarkets (Estonia and Spain) as a pilot project. In order to understand the needed changes to shopping, (Fuentes et al., 2019) employed a shopping-as-practice ethnography in a Swedish zero-waste grocery store to show that removing packaging requires reinventing the shopping practice itself, e.g. introducing reusable containers, new retail setups, and consumer routines. (Weber, 2021) proposed a sustainable shopping guide in a study which demonstrates that embedding eco-score rankings into a mobile shopping app significantly increases consumers’ selection of low-impact food products by improving decision support and reducing information overload. Consumer psychology is complex and (van der Wal et al., 2016) discusses how status motives make people publicly display sustainable behavior, revealing that shoppers purchase branded reusable bags rather than bring their own, exposing a “paradox of green to be seen” and its hidden environmental costs.

Sustainable consumption relationships in Europe.

Make use of indexes to compare companies.

### **11.3.2 Shopping’s Environmental Footprint: Increasingly Driven by Digital Platforms, Social Commerce, AI Assistants**

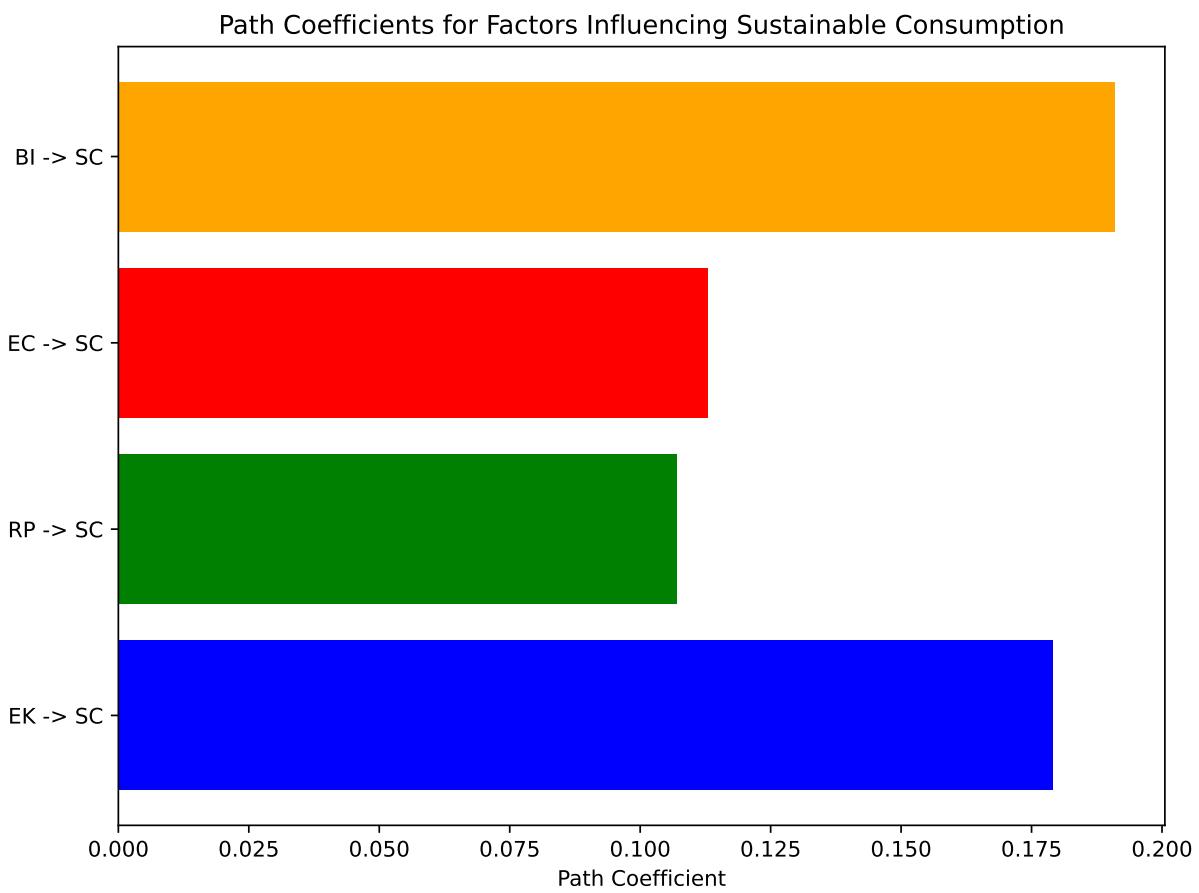
It may seem impossible to turn the tide of consumerism, given the projected growth in online shopping, Single’s day, etc. (Forrester, 2024). However, importantly - more and more consumers are using AI assistants to find alternative products, make shopping lists, which may have an effect on *what type* of products are bought (Neuron, 2025; Pandya, 2025; Pastore, 2025)

Double Eleven 11/11 celebrated on November 11 is the world’s largest shopping festival (時代財經, 2023). In June 2023, 526 million people watch e-commerce live-streams in China; online bargaining is a type of ritual (Shiyu Liu et al., 2024). According to (Igini, 2024b) “*Asia is set to account for 50% of the world’s total online retail sales*”. (The Influencer Factory, 2021) China is the furthest ahead in *social shopping*, the Chinese and U.S. market may be mature and growth will come from emerging markets (SEA, Latin-America).

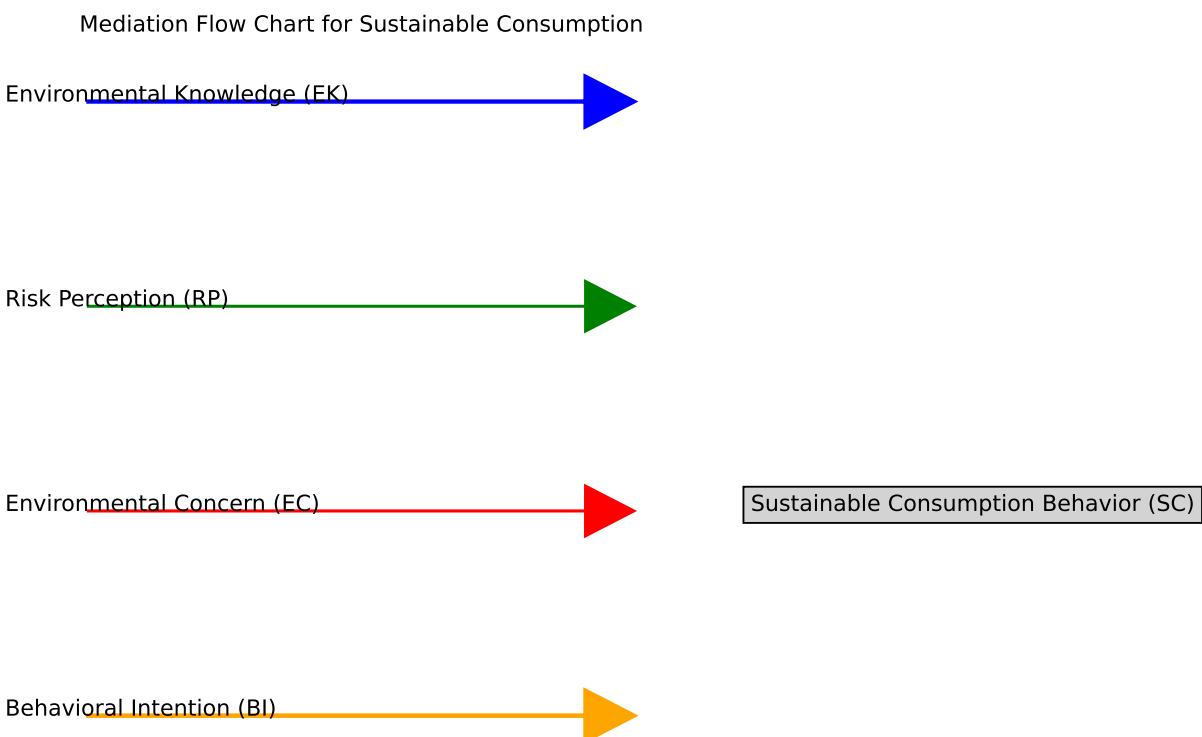
In the US, TikTok is the leader in social commerce (Loyst, 2024).

### **11.3.3 The Evolution of Payments: The Entry Point for Personal Finance from Mobile Wallets to Buy Now Pay Later (BNPL) Services - Globally, and In Taiwan**

Payments is one way consumers can take individual climate action. In the words of a Canadian investment blogger, “*every dollar you spend or invest is a vote for the companies and their*



(a) Sustainable Consumption



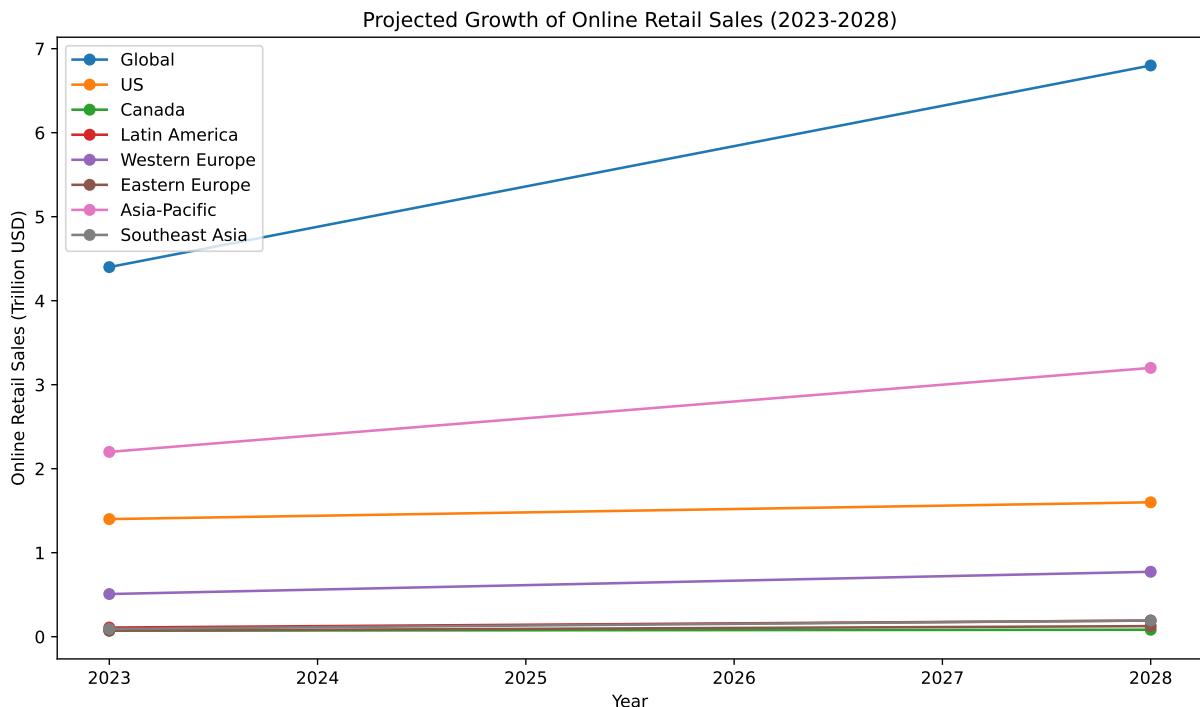


Figure 81: Growth of Consumerism

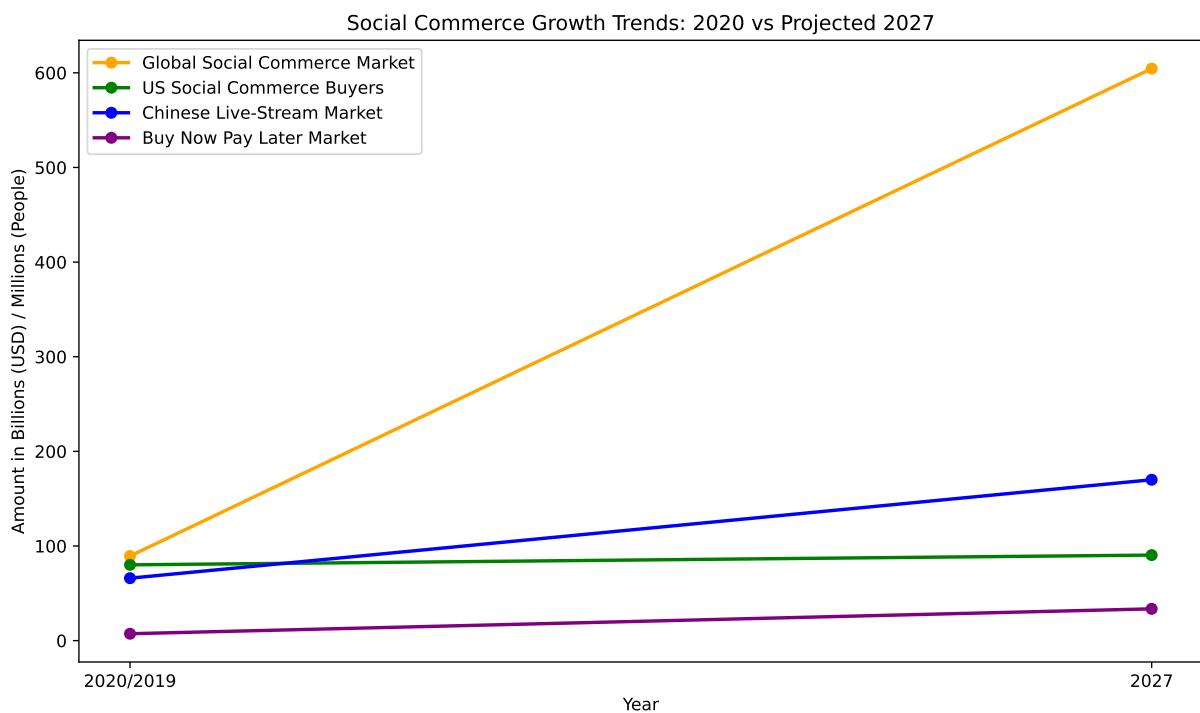


Figure 82: Social Commerce

*ethical and sustainability practices*" (Fotheringham, 2017). The combination of consumption and investment is an access point to get the consumer thinking about investing. Even if the amount is small, they are a starting point for a thought process.

Table 73: Comparing Payments Apps; Data compiled from (Focus Taiwan, 2025; PXPay Plus, n.d.; Taiwan News, Mar. 14, 2025 11:31)

Payment App	Features	Users in Taiwan	Origin
<b>LINE Pay</b>	Most popular payment app accepted all over Taiwan. Works stand-alone and inside the LINE messenger. Supports both in-store and online shopping payments, also direct P2P transfers to contacts (requires LINE Bank). Displays a map of its merchant network with discounts and coupons; integrates iPASS MONEY.	> 12 Million	Japan / Korea
<b>JKOPay (街口支付)</b>	QR code payments and P2P transfers to contacts; paying for bills.	> 7 Million	Taiwan
<b>Taiwan Pay (台灣Pay)</b>	Official Taiwanese Government app in collaboration with Taiwanese banks. Supports payments directly from bank accounts (without the need for a card). Supports QR code payments, P2P transfers to contacts and paying bills. A unique feature is cash withdrawal from ATMs without the need for a bank card.	> 6 Million	Taiwan
<b>Apple Pay</b>	Requires an Apple iOS device; uses credit/debit cards via NFC, Secure, In-app & web payments	?	USA
<b>Google Pay</b>	Supports NFC and credit/debit cards, in-app and online payments as well as public transport.	?	USA

Payment App	Features	Users in Taiwan	Origin
<b>iPASS MONEY (一卡通 MONEY)</b>	Digital version of the iPASS card which can be used for QR code payments, P2P transfers to contacts, paying bills and public transport.	?	Taiwan
<b>E.Sun Wallet (玉山 Wallet)</b>	Requires the Taiwanese E.Sun Bank and allows QR payments, P2P transfers to contacts and paying bills as well as financial management tools.	?	Taiwan
<b>Pi Wallet (Pi 拍 錢包)</b>	Payment app by the PChome online shop supporting in-store QR and online payments, and paying for bills a parking.	?	Taiwan
<b>PXPay (全聯福利 中心)</b>	Payment app by PX Mart, the largest domestic Taiwanese supermarket chain, supporting QR code payments, offering rewards and discounts and loyalty plans. Recently expanded to Korea quoting the interest of Taiwanese young people in Korean culture. <b>In early 2025, PXPay began offering a saving and investing service called “Digital Hen” in collaboration with J.P Morgan Asset Management.</b> According to the press release, the service aims to be a beginner-friendly financial innovation helping shoppers get into micro-investing.	?	Taiwan
<b>Hami Pay (中華 電信)</b>	Payment app by the largest phone company Chunghwa Telecom supporting NFC payments, public transport, and paying bills.	?	Taiwan

Payment App	Features	Users in Taiwan	Origin
<b>Samsung Pay (悠遊卡)</b>	Requires a Samsung device; uses NFC; integrates EasyCard and credit/debit cards; supports public transport.	?	Korea

Banks and fintechs both are skilled at capturing user data and digital payments are an important entry point for financial services and a source of consumer action data, shopping data. Payments is the primary way consumers use money. Is there a funnel From Payments to Investing? ESG Shopping is about Changing our relationship with money. Make commerce more transparent. Current shopping is quite superficial. One barely knows the name of the company. You don't know much about their background. Building consumer feeling of ownership, create meaningful connections between producers and consumers.

Digitalization of payments creates lots of Point of Sale (PoS) data that's valuable to understand what people buy. Banks have access to each person's financial habits which makes it possible to model sustainable behavior using big data analysis. Asian markets have shown the fastest growth in the use of digital payments (McKinsey, 2020). In Macao, contactless payments are becoming the most prevalent form of value exchange, growing rapidly, up 40% from the prior year (*Contactless Payments Prevalent in Macau - City's de Facto Central Bank*, 2023). In Europe, fintech is also one of the fastest-growing sectors, with 35% of the fintech ecosystem is made up by giants like Klarna, Checkout.com and Revolut and 65% belonging to newcomers; in general describe equally strong consumer uptake and friendly regulators (*The European Fintechs to Watch in 2022*, 2022). With the increasing number of financial services available, open banking initiatives, which set standards for financial data sharing, have the potential to improve the user experience by allowing people to access their data across all the different banking apps they use, seamlessly and securely, which improves the flow of the entire customer journey.

(Green Finance Platform, 2020) report predicts the rise of personalizing sustainable finance, because of its potential to grow customer loyalty, through improving the user experience. Similarly to good design, interacting with sustainable finance for the 'green-minded' demographics, providing a reliable green product is a way to build customer loyalty. The UN has been handing out Global Climate Action Awards since 2011 for idea such as the Climate Credit Card in Switzerland, which automatically tracks emissions of purchases, creates emissions' reports for the user which can then be offset with investments in climate projects around the world (UNFCCC, 2023a).

Sustainability data is an important part of the customer journey which digitalization and digital transformation make increasingly accessible. Digital receipts are one data source for tracking one's carbon footprint. In Taiwan, O Bank makes use of Mastercard's data to calculate each transaction's CO<sub>2</sub> emissions and offer Taiwanese clients "*Consumer Spending Carbon Calculator*" and "*Low-Carbon Lifestyle Debit Card*" products (*Taiwan's O-Bank Launches 'Consumer Spending Carbon Calculator,' Rewards Carbon Reduction*, 2022). This is based on technology

by Mastercard, which has developed a white-label service for sustainability reports that banks can in turn offer to their clients (Mastercard, 2021). Similarly, Commons, formerly known as Joro, an independent app, analyses one's personal financial data to estimate their CO<sub>2</sub> footprint (Chant, 2022). ReceiptHero's digital-receipt platform records the CO<sub>2</sub>eq footprint for each purchase, turning every transaction into a data point for tracking individual emissions, promoting eco-awareness (*Digital Receipts and Customer Loyalty in One Platform | ReceiptHero*, n.d.). Another example is the Dutch fintech company Bunq offers payment cards for sustainability, provided by MasterCard, which connects everyday payments to green projects, such as planting trees and donations to charities within the same user interface (Bunq, 2020). However, arguably this could be considered greenwashing as Bunq only plants 1 tree per every € 1,000 spend with a Bunq card. The example marketed at students cites *8 trees planted this month* while students scarcely would have € 8,000 to spend every month.

Sharing a similar goal to Alibaba's Ant Forest, Bunq's approach creates a new interaction dynamic in a familiar context (card payments), enabling customers to effortlessly contribute to sustainability. However, it lacks the level of gamification which makes Alibaba's offering so addictive, while also not differentiating between the types of purchases the consumer makes, in terms of the level of eco-friendliness.



Figure 83: Bunq promises to combine banking and eco-friendly actions in the same user interface - yet is this greenwashing?

In Nigeria, (Emele Onu & Anthony Osae-Brown, 2022) reports how in order to promote the eNaira digital currency use, the Nigerian government limited the amount of cash that can be withdrawn from ATMs "*In Nigeria's largely informal economy, cash outside banks represents 85% of currency in circulation and almost 40 million adults are without a bank account.*" [E-Naira find papers]

In Kenya, M-Pesa started since 2007 for mobile payments, used by more than 80% of farmers (Parlasca et al., 2022; Tyce, 2020). Using digital payments instead of cash enables a new class of experiences, in terms of personalization, and potentially, for sustainability. Buy Now Pay Later (BNPL) is the biggest consumer payments / financing success story innovated by Klarna in Sweden in 2005 and Afterpay in Australia in 2015 but with roots in Layaway Programs created during the 1930's US Great Depression (Kenton, 2023). By 2021, 44.1% of Gen-Z in the US had used BNPL according to (EMarketer, 2021). Users in the Gen-Z demographic mostly use BNPL to buy clothes (LHV, 2024).

People will be more likely to save and invest if it's easy. In Sweden, point of sales (PoS) lending (BNPL, as introduced above) is a common practice, and one of the reasons for the success of Klarna, the Swedish banking startup, which has managed to lend money to more consumers than ever, through this improved user experience. Taking out loans for consumption is a questionable personal financial strategy at best. Yet, if people can loan money at the point of sales, why couldn't there be 180 degrees opposite service - point of sales investing? And there is, called "round-up apps". (Next Generation Customer Experience, n.d.) suggests "*Targeted at millennials, Acorns is the investing app that rounds up purchases to the nearest dollar and invests the difference.*" - and example of From Shopping to Investing. Likewise, many banks have started offering a service to automatically save and invest tiny amounts of money collected from shopping expenses. Every purchase one makes contributes a small percentage - usually rounded up to the nearest whole number - to one's investment accounts. For example, (Swedbank, 2022), the leading bank in the Estonian market, offers a savings service where everyday payments made with one's debit card are rounded up to the next Euro, and this amount is transferred to a separate savings account. Similarly, the Estonian bank (LHV, 2020) offers micro-investing and micro-savings services, with an interesting user experience innovation showing how for an average Estonian means additional savings of about 400 € per year. User experience innovation can improve accessibility and financial inclusion, while opening up a new market which used to be underserved. For example, (Y Combinator, 2023) launched a bank inside of Whatsapp for the underbanked gig workers in Latin America.

While the financial industry is highly digitized, plenty of banks are still paper-oriented, running digital and offline processes simultaneously, making them slower and less competitive, than startups. Indeed, the new baseline for customer-facing finance is set by fintech, taking cues from the successful mobile apps in a variety of sectors, foregoing physical offices, and focusing on offering the best possible online experience for a specific financial service, such as payments.

Traditional banks and fintechs are becoming more similar than ever. 39% of Millennials are willing to leave their bank for a better fintech (n = 4282); innovation in payments helps retention (PYMNTS, 2023). The European Central Bank describes fintech as improving the user experience across the board, making interactions more convenient, user-friendly, cheaper, and faster. "Fintech has had a more pronounced impact in the payments market [...] where the incumbents have accumulated the most glaring shortcomings, often resulting in inefficient and overpriced products," Yves Mersch, Member of the Executive Board of the ECB says in (European Central Bank, 2019).

There are also people who are concerned with digital payments. There are concerns digital cur-

rencies also help to “*democratize financial surveillance*”. China was a money innovator introducing paper money in the Tang Dynasty (618-907 AD) (*First Paper Money*, n.d.). Jeff Benson (2022) is troubled by the “use the e-CNY network to increase financial surveillance” (*Central Bank Digital Currency (CBDC) Tracker*, 2023) believes digital currencies make tracking easier. Economist Eswar Prasad argues that the era of “private” cryptocurrencies is coming to an end down as they’ll be supplanted by government-backed central bank-issued digital currencies that marry blockchain’s efficiency with legal oversight (MARISA ADÁN GIL, 2022). The same author compares WeChat, Alipay vs the digital yuan (Yahoo Finance, 2022).

There are many *neobanks*, or challenger banks, far too many to list. The table only includes a small sample of banks and the landscape is even larger if one includes the wider array of fintechs. Neo-banks often use sustainability marketing. Legendary investor Warren Buffett’s company Berkshire Hathaway invested \$1 Billion USD in Nubank, Brazilian digital challenger Bank, while reducing its stakes in Mastercard and Visa, signaling growing faith in digital banking platforms over traditional card-issuers (Andrés Engler, 2022).

The following popular (totaling millions of users) robo-advisory apps combine sustainability, personalization, ethics, and investing however, they are mostly only available on the U.S. market.

Table 74: Comparing Investing Apps; Data compiled from (Lightyear, n.d.; Monzo, 2023; *Mos - The Money App for Students*, n.d.; *Nubank - Finalmente Você No Controle Do Seu Dinheiro*, n.d.; *Selma – Your Finances Done Right*, n.d.; *Ziglu | The Fast, Simple Way to Buy and Sell Crypto, with No Hidden Fees.*, n.d.).

Service	Features	Availability
Goodments	Matching investment vehicles to user's environmental, social, ethical values	USA
Wealthsimple	AI-assisted saving & investing for Millennials	USA, UK
Ellevest	AI-assisted robo-advisory focused on female investors and women-led business	USA
Betterment	AI-assisted cash management, savings, retirement, and investing	USA
Earthfolio	AI-assisted socially responsible investing	USA
Acorns	AI-assisted micro-investing	USA
Trine	Loans to eco-projects	USA
Single.Earth	Nature-back cryptocurrency	Global
Grünfin	Invest in funds	EU
M1 Finance	Finance Super App	US
Finimize	Investment research for anyone	US
NerdWallet	Financial clarity all in one place	US
Tomorrow Bank	Green Banking	EU
Marcus Invest	Robo-Advisor	US
Chipper	Digital cash app for African markets	Africa

Lightyear	Simple UI for Stocks, ETFs, interest from Estonia	EU
Ziglu	UK simple investing app	UK
Selma	Finnish investing app	EU
Monzo	Bank	UK
Nubank	Bank	Brazil
EToro	Investing and copy-investing	EU
Revolut	From payments to investing	UK, EU
Mos	Banking for students	US
Robinhood	Investing	US
Mintos	Buy bonds and loans	EU

Becoming a major payments player requires navigating the maze of global directives, including legislation regarding finance, privacy, data protection, money laundering, localized licensing regimes, and more. For an example, Google Wallet’s privacy notice sheds some light on how a unified payments profile links services under one’s Google account while following its broader data - use policies (Google, 2025).

Alipay is by far the largest payments super-app and provides two investment services within it’s payments platform, first launching Yu’e Bao (餘額寶) in 2013, which automatically invests small amounts on the users’ accounts for returns typically above those of traditional banks’ saving accounts, and later in 2015 Ant Fortune (螞蟻財富), offering access to thousands of investment products from partner companies (KraneShares, 2020). Alibaba owns over 30% of Alipay and both companies are pushing for increased use of AI within their services (“Chinese Billionaire Jack Ma Sees AI Future for Ant Group, in Rare Appearance,” 2024).

Similarly, both Line, through it’s Line Pay, Line Securities, and Line Bank, and Naver, though Naver Pay, have been on a path for several years evolving into comprehensive financial platforms (Anna J. Park, 2023; LINE Corporation, 2019). None of these payment apps have a specific focus on sustainability while Alipay does have a separate sustainability-focused service called Ant Forest for planting trees. Payment apps created by Apple and Google are less-feature rich focusing on payments only, and are being challenged by newcomers. An Australian fintech Douugh released it’s robo-advisor in 2024 (Paul, 2024). Douugh’s tagline explain the ethos of a unified financial app simply: “*One app to spend and grow your money*”. The newest generation of robo-advisors are integrating large-language modules, for example Reuters highlights the Chinese brokerage firm Tiger Brokers as one among 20 Chinese companies integrating DeepSeek deeply into asset management from simple chat functionality all the way to executing trades.

### **Established Consumer Payment Giants**

Table 75: Established consumer payment giants, none of which has a specific sustainability focus.

Service	Features	Users	Investing	Savings	Shopping (Payments)
Alipay	Payments, banking, Yu'e Bao, Ant Fortune investing	1.3 billion	Yes	Yes	Yes
WeChat Pay	Payments, financial services, Licaitong investing	900 million	Yes	No	Yes
Apple Pay	Contactless payments	744 million	No	No	Yes
PhonePe	Payments, mutual funds, digital gold	590 million	Yes	Yes	Yes
Paytm	Payments, banking, Paytm Money for stock & fund investing	350 million	Yes	Yes	Yes
Google Pay	Payments, loyalty, transit	150 million	No	No	Yes
Samsung Pay	Mobile payments	?	No	No	Yes
Zelle	Bank-to-bank P2P payments	?	No	Yes	Yes
Nubank	Full features of a traditional bank in a digital form	?	No	Yes	Yes

## Growth Companies

For human psychology, the fact that money on a Wise account will accrue value while on Monese

it's just static, immediately makes Wise more attractive, even if the amounts are small.

Table 76: Growth companies in fintech, none has a sustainability focus.

Service	Features	Availability	User Base	Investing	Savings	Shopping (Payments)
Venmo	P2P payments, crypto investing	USA	70 million	Yes	No	Yes
Cash App	P2P payments, stock & Bitcoin investing	USA, UK	57 million	Yes	No	Yes
Chime	Online banking services including spending accounts, savings accounts	USA	22 million	No	Yes	Yes
MoneyLion	Banking, investing, credit-building loans, financial tracking tools	USA	20 million	Yes	Yes	Yes
NerdWallet	Financial clarity all in one place	USA	19 million	No	No	Yes
SoFi	Loans, banking, robo-investing, stock & crypto	USA	10 million	Yes	Yes	Yes

Service	Features	Availabil- ity	User Base	Investing	Savings	Shopping (Payments)
Albert	Budgeting, saving, spending, investing, access to financial advisors	USA	10 million	Yes	Yes	No
Acorns	AI-assisted micro- investing	USA	5.7 million	Yes	No	No
Wealth- simple	AI-assisted saving & investing for Millennials	Canada, USA, UK	2.6 million	Yes	Yes	No
Qapital	Saving and investing with gami- fication features	USA	2 million	Yes	Yes	No
M1 Finance	Finance Super App	USA	1 million	Yes	No	No
Finimize	Investment research for anyone	Global	1 million	Yes	No	No
Robinhood	Investing	US	?	Yes	No	No
Betterment	AI-assisted cash man- agement, savings, retirement, and investing	USA	?	Yes	Yes	No
Revolut	From payments to investing	UK, EU	?	Yes	No	TRUE
Monzo	Bank	UK	?	No	Yes	No
eToro	Investing and copy- investing	EU	?	Yes	No	No

Service	Features	Availabil- ity	User Base	Investing	Savings	Shopping (Payments)
Marcus Invest	Robo- Advisor	USA	?	Yes	No	No
Varo Bank	Online banking services including checking and high-yield savings	USA	?	No	Yes	Yes
Stash	Micro- investing platform enabling small in- vestments	USA	?	Yes	No	No
Mint (Ceased operations)	Budgeting tools, bill tracking, free credit score monitoring	USA	?	No	No	No

### Up-and-Coming Startups

Table 77: Among up-and-coming startups there are some examples of sustainability-focused apps.

Service	Features	Avail- ability	User Base	Investing	Savings	Shopping (Pay- ments)	Sustain- ability Focus
Chipper Cash	Digital cash app for African markets	Ghana, Nigeria, Uganda, USA	?	No	No	Yes	No

Service	Features	Avail-ability	User Base	Investing	Savings	Shopping (Pay-ments)	Sustain-ability Focus
Douugh (Merged with Good-ments)	AI financial wellness app, smart account, saving tools	USA, Australia	?	Yes	Yes	Yes	No
DUB	Copy-trading, mirror trades of notable figures	USA	1 million down-loads	Yes	No	No	No
Earthfo-lio	AI-assisted socially responsi-ble investing	USA	?	Yes	No	No	Yes
Ellevest	AI-assisted robo-advisory focused on female investors and women-led business	USA	?	Yes	No	No	No

Service	Features	Avail-ability	User Base	Investing	Savings	Shopping (Pay-ments)	Sustain-ability Focus
Good-ments (Merged with Douugh)	Matching investment vehicles to user's environmental, social, ethical values	USA	?	Yes	No	No	Yes
Grünfin (Ceased operations)	Invest in funds	EU	?	Yes	Yes	No	No
Lightyear	Simple UI for Stocks, ETFs, interest from Estonia	EU	?	Yes	No	No	No
Mintos	Buy bonds and loans	EU	?	Yes	No	No	No
Mos	Banking for students	US	?	No	Yes	Yes	No
Selma	Finnish investing app	EU	?	Yes	No	No	No
Single.Earth	Nature-backed crypto-currency	Global	?	Yes	No	No	Yes
Tomorrow Bank Trine	Green Banking Loans to eco-projects	EU	120,000	No	Yes	Yes	Yes
		USA	?	Yes	No	No	Yes

Service	Features	Avail-ability	User Base	Investing	Savings	Shopping (Pay-ments)	Sustain-ability Focus
Ziglu	UK simple investing app	UK	?	Yes	No	No	No

Considering AI assistant for ESG investing, (G. K. S. Tan, 2020) proposes “*financial ecologies*” to understand the dynamic relationships between various actors: investors, advisors, government, where the government plays an active role in growing financial inclusion and responsible financial management; however, the paper further suggests that current robo-advisors (available in Singapore) make the investor captive to the agency of AI, making the person lose agency over their financial decisions.

#### 11.3.4 The Psychology Saving: Anthropomorphism and Loyalty Schemes

There are at least two ways to look at sustainable savings, however related. In general, people will save nature if it also saves money. This section looks at savings in the *financial* sense of the word. Savings in the sense of CO<sub>2</sub>e emission and environmental cost reductions have an entire separate chapter dedicated to them titled ‘*sustainability*’ however a short definition might be valuable here as well.

*Environmental Savings* means “*the credit incurred by a community that invests in environmental protection now instead of paying more for corrective action in the future*” (see Yale Center for Environmental Law & Policy, 2018) and (*Yale, Princeton, Stanford, MIT and Vanderbilt Students Take Legal Action to Try to Force Fossil Fuel Divestment - The Washington Post*, n.d., p. 33).

Savings in CO<sub>2</sub>e equivalent emissions: CO<sub>2</sub>e savings are the amount of CO<sub>2</sub>e reduction one manages to achieve by changing one’s behavior and influencing others (people, companies). While the individual footprint is so small, the largest reduction will come from influencing large groups of people, either by leadership, role-model, or other means.

In theory, ethical savings accounts only finance businesses aligned with the customers’ values: screening out problematic and potentially harmful industries such as fossil fuels, tobacco, weapons, etc.; in practice, one should carefully evaluate a bank’s investment principles, environmental policies and governance practices (*Ethical Savings*, 2023).

Pension funds are some of the largest asset holders and choosing where to invest one’s pension can be a sustainable financial action. College students might not have a pension fund yet, however their financial savvy will influence their choices in the future. Savings and investing are somewhat conflated because the large majority of savings that people have are invested by their banks. Thus, the question of *sustainable savings* comes one of where exactly are they invested

and what is the impact of that investment of sustainability. Savings are the money one has in a pension fund or managed by themselves. For the majority of people, savings are invested by the bank and make up the largest proportion on investments for the people who are not active investors themselves. However, there are cases where people manage their pensions themselves; for example due to a law change Estonian could take out their entire accumulated pension and invest or spend them however they wanted (Raido Tõnisson, 2022b). While many Estonians used the money for consumption, some people invested their retirement funds in crypto(Marten Põllumees, 2022).

Saving precedes investing. From building loyalty to building ownership, the first step towards investing is to start saving money. How to encourage savings in daily life and make it a part of the everyday payments experience? Even starting with a small step, gathering a small target amount per month for savings, has the potential to shift the user's way of thinking about money. The second step, choosing where to invest these savings, will help us begin thinking like an investor. To start noticing trends and looking into how finance shapes the world. One experimental study showed people think about putting money in a “safe” place and *money anthropomorphism* increased saving behavior by 18% (L. Wang et al., 2023). Mobile money users are better at saving (Naito et al., 2021). Nerdwallet’s (Tommy Tindall, 2023) suggests making *financial commitments* instead of resolutions, in order to successfully save money.

Help consumers save money and business increase repeat business. Building customer loyalty is a key part of repeat business and financial predictability for any company. Large consumer brands like Starbucks have for long ran successful rewards programs that encourage customers to come back (Steinhoff & Zondag, 2021). Could loyalty schemes create a pathway to investing in the company to strengthen the feeling of connection with the business even further? After all, I’m now a minority owner! Yet in practice, many consumers lack the financial literacy for investing and there are many legislative difficulties for turning loyalty points into investments. It’s easier instead to create a separate cryptocurrency or token program which users could collect and redeem for some benefit.

Table 78: Example sustainable loyalty schemes

Company	Scheme
<b>Patagonia</b>	“Worn Wear” program
<b>H&amp;M</b>	Garment Collecting program
<b>The Body Shop</b>	Return, Recycle, Repeat

Loyalty schemes can take a physical form. In Malaysia, Beebag shopping bags made of recycled plastic bottles with a NFC chip that works in conjunction with an app to provide rebates for customers (The Green Factor, 2022).

### 11.3.5 Sustainable Investing: Measuring the Eco-Investment Gap

By the latest estimates sustainability lacks several trillions of USD in investment. Even with massive financing already in the pipeline, the estimate for the global *financing gap* for low-carbon energy production was 5.2 trillion USD as of 2016 (Earth Day, 2023; *Mapping the Gap*, 2016). Ray Dalio puts the needed climate investment at \$5T and believes these financial goals won't be met (Ray Dalio, 2023). A newer United Nations Environmental Programme (UNEP) calculation lowered the world needs an additional 4.1 Trillion USD of financing in nature-based solutions by 2050 to meet climate change, biodiversity, and land degradation reduction targets (UNEP, 2022). According to (The Rockefeller Foundation, 2022) a slightly lower 2.5-3.2 Trillion USD would be sufficient.

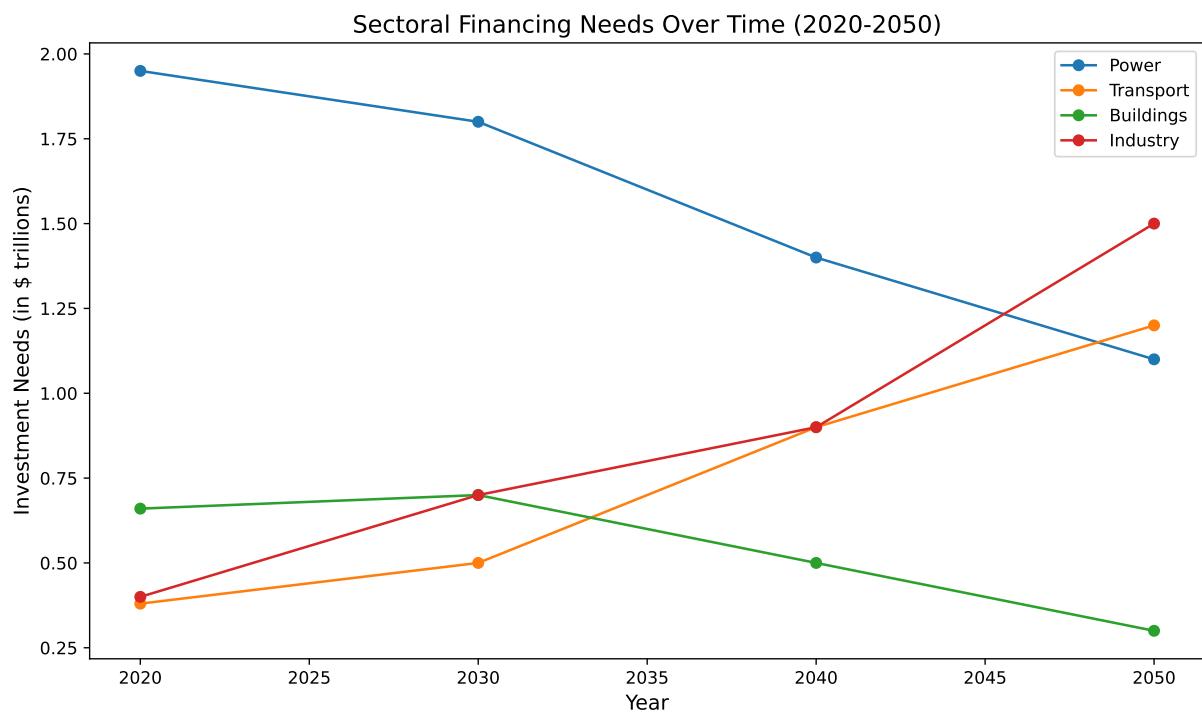


Figure 84: Climate Finance Funding Gap

What if 10% of annual consumer spending – *ten percent is about \$2,8T* - went towards protecting our climate. The theme for the 2023 Earth Day was “*Invest In Our Planet*”.

The needed investment doesn't seem so large, around 5% of the global GDP, if one compares it to the *per year* Global Gross Domestic Product (GDP) estimated at around 100 Trillion USD in 2022 and growing to 105 Trillion USD in 2023 (Aaron O'Neill, 2023; IMF, 2023b). In essence, the estimated total investment gap in climate fits into the economic growth of 1–2 years of the global economy. (OECD, 2024b) projects steady economic growth 3.1% in 2024 and 3.2% in 2025 while the (World Bank & World Bank, 2024) is more conservative projecting 2.6% and 2.7% respectively.

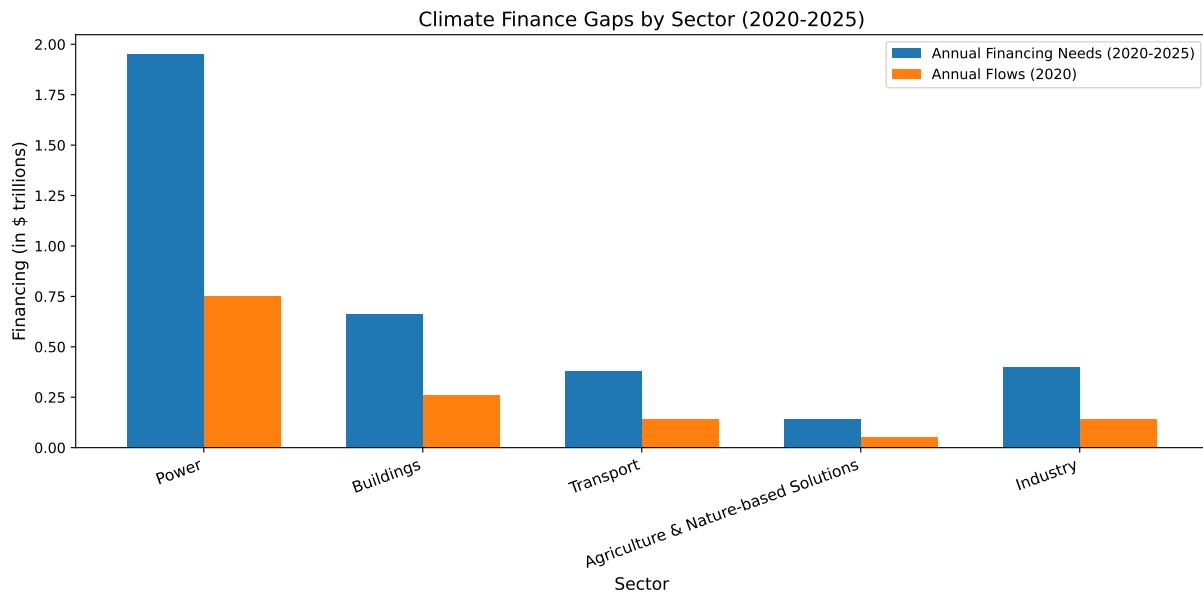


Figure 85: Climate Finance By Sector

The lack of funding in green energy especially affects emerging economies (*Mobilizing Capital Into Emerging Markets and Developing Economies*, 2022). “*We can and must channel private capital into nature-based solutions. This will require policy and regulatory support, catalytic capital and financial innovation*” argued the CEO Green Finance Institute, Dr Rhian-Mari Thomas, ahead of COP27 in Egypt (*Green Finance Institute*, 2023). It’s not happening fast enough.

Table 79: Comparative data on needed climate investment and other valuable assets; all figures in Trillions of USD (Aaron O’Neill, 2023; Blockworks, 2023a, 2023b; M. Fox, 2023; Grand View Research, 2021; IMF, 2023a; McKinsey & Company, 2023; Oguh & Oguh, 2023; Rao, 2023; SIFMA, 2023; S&P Global, 2019; Statista, 2021, 2023b; Stephanie Aaronson & Aaron Tilley, 2023; Thinking Ahead Institute & Willis Towers Watson, 2023; Trucost & TEEB for Business Coalition, 2023; US Treasury, 2023)

---

#### High-Value Assets (Trillions of USD)

---

Global Real Estate (2020, valuation)	\$326T
Global Equity Markets (2023, valuation)	\$108T
Global GDP (2024, estimated)	\$110T
Global GDP (2023, per year)	\$105T
Global GDP (2022, per year)	\$100T
<i>Global Pension Funds (2023, valuation)</i>	\$47.9T
U.S. Equity Markets (2023, valuation)	\$46.2T
U.S. National Debt (2023, valuation)	\$32.6T
<i>Millennials Inheriting Money from Parents in the U.S., U.K. and Australia (2022-2032)</i>	\$30T

---

### High-Value Assets (Trillions of USD)

Global Retail Sales of Goods and Services to Consumers (2023, per year)	\$28.2T
GDP of U.S.A. (2023, per year)	\$26.8T
GDP of China (2023, per year)	\$19.3T
Global Private Market Assets (2023, per year)	\$11.7T
<i>Unpriced Externalities (2023, per year)</i>	\$7.3T
Global E-Commerce Sales (2021, per year)	\$5.2T
<i>Missing Climate Investment (2022, estimate per year)</i>	\$4.1T
Industrial & Commercial Bank of China (2019, total assets)	\$4T
Global Real Estate Sales (2021, per year)	\$3.7T
Apple Computers (2024, market value)	\$3.1T
GDP of Japan (2023, per year)	\$4.5T
GDP of Germany (2023, per year)	\$4.3T
GDP of India (2023, per year)	\$3.7T
U.S. Gen-Z and Millennials Consumer Spending (2022, per year)	\$2.5T
NVIDIA 英偉達 (2024, market value)	\$2.5T
<i>Retail Investors (2023, liquid assets)</i>	\$1.8T
Blackstone (2023, total assets)	\$1T
Bitcoin (2024, market cap)	\$1T
GDP of Taiwan (2023, per year)	\$0.8T
GDP of Finland (2023)	\$0.3T
Ethereum (2024, market cap)	\$0.3T
<i>Individual Climate Investors (2020, per year)</i>	\$0.1T
GDP of Estonia (2023, per year)	\$0.04T

---

While these assets and GDP values reflect different aspects of the global economy, the comparison illustrates that redirecting a relatively small fraction of global wealth and economic activity towards sustainable investments can close the investment gap. This perspective should inspire confidence that the goal is achievable with coordinated effort and policy support. Indeed, it would be easier for large institutional investors to move their money to sustainable assets than for retail investors to move their relatively small investments.

#### 11.3.6 Retail Investing Enables Financial Inclusion and Growing Money Sustainably

*Retail investing* can be seen as a form of financial inclusion. Ant Group's CEO Eric Jing remarked in (Turrin, 2021): “*The financial system of the past 200 years was designed for the industrial era and served only 20% of the population and organizations. As we enter the digital age, we must better serve the remaining 80%*”.

Many ecologically-focused funds with different approaches have been launched in recent years, with variations in asset mix and style of management; thematic asset management is expected

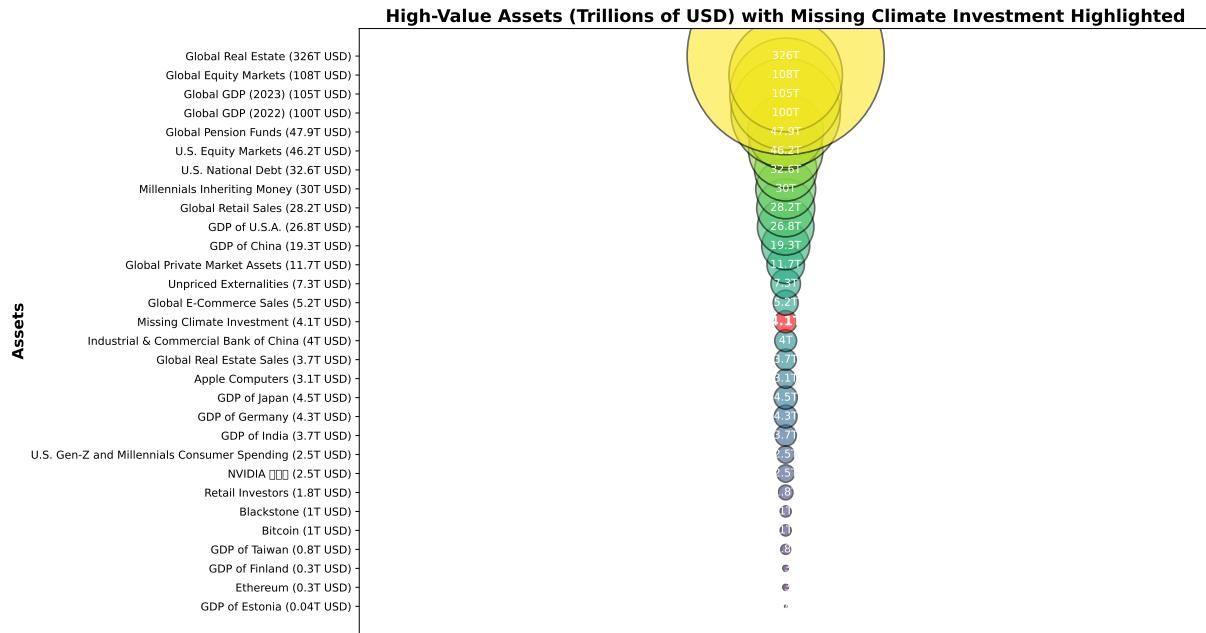


Figure 86: Climate Funding Gap vs High Value Assets

to grow, with investors packaging opportunities based on consumer trends (van Doorn, 2020). Among retail investors, there's some appetite for sustainability however investors are not sure how to separate sustainable assets from less sustainable ones (Ho, 2019). While literature has been debating if it's possible to "*do well while doing good*", latest research suggests it's possible to make investments that both make an attractive financial return and adhere to sustainability goals (Y.-M. Tan et al., 2023). "*Sustainable investing is now part of mainstream financial strategy*" (Morgan Stanley, 2019).

(T. Smith, 2019) suggests 74% of Chinese youth are looking for "positive impact" and (Lingeswaran, 2019) philanthropy is on the rise in Asia in general. (M. Li et al., 2022) believes retail investors are important for innovation: "*investor attention can significantly improve enterprises' green innovation level*".

Sweden is a country with highly developed financial markets and active social campaigns demanding sustainability as well as the home for several green fintech companies, including Doconomy and Trine (*Meet the Fintechs Leading Sweden's Green Revolution*, 2021). (Lagerkvist et al., 2020) undertook a choice experiment "Preferences for sustainable and responsible equity funds" with 559 Swedish private investors In Sweden, and found that sustainability strategies and an environmental focus carry more weight than fees, past performance or fund size.

(BlackRock, 2022) notes some ESG-oriented hedge funds can be "highly engaged with management teams" in order to influence management towards ESG practices in said companies. Barclays' 2021 investor survey found hedge - fund LPs (limited partners) adding screening for ESG data and willingness to start new "green alpha" funds if performance can be proven by robust data (*ESG Hedge Funds | Barclays Corporate & Investment Bank*, 2021). High quality

data is the key to unlocking this potential. ESG Analytics founder Qayyum Rajan introduces a sentiment - driven, alternative - data platform that maps real - time ESG events to SASB topics for deeper, faster screening (Qayyum Rajan, 2021). In addition to finance being increasingly data-driven, it's also increasingly personalized, for example Vise showcases its AI - powered portfolio - builder that lets RIAs customise, manage and explain client portfolios at scale, pitching itself as the “Copilot for wealth managers”, allowing creation of highly personalized portfolios (Vise, 2023). RavenPack provides an analysis tool tracking media and sentiment to gauge capital flows driven by ESG (RavenPack, 2021).

Companies themselves need to better understand their emissions, giving birth to the industry of climate accounting. The myclimate NGO is among the many providers or detailed calculate climate cost calculators, consulting and verified carbon - offset projects aimed at helping firms net - zero targets (*Myclimate – Your Partner for Climate Protection*, 2023).

Institutional finance is highly linked and constantly learning from each-other. For example, The Network for Greening the Financial System (NGFS) is a coalition of over 140 central banks that publishes scenarios, best - practice guides and policy papers on climate - related financial risk (NGFS, 2023). In Thailand, the Thai Fintech Association site lists its ecosystem map, events and membership tiers aimed at fostering fintech innovation and regulatory dialogue in Thailand (*Thai Fintech Association (TFA)*, n.d.). Online news platforms such as (*Green Central Banking*, n.d.) aggregate research and daily news on how central banks integrate climate risk—scorecards, policy trackers and expert commentary.

#### **11.3.7 Investable Asset Classes for Retail Investors: Increasing Exposure to Stocks, Bonds, Commodities, Real-Estate, Digital Tokens and Alternatives, Lending, Futures, Hedge Funds, Private Equity, and even Venture Capital**

There are many asset classes with varying degree of access to a retail investors. The main categories of investment products are, based on the U.S. Securities and Exchange Commission categorization (U.S. Securities and Exchange Commission, 2025).

Table 80: Investment Types

Investment Product
Stocks
Bonds
Mutual Funds
ETFs
Insurance Products such as Variable Annuities

There are also newer asset classes.

*Stocks* are the most popular assets class with a long history and highly accessible to retail investor, albeit usually at the cost of a trading fee. *Meme stocks* are another aspect of the *entertainmenization* of investing. There are many groups of Twitter, Reddit, and elsewhere, where

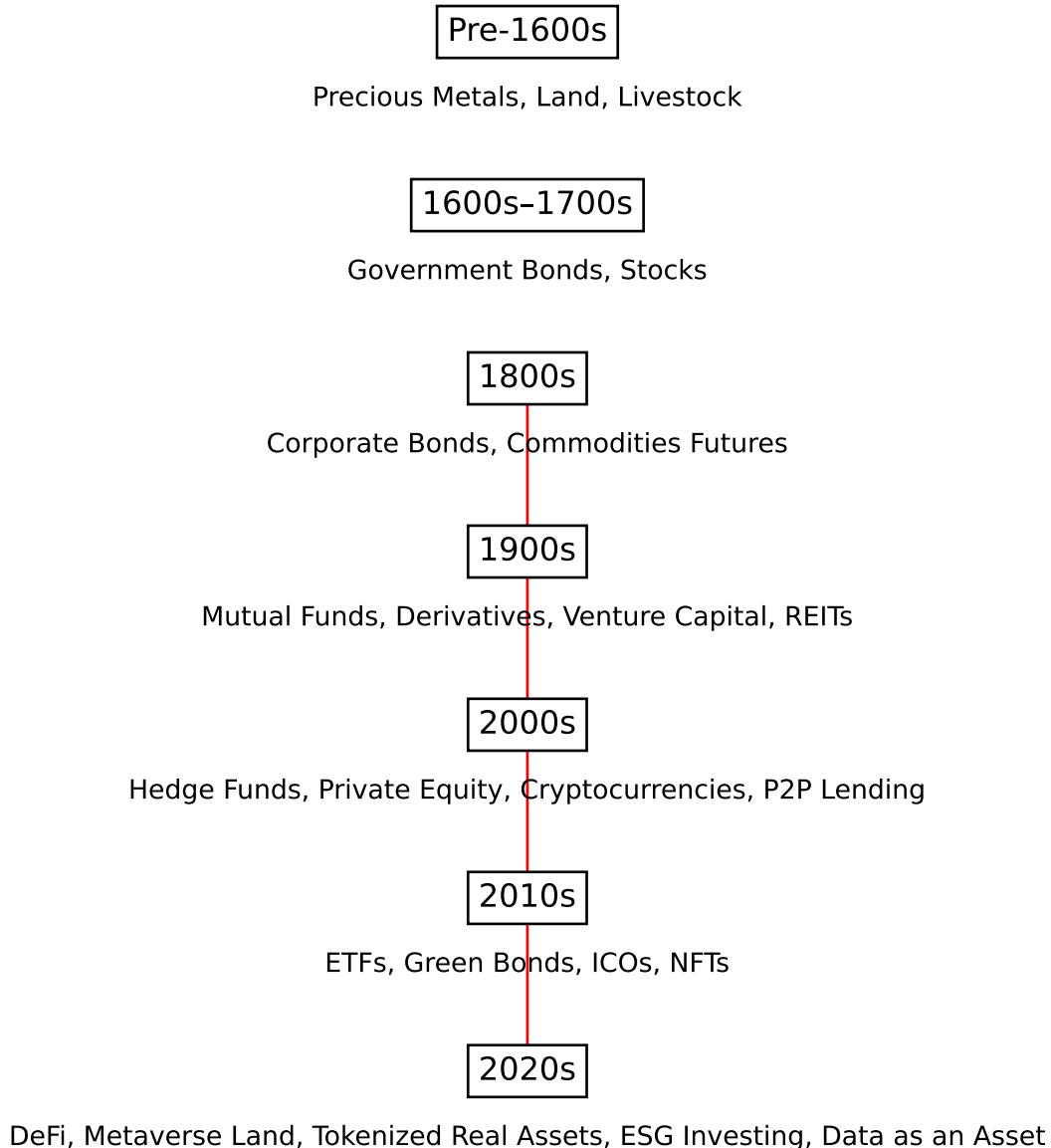


Figure 87: Asset Classes

investing trends start, causing more volatility. Retail investing apps blend entertainment into the UX/UI of investing. For example stock-trading app Robinhood uses game-like features such as displaying a confetti animation to create a sense of excitement around trading investing. Retail investing UI/UX is simplified and gamified, which encourage impulsive short-term buying and selling with a focus on speculation over fundamentals and cause FOMO (fear of missing out).

*Bonds* are a form of debt investment also known as a fixed-income asset where the principal is repaid at the maturity date of the bond (usually in years) with an added premium. Individuals can't emit bonds, but they can invest in them. It can be a way to invest locally in one's own city - or globally. For individuals, there's access to some green bond exposure through ETFs (exchange-traded funds) available on retail investing apps. Access is not universal and availability depends on the geography of the user and local legislation; for example Revolut, the most downloaded finance app in the EU, only enabled bond investing for European customers in summer 2024 (Revolut, 2024c, 2024a). Investing in bonds is a form of *Passive Investing* and allows investors focus on low-risk passive income instead of daily stock investing most popular on Robinhood and Revolut - albeit with much less potential for returns.

*Lending* is an attractive assets class with a significant social impacts providing opportunities to small farmers and other participants in the money markets while offering the lender a return, all possible through online apps and platforms. Retail investors can lend small amounts of money (also known as MicroLending) on peer-to-peer (P2P) lending platforms such as Twino. These loans are pooled and the risk is borne in aggregate as a form of risk-management.

*Hedge funds* generally are not accessible to retail investors, requiring a substantial minimum investment. However, some Hedge Fund based ETFs (exchange-traded funds) and Mutual Funds with Hedge Fund Strategies may try to mimic hedge funds, investing in the same underlying assets. While hedge funds used to be available for professional investors, online platforms such as (Hedge, 2023) aim to provide retail investors a social investing experience to "make a hedge fund with your friends", where people can come together and pool their funds in "mini - fund", with social tools such as chat and voting on trades built-in, aiming to democratize the hedge - fund model for small retail groups. It's how many people in the world of venture capital invest, investing together, or after a lead investor, who they trust. An early entrant into the market, (Renato Capelj, February 16, 2021 6:47 PM) positions Titan as a "*mobile hedge - fund*" app, which is actively managed, with transparent fees, and a competitor to automated robo - advisors.

*Commodities* are increasingly investable, with retail investors can now buy gold and silver as well as rare metals on financial platforms such as Revolut. Democratization of commodity trading lowers the barriers and allows individuals to diversify their portfolios beyond equities and bonds.

*Real-estate* is increasingly available on co-investing platforms allowing retail investors access into this asset class with a relatively low starting price. Thus investing in sustainable architecture can be an attractive proposal both from an environmental as from a financial standpoint, potentially providing a passive income stream in the form of rent. According to (Debnath et al., 2022) 39% of global CO<sub>2</sub> emissions comes from the building sector. Construction is large emitter be-

cause of the use of concrete; super tall buildings are very CO<sub>2</sub> intensive (Zhao & Qin, 2015). Building emissions can be reduced by using sustainable design and materials, *digital twins* of architecture enable pre-visualization of different designs (Panaro et al., 2024) as well modeling the usage of the building, for example the interior shop floors in commercial real-estate (Jia et al., 2023). In housing development, there's evidence of 'green' buildings achieving a 'higher financial return than conventional buildings, both in terms of rent and sale price' (Oyedokun, 2017).

*Venture capital* largely remains inaccessible for retail investors, and not only for its high capital requirements; groups like the Investment Company Institute (ICI) pushing to increase retail access to private markets are criticized for exposing retail investors to increased risk (Langton, 2025). While value investors love rules-based screens such as the Piotroski F-score, used to identify stocks that have strong fundamentals, these measures break down for high-growth startups whose financials are distorted by deliberate burn (Gurung et al., 2025).

*Thematic Capital* refers to choosing a clear investing thesis around a topic and building a resilient strategy. For example, for ESG-themed investments might pick Green Bonds, Sustainable Equities, and ESG - focused Mutual Funds and ETFs as the core, each screened through ESG metrics integration to ensure material impact rather than superficial marketing however although there is a wide range of investment products marketed as sustainable, many are fake, so rigorous due diligence is essential to weed out greenwashing and align holdings with authentic sustainability outcomes. Just like there are "green shops" for buy everyday products, there are also green investing platforms for purchasing various types of investment products that have been rated on some type of sustainability metric, for example green ETFs, green bonds, and the like. All of these are essentially forms of green branding, designed to make it easier for investors to find an investing product they trust.

There are many investment platforms self-describe as green, but the questions remains, who to trust.

Table 81: Green Investment Platforms

Name	Description	Link	Sources
Trine		trine.com	
The Many		the-many.com	
Sugi		sugi.earth	
ClimateInvest		clim8invest.com	
Circa5000		circa5000.com	
FairOwn	Aims to use product subscriptions to simplify circular economy, instead of buy-throw-away culture.	fairown.com	(Hankewitz, 2021)

Beyond the core, a diversified sustainable portfolio might incorporate *Impact Investing*. I've listed a sample of existing platforms that channels capital into mission - driven ventures, Renewable Energy Infrastructure (via ETFs or mutual funds) supporting wind, solar, and hydro assets, and Sustainable Real Estate accessed through REITs or ETFs that prioritize energy efficiency and low - carbon construction. *Social Bonds* expand the opportunity set by financing healthcare, education, and affordable housing, while Carbon Credits (via ETFs or specialized funds) and Sustainable Commodities (via ETFs or funds) offer exposure to emissions - reduction markets and responsibly sourced raw materials, respectively. For deeper community impact, one might allocate some funds to crowdfunding and crowd-loan platforms and to Sustainable Infrastructure Funds (available as ETFs, bonds, and mutual funds) that upgrade transport, water, and grid systems for a low - carbon future. In short, disciplined selection across various investment vehicles increasingly available to retail investors, guided by a robust investing thesis and aide by monitoring tools, in theory, would enable one to align financial performance with genuine social and environmental progress while avoiding the pitfalls of superficially labeled products.

### 11.3.8 Green and Sustainability-Linked Bonds

*Green bonds* are released by companies, international organizations, and cities to raise money for green transformation, usually for building something to improve sustainability, tied to specific projects. There's a growing global trend in green bond emission, with 257 Billion USD worth of green bonds issued in 2019, expected to reach 1 Trillion USD annually by 2030 (MacAskill et al., 2021). That prediction was too low with 870 Billion USD green bond emissions reached already in 2023; currently Europe is the largest emitter of green bonds (Climate Bonds, 2023). China has the 2nd largest green bond market in the world, and it's growing fast; buyers are looking for green bond certification to reduce yield spread, meaning the price of the green bond is becoming more similar to the price of a 'regular' bond (Q. Li et al., 2022; W. Peng & Xiong, 2022). The Climate Bonds Initiative, which is working on greening the entire short-term debt (bond) market, puts the size of the entire market at \$55 trillion, underlining the relative percentage of green bonds is tiny (*Climate Bonds Initiative Calls for Greening of \$55trn Short-Term Debt Market*, 2022).

In 2017 the Malmö city in Sweden released green bonds to finance a sustainable transition of the city (City of Malmö, 2017). An independent analysis found bonds may not be emitted for financial reasons but to improve the reputation and city image, lower interest rate (aptly named *greenium*) with a similar in returns to traditional bonds - and have their share of challenges, namely being difficult to certify, monitor, report and measure impact (Sjöström et al., 2020).

Making sure a green bond is truly supporting sustainability is a challenge. For example, Aramco, the Saudi Arabian public petroleum and natural gas company faced scrutiny for what critics deemed as 'Fake green bonds' (Anthropocene Fixed Income Institute (AFII), 2022). Green bonds can also be emitted on blockchains with the stated goal of improving transparency. Hong Kong multi-currency green bond on the blockchain. The issuer (Hong Kong government) hopes to reduce greenwashing (Hall, 2024; Kitano, 2024). In the EU as well, there are emerging tools for monitoring green bonds on blockchain (Christodoulou et al., 2023). (Qin et al., 2023) finds

evidence that the combination of green bonds and blockchains are an enabler carbon neutrality in China. The World Bank successfully raised 110 Million USD in Australia in 2018-19 and has since doubled the amount in a new 220 Million USD emission in Switzerland using bonds on a blockchain ledger for SDG-related projects (World Bank, 2018, 2019, 2024).

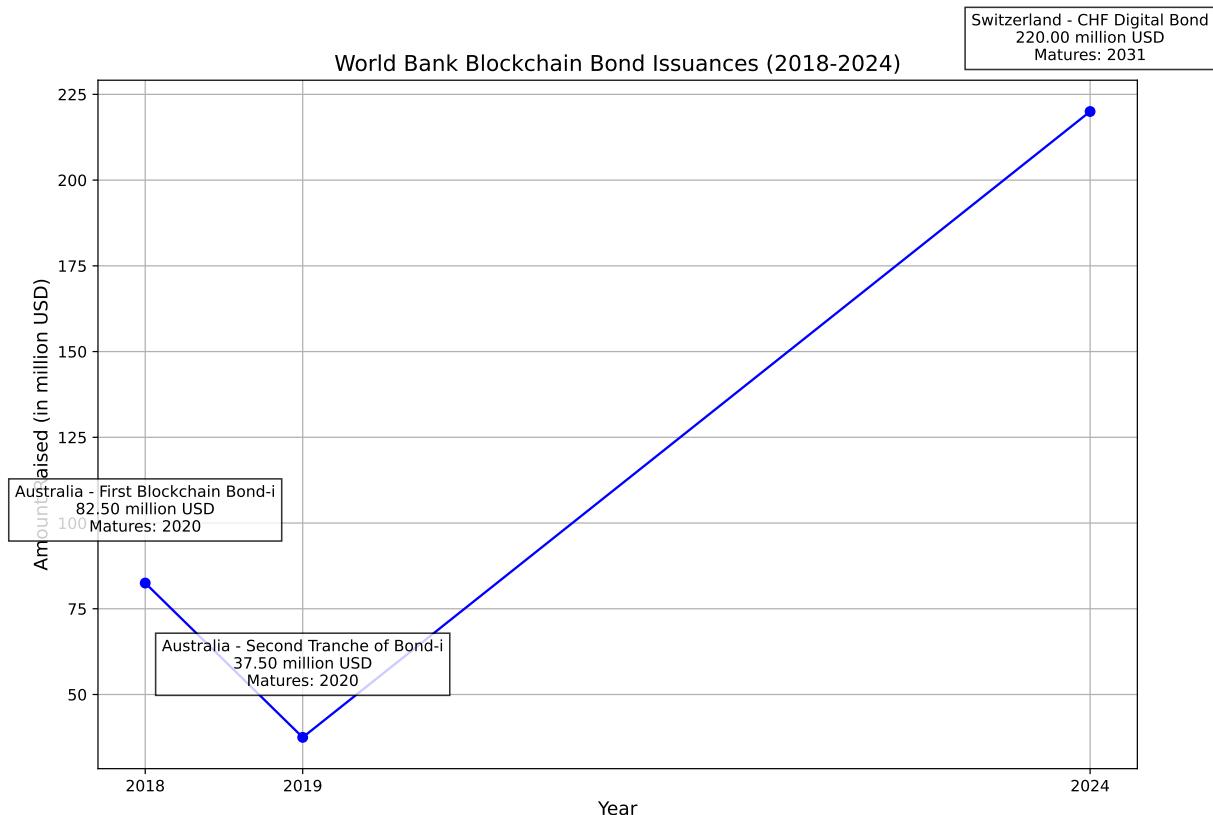


Figure 88: World Bank Bonds

*Sustainability-Linked Bonds* are less stringent than green bonds; they are not tied to specific projects but more broad sustainability targets (Priscila Azevedo Rocha et al., 2022): “Sustainability-linked bonds let companies borrow cheaply if they meet environmental, social, and governance targets. A Bloomberg News analysis found those goals are weak”. (Priscila Azevedo Rocha et al., 2022) suggests “So far, most ESG investing is in the stock market. But the \$22 trillion corporate bond market, where mature global companies such as Chanel go to borrow money from investors, has a particularly powerful role to play. Companies rely on debt much more than they do on stocks.”

### 11.3.9 Fusion of Traditional Finance and Decentralized Finance (DeFi)

Crypto-assets and digital tokens (known as decentralized finance or DeFi) are a highly accessible yet risky asset class, offering investment opportunities to anyone with a mobile phone and internet access. The low entry barrier makes crypto among the most potentially inclusive forms of

investment, though bearing significant risks, as well as regulatory challenges. Cryptocurrencies are popular among young people yet in many ways crypto needs even more financial literacy than traditional financial assets. Crypto investing removes most entry barriers while having high risk.

(Statista, 2024) estimates over 860 million cryptocurrency users worldwide by 2025, just shying away from 1 Billion users. A Brazilian study ( $n = 573$ ) found that crypto investors in Brazil are young, male, and have a high risk tolerance, when compared to non-crypto investors (Colombo & Yarovaya, 2024). “Brazil’s planned adoption of CBDC (Central Bank Digital Currency).” “It finds that risk tolerance, economic pessimism, and a belief in better investment acumen are significant predictors of crypto investment.”

The large number of crypto users begs the question: what would investing look like at the scale of 1 Billion people? The most popular use cases for crypto have been NFTs, online smart contracts attached to some type of asset, typically a picture. Social media is even bigger, with over 2 Billion users, so it’s not difficult to image the combination of Social + Crypto (NFTs?) to become the largest retail investing revolution, albeit a risky one, with many users losing their assets. This is the vision behind Sandbox, a Metaverse cryptocurrency sold by banks such as LHV in Estonia (Raido Tõnisson, 2022a).

Taiwan has an active market for crypto-assets while with some limitations. In 2022, the Taiwan government banned buying cryptocurrencies with credit card quoting the volatility makes it similar to gambling (David Attlee, 2022; 廣編企劃, 2022). In January 2022, BlockTempo and OpenSea teamed up to mint the “Top Taiwan Influencers” collection—21 unique, limited-edition Taiwanese digital influencers as NFTs, depicting Taiwan’s leading blockchain figures, designed to honor their industry contributions in digital art (OpenSea, 2022).

In general, crypto ownership can be divided into self-custody (you own the keys to your wallet) and custodial ownership, where you trust someone else (i.e. a centralized exchange or a bank) to hold the cryptocurrency for you. Both have their risks (self-custody, losing your keys; custodial: the exchange steals your tokens or goes bankrupt). Centralized crypto exchanges are in essence loaning assets from the user. *“The piece of the settlement aimed at getting important information to customers is more understandable from a retail protection standpoint. Customers who lend crypto assets to a company in exchange for a promised return should get the information they need to assess the risks against the rewards”* (Hester M. Peirce, 2022).

There’s also a large trend of fusion of decentralized finance (DeFi) and traditional finance (TradFi), with the largest established investors, such as BlackRock, launching tokenized funds (Matos, 2024; Sandor, 2024; Securitize, 2024). Tokenization is similar financial securitization which has been happening for a long time, with blockchains creating new tools for securitization: for example art can be securitized and tokenized (Masterworks, 2023). Blockchains makes this kind of financial engineering easier as any developer can do it; one does not need to be a bank.

In Switzerland, institutional funds entered crypto early. Licensed already in 2019 by the Swiss Financial Market Supervisory Authority (FINMA), AMINA, formerly known as SEBA Bank, was among the first regulated cryptocurrency banks (AMINA Bank AG, 2023). The first crypto fund was launched in September 2021, when FINMA approved Switzerland’s first regulated

crypto-asset fund—the “Crypto Market Index Fund” from the same AMINA bank, giving investors access to a FINMA-supervised vehicle that tracks a diversified basket of blockchain-based assets with the AMINA Bank’s custody (FINMA, 2021). AMINA of course was not the only bank interested in crypto, with “[m]ore than half” of Swiss banks planning to offer digital assets services in the near future (swissinfo.ch/urs, 2022). Banks launching Crypto ETFs (Exchange Traded Funds) enable their clients to have exposure to crypto without ever buying cryptocurrencies directly themselves. However, while owning cryptocurrency directly allows one to use crypto tools to look at any wallet balance, ETFs hide that transparency.

To put it very simply (knowingly oversimplifying), in traditional finance legislation is an enabler of corruption as in the case of Swiss privacy laws, where illegal funds can be hidden, while in cryptocurrencies, the lack of clear and comprehensive regulation is an enabler of corruption.

Pricing crypto is not based on any single fundamental metric, but comes from tokenomics: a catch-all word for token design and internal economics, such as supply schedules, emissions cuts, burns and staking yields to frame the basic scarcity curve as well as demand side narratives, and real world utility and user sentiment. Crypto enables significant potential for financial engineering and innovation by anyone with enough programming skills.

Bitcoin is by far the most popular cryptocurrency with its high price volatility creating opportunities for high gains and high losses. While bitcoin has been called a “digital gold” for store of value, its volatility characteristics are very different from gold, as seen on this chart.

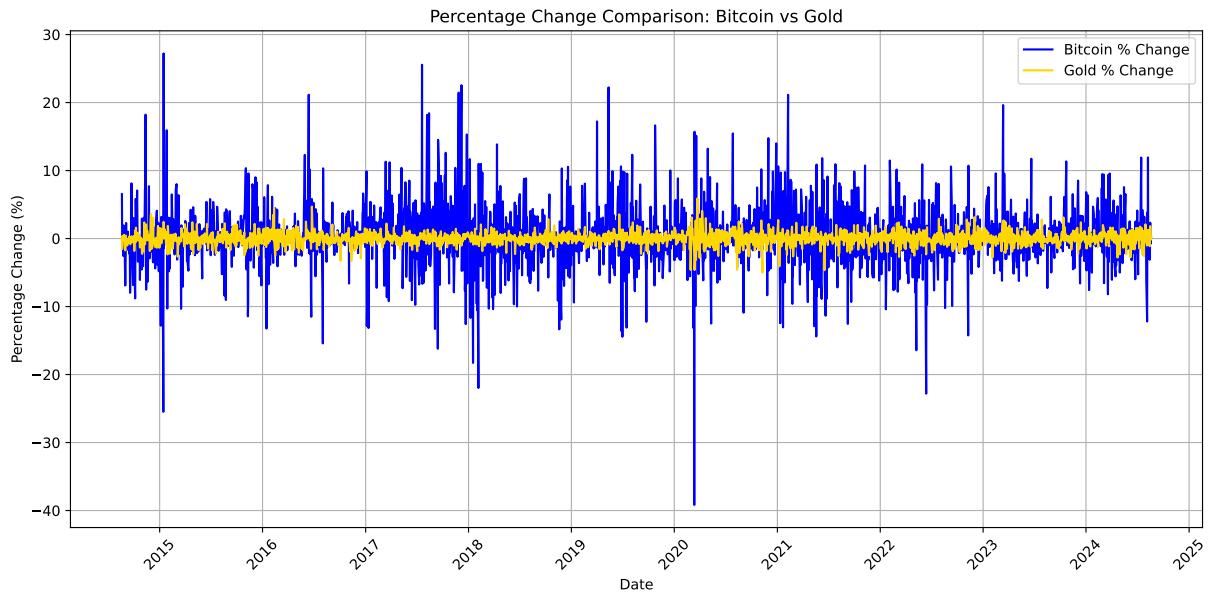


Figure 89: Bitcoin vs Gold Futures

The volatility of the markets has notably shifted crypto research towards pricing theories (S. Peng et al., 2024). However volatility is relative. Volatile national currencies lead people to find other assets to hold. If one’s national currency is collapsing, one might find crypto has a relative safe haven to keep one’s funds. People in Turkey losing 75% of the value of their assets when

currency collapses, is one of the reasons why people might buy crypto (Saba & Saba, 2022; T. R. Wilkes et al., 2021).

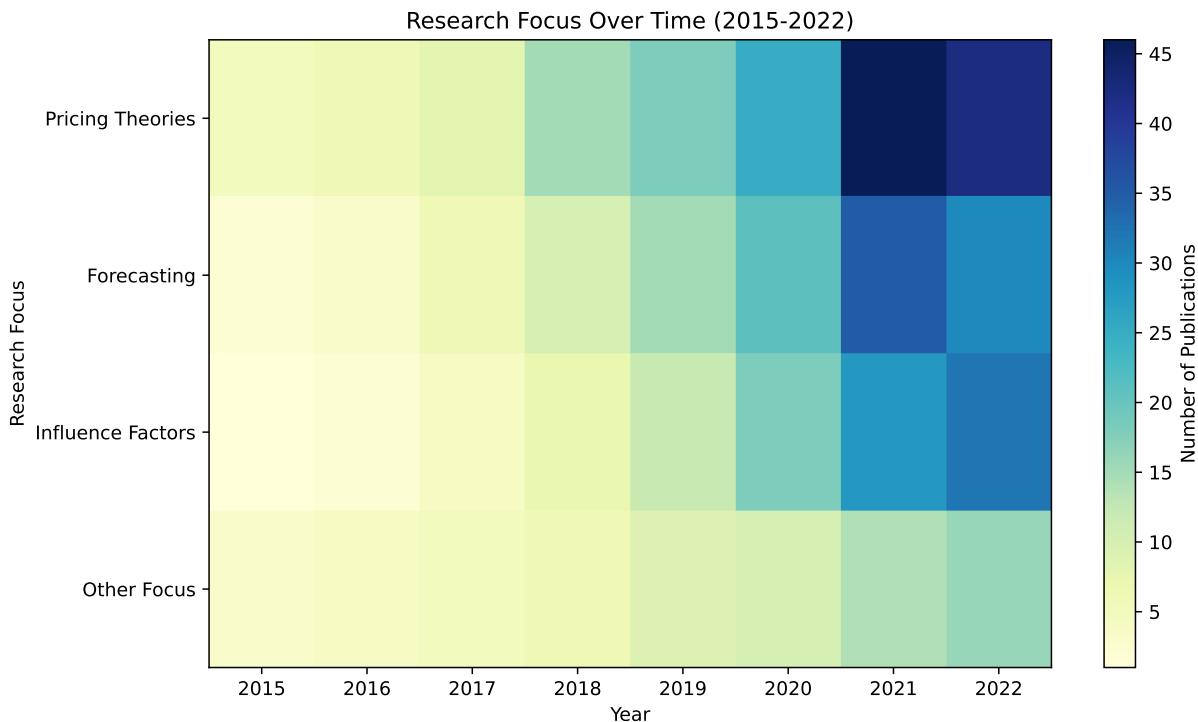


Figure 90: Crypto Pricing Theories

For example, an index of major sustainability news can be compared with crypto prices, which may have negative, positive, or no correlation with the listed cryptocurrencies.

### 11.3.10 Regenerative Finance (ReFi) and DAOs

*“Would you rather buy a DogeCoin or a regenerative food forest token?”* Curve Labs founder Pat Rawson quotes Shiller (2019) in ReFi podcast about Kolektivo (ReFi DAO, 2022).

(Caio Jobim, 2022) believes Bitcoin has failed as a mainstream money but blockchain technology in general will underpin the next-generation digital-currency systems, ultimately replacing both cryptocurrencies and cash. While Bitcoin uses proof-of-work, and protocol which is highly energy intensive (and thus, unsustainable), later innovations such as proof-of-stake enabled the creation of blockchains, which are energy-efficient; an overview from 2023 details 23 low-carbon blockchains (Alzoubi & Mishra, 2023). (Sepandar Kamvar, 2022) Sepandar Kamvar, co-founder of Celo, famously calls “[a] blockchain is a database without a database admin”. (dGen & PositiveBlockchain, 2021) built a positive blockchain database of blockchain for good projects. Some traditional green investors have started to take note. (Marquis, 2021) reports on RSF Social Finance’s shifting from impact investing to regenerative finance, detailing its \$230

million under management and community-pricing innovations. Blockchains are proliferating, with newer blockchains being more energy efficient (and thus having better sustainability properties); as of early 2025, there are nearly 2000 unique public blockchains in existence (Routescan Research Team, 2025; L. Schwartz, n.d.).

Inspired by the decentralized finance (DeFi) Summer of 2020, when projects like Compound, Yearn, and Uniswap demonstrated blockchain-based financial tools could go viral, followed by COVID-19, which exposed systemic fragility and served as a wake-up call about global interconnectedness and ecological risk, crypto pioneers attempted to use their native tools for public good, instead of only financial goals, giving birth to the regenerative Finance (ReFi) movement, applying technology to carbon accounting, market development, and governance (B. Smith, 2021). Innovating on the intersection of blockchains, tokenization, nature-backed assets, and cryptocurrencies, ReFi leveraged DeFi to create financial systems that aimed to restore ecosystems and empower communities by prioritizing positive environmental and social impact (*What Is ReFi | Regenerative Finance Explained*, 2023).

Founded already in 2018, Regen Network built a blockchain for ecological data and carbon credits, using the Cosmos blockchain SDK (Regen Network, 22-01, 2023). Another early example is the Celo proof-of-stake blockchain, founded in 2020, which offsets carbon emissions at the protocol level, automatically investing a small percentage of each transaction into a reserve, which buys green assets, such as tokenized carbon credits (e.g. Moss MCO<sub>2</sub>), laying the groundwork for a regenerative financial system (*Celo and Regenerative Finance - Climate and ReFi*, 2021). (*Planet of the Klimates - Luis Adaime - Founder & CEO of MOSS.Earth*, n.d.) details the issuance and tokenization of tropical-forest carbon credits (Moss.Earth MCO<sub>2</sub>) and biodiversity tokens within the Celo ecosystem. Similarly, the (*KlimaDAO*, 2023b) KlimaDAO protocol, founded in 2021, tokenizes real-world carbon assets into liquid Klima tokens, establishing a DAO-governed, transparent market for carbon neutrality, which has \$4 billion in total transaction volume.

Social features has always been a weakness of Web3, and (Syndicate, 2022) contends that it's not enough to build decentralized financial rails to democratize wealth creation; crypto investing must also redesign the social networks around capital. The Web3-based attempt to achieve these goals is called DAO or Decentralised Autonomous Organizations, which allow wallet holders to collaborate and vote on issues. (BlockChannel, 2017) defines a DAO as a Decentralized Autonomous Organization on blockchain, using smart contracts and token-weighted voting to enable permissionless, community-driven governance. In the world of Web3 and cryptocurrencies, smart contracts make it possible for DAOs to also pool member resources for investing. Because of the on-chain nature where transactions are visible to anyone, they may be seen as more transparent. DAOs can be used in a similar way to Hedge funds; a DAO can have a treasury, with a shared multi-sign wallet (similar to a bank account) from which investments can be made together. Typically DAOs have a voting system to make decision while Hedge Funds may be more centrally controlled. A notable example, (Carra Wu & Chris Dixon, 2021) details how the Friends With Benefits (FWB) DAO transformed consumers into investors by requiring an application review and token buy-in, granting members governance rights and meaningful ownership in a token-gated community. With a specific sustainability focus, (*Trees for the Future*,

2023) DAOs to enable concerted action towards climate goals using the pooled resources in a treasury, a blockchain (on-chain), similar to how hedge funds work.

(Ian Bezek, 2021) argues that DAOs and governance tokens could replace stock exchanges and corporations by using programmable blockchains for digital ownership and control of assets registered in on-chain distributed databases. (Nathan Reiff, 2023) explains how DAOs use smart contracts and cryptographic voting to manage organizations without a central authority; some advantages include transparency and community ownership, while existing challenges of being in a legal gray zones (one still needs to register a legal entity) and risks of security hacks, are real. (Rehash: A Web3 Podcast, 2022) insists that people and not just code must be the north star in Web3 design frameworks to achieve a truly human-centered Web3. Yet, the first wave of Web3 users were privacy-conscious and wouldn't answer questions, making it challenging to create good personas, making design difficult (Crabb, 2023). While somewhat out of date, (Ray, 2023) offers a comprehensive review mapping the Web3 technology landscape which serves as a good introduction. Finally, (*Empowering Digital Asset Banking*, n.d.) notes it's not only retail investor entering the crypto world, large institutions are doing the same, with tokenization, crypto custody and asset - management increasingly becoming a part of mainstream finance.

(Aikman, 2022) proposes using a DAO called OpenESG to cut opacity and greenwashing, with a Decentralized Expert Council and Community Voting to build transparent rating methodologies, while validator bounties would incentivize crowdsourcing and verification of data, making every scoring step is auditible; high scorers could gain direct access to sustainable financing, turning ESG excellence into tangible regenerative outcomes. While the ideas remain, the OpenESG organization itself has defunct for unknown reasons, leaving one to wonder if these ideas are workable.

A lot of financial tooling from traditional finance (called trad-fi in crypto circles) has been replicated using blockchains and related technologies. However, the legislation affecting Hedge Funds and DAOs would be different as hedge funds are an older and more established financial tool whereas DAOs still fall in somewhat of a gray area. For example, in the U.S.A. federal judge ruled that crypto collectives (crypto investment clubs) like Lido DAO are general partnerships liable for unregistered securities offerings (*Investment Clubs and Collectives | Deprecation FAQ*, n.d.). In order to overcome these legal hurdles, VC-backed startups have launched platforms to support a new generation of DAOs, providing regulatory navigation and smart-contract tooling that broaden blockchain dependencies beyond DeFi protocols (Lucas Matney, 2022).

Oracles provide the intersection between finance and real world sustainability data. A data oracle is the concept of a source of real-world data which can be ingested through an application programming interface (API) to a blockchain system. There are many databases of sustainability information which could serve as an oracle for carbon labeling, packaging, transportation, consumption, and waste. For example, crypto crop insurance provided by IBISA Network uses blockchain triggers and satellite data to offer transparent, automated payouts for farmers facing weather-related risks (*IBISA Network – Enabling the Next Generation of Insurance for Agriculture*, n.d.). While (Caldarelli et al., 2020) notes it's a challenge to ensure the accuracy and trustworthiness of real-world data from Oracles, the largest Oracle provider ChainLink founder

Sergey Nazarov believes the collaboration of oracles and blockchains can make carbon credits more trustworthy. (Brady Dale, 2021; Chainlink, 2022).

### **11.3.11 Divestment: Supporting Sustainability by Avoiding the Worst Polluting Companies**

Divesting is the inverse of investing. If no sustainable alternative can be found, at least taking one's money out from polluting companies signals one's green preferences. "Sustainable development requires more investment in sustainable companies and less in unsustainable firms." (Van Zanten & Rein, 2023). In institutional finance, the Norwegian \$1.3T USD sovereign wealth fund (the world's largest) started a divestment trend in 2016 by divesting first from coal following by divesting from oil, gas and coal extracting companies (Ben Martin, 2017; Holger, 2019). Their plan to reach net-zero CO<sub>2</sub>eq nonetheless only targets 2050. Furthermore, who would be the counterpart for such large transactions. The fund also announced divesting from Russia after its invasion of Ukraine, however has yet to sell any shares citing lack of buyers on the Moscow stock market. Even with divesting from oil and gas, Norway Government Pension Fund Global (GPFG) still adheres to the Markowitz's Modern Portfolio Theory (MPT), with enough diversification between assets (Papaioannou & Rentsendorj, 2015).

University of California also followed suit with divestment of its \$126B USD portfolio from oil and gas. Other large university endowments, such as managed by Yale, Stanford and MIT are in decision gridlock.

While divesting makes news headlines, even divestment by large institutional investors, such as the Norwegian National Pension Fund (GPFG), has a negligible effect on the heavy polluters' business; by the same logic, it can be deducted, the financial effect of retail investors divesting, is meaningless. If retail investors act in aggregate, the reputational effect needs further research. "*To halt climate change, some investors have decided to divest from fossil fuel companies. Reviewing the literature suggests that divestment from fossil fuel has limited financial consequences; it slightly increases divested firms' risk and their cost of capital, while reducing divested firms' market value,*" is the pessimistic conclusion by (Plantinga & Scholtens, 2024).

By extension, it may sound feasible that divesting could have a meaningful impact on companies if a large number of retail investors collaborate on 'banning' the company to send a message to the board, yet in practice small individual divestments may be negligible to governance decisions.

## **11.4 The Economics of Decoupling: Attempts to Disconnect Economic Growth from Eco-Degradation**

Is the "eco" in ecology and economy the same? *Oîkos*, the Greek word for "household", seeds two modern disciplines: ecology studies how the home works; economy sets the rules for managing it. The two have drifted apart: one guarding planetary health, the other chasing growth. This chapter reunites them by asking: how do we measure prosperity without wrecking our home?

#### **11.4.1 Post-AI Economics**

People around the world are discussing how traditional economics can adjust to the abundance provided by AI, known as *Post-AI, Post-Labor, or even Post-Scarcity economics*. Last year, the Seoul AI Summit pushed for voluntary safety standards to manage systemic risks while the French AI Summit tackled energy consumption and environmental costs, highlighting the need to embed AI sustainability into economic planning, regulatory frameworks, and corporate accountability (Hern, 2024; Milmo, 2024). More recently, the Anthropic Economic Index tried to capture how AI impacts human work and economics in general, noting that among millions of work tasks submitted to Claude - studied as anonymized conversations using a privacy-preserving clustering tool Clio, separately described in (Tamkin et al., 2024) -, that 43% of the work could be categorized as automation and 57% as augmentation of human economic activities (Handa et al., 2025). At the same time, economists' predictions of the future impact of AI are far from uniform, for instance MIT economist Daron Acemoglu estimating that in the U.S. only 5% of the tasks can be profitably automated and AI will only contribute a modest 1.1% to the GDP until 2035 (Acemoglu, 2024).

#### **11.4.2 Econometrics: The Many Ways to Measure an Economy**

*Econometrics* is the science of measuring the economy.

The creator of the Gross Domestic Product (GDP) metric in 1934 Simon Kuznets said: “The welfare of a nation can scarcely be inferred from a measurement of national income as defined by GDP...Goals for ‘more’ growth should specify of what and for what” (United States. Bureau of Foreign and Domestic Commerce et al., 1934).

GDP was the culmination of previous work by many authors, beginning with William Petty in the 17th century (Rockoff, 2020). This long journey underlines how a metric about a complex system such as the economy is continuous work in progress. There has been ongoing work to create improved metrics such as the Sustainable Development Goals (SDGs), Human Development Index (HDI), Genuine Progress Indicator (GPI), Green GDP, Inclusive Wealth Index, and others (Anielski, 2001; Bleys & Whitby, 2015; Kovacic & Giampietro, 2015).

Measuring wellbeing in addition to GDP and the metric should include resiliency dashboards, to visualize metrics beyond GDP, and they are an integral part of country reports (GreensEFA, 2023). Similarly, the doughnut (donut) economics (more below) model calls for a “*dashboard of indicators*” (TED, 2018).

The National Academies links public health outcomes (air quality, water safety, and food systems) with sustainability actions, calling for an integrated cross - sector strategy to protect community well - being (*Public Health Linkages with Sustainability*, 2013).(Guidotti, 2015) argues environmental quality foundational to public health and urges embedding sustainability principles across healthcare systems and policies; in order to have healthy communities, we need clean air, pure water, and toxin - free surroundings.

### **11.4.3 The Evolution of Economic Metrics**

Traditionally, the true cost of products is hidden. The work is hidden. The first two decades of the 21st century have seen increasing economic thinking, looking to challenge, improve and upgrade capitalism to match our current environmental, social, and technological situation, often called *New Economics*. Some of these include behavioral economics, sustainable capitalism, regenerative capitalism, doughnut economics, ecological economics, blue economy, degrowth, attention economy, gift economy, intent economy, among others. There's no lack of published books on changing capitalism, which goes to show there's readership for these ideas. Build a new economic theory is out of scope for my thesis design, however I'll focus on the parts of economic theory I believe are relevant for *interaction design*-ing for sustainability.

There are those looking for *new metrics*. One of the first innovators, already in 1972, was Buthan, with the *Gross National Happiness Index (GNH)*, which in turn inspired the UN, decades later, in 2012, to create the International Wellbeing and Happiness Conference and the International Happiness Day(Kamei et al., 2021; Ribeiro & Lemos Marinho, 2017). The World Bank talks about the comprehensive GDD+ metrics in its Changing the Wealth of Nations report (World Bank, 2021).

The Wellbeing Economy Alliance (WEAll) countries (New Zealand, Iceland, Finland, Scotland, Wales) as well as the EU and Canada, started the coalition in 2018 looking to involve more broad-based metrics in developing their societies (CEPR, 2022; David Suzuki Foundation, 2021; Ellsmoor, 2019; Scottish Government, 2022; Wellbeing Economy Alliance, 2022). (Giacalone et al., 2022) looks at wellbeing of Italian communities and proposes a new composite index. There's also work ongoing on macroeconomic modeling, aiming to create a *digital twin* of the economy. Some of the most complex computer models of the economy include the Global Integrated Monetary and Fiscal Model (GIMF) (Laxton et al., 2010) and DSGE (Dynamic stochastic general equilibrium).

### **11.4.4 Hidden Costs: Pricing Externalities**

Markets mis price “home maintenance.”

Co-founder of Generation Capital with 50 Billion under management David Blood “the most significant thing we can do as capital allocators is to price in those difficult to price externalities” Liebreich (2025)

In the simplest sense, prices do not capture all costs. “Consumption, production, and investment decisions of individuals, households, and firms often affect people not directly involved in the transactions” (Helbling, 2012). Externalities as an economic concept was implied by Alfred Marshall, one of the founders of neoclassical economics, in his 1890 treatise “Principles of Economics,” and further developed by Arthur Cecil Pigou in his 1920 book “The Economics of Welfare” (Marshall, 1997; Pigou, 2002). As of 2023, the value of unpriced externalities which are not included in the GDP is 7.3 trillion USD per year (Trucost & TEEB for Business Coalition, 2023). The award-winning economist Mariana Mazzucato argues in (A. H. Gupta, 2020)

### Timeline of Notable Economic Theories and Authors

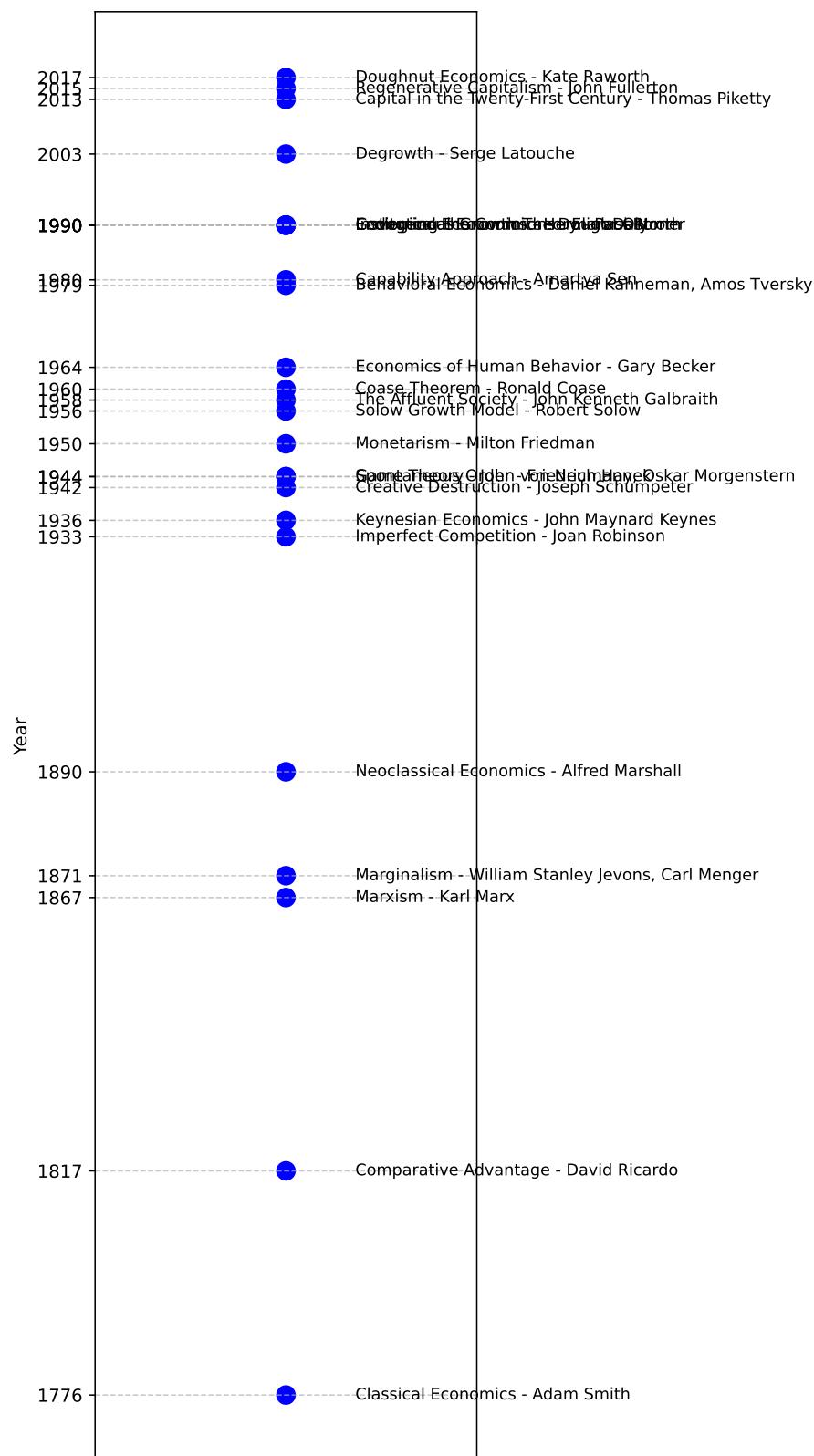


Figure 91: Economic History

we should include more into how we value unpaid labor, relating to the social (S in ESG) (Mazucato, 2018) as part of our metrics.

#### 11.4.5 Ecological Economics Builds Upon Classical Economics

While Adam Smith is most famous for his concept of the *invisible hand* first appearing in *The Theory of Moral Sentiments* (1759) and further developed in his seminal work *The Wealth of Nations*, published in 1776, his writings also highlight the interdependence of economic actors, who through specialization increase productivity, but also increasingly dependent on each another as well as the role of empathy in individual actions (Atal et al., 2024).

Ecological economics doesn't necessarily argue with the foundation of classical economics, rather ecological economics finds the classical economics model and by extension neoclassical economics are *incomplete*, ignoring the physical limits of natural resources. Ecological economics draws attention to the interdependence of economy and the ecosystem; there are physical limits to economic growth on a planet with finite resources.

The biggest point of contention is the necessity of *economic growth*. The founder of ecological economics Herman Daly was talking about *prosperity without growth* more than two decades ago, focusing on the diminishing natural resources (Daly, 1997). Daly was teaching economics to undergraduates at Louisiana State University when he grew dissatisfied with the standard model of the market, which didn't include any inputs (resources) or outputs (pollution), and later modeled his work by placing the economy *within* the larger system of the ecosphere (Ketcham, 2023). More recently.(Jackson, 2009, 2017) have expanded on these ideas with recipes for a *post-growth* world, making the ideas seem more tangible and precise, yet mostly untested in the real world.

Writing in 1973, E. F. Schumacher argued economics overlooks both natural resource depletion and environmental degradation and draws on religion (particularly Buddhism) to suggest a simpler way of life:

*"Simplicity and non-violence are obviously closely related. The optimal pattern of consumption, producing a high degree of human satisfaction by means of a relatively low rate of consumption, allows people to live without great pressure and strain and to fulfil the primary injunction of Buddhist teaching: 'Cease to do evil; try to do good.' "* (Schumacher, 1985)

New economic thinkers are asking how can economic growth and sustainability be compatible. Some even ask if *economic growth* itself is the wrong goal? (Diduch, 2020). Lewis Hyde's book "The Gift" argues creativity thrives in "gift economies"; reciprocity is more important for creativity than market exchanges (Hyde, 2006).

(Yüksel et al., 2023) criticizes excessive financialization where the real economy and financial markets disconnected, blaming it for the 2008 economic crisis, proposing a new index for *participation finance* aiming to ground the financial economy in the real economy; rooted in Islamic banking, participation finance avoids highly speculative activities, which are seen as exploitative, looking to promote stability, transparency, and fairness.

Degrowth is the most famous contender in that branch of economics. Is Decoupling Economic Growth and CO<sub>2</sub>eq Emissions Possible? Is Green Growth an oxymoron? No-one knows as it hasn't been done before. Degrowth proponents are pessimistic it's possible to decouple greenhouse gas emissions from economic growth; historical data shows does not show any decoupling (Vadén et al., 2020).

The original Ramsey model introduced by Frank P. Ramsey in 1928, becoming foundational for traditional economic growth theory, does not assume infinite economic growth (Attanasio, 2015). (Marc Germain, 2016) has adopted the Ramsey Model and introduced constraints such as pollution, distinguishing renewable and non-renewable capital.

(Jackson, 2017) limits to growth update shows that absolute decoupling of GDP growth from environmental impact at the speed needed for climate targets is effectively impossible; prosperity should be redefined around wellbeing, sufficiency and resilience rather than perpetual economic expansion.

#### 11.4.6 Doughnut Economics and Regenerative Capitalism

*Doughnut Economics*, introduced in the eponymous book uses a simple visualization of a doughnut (donut in American English) to help us grasp the big picture of the economy *embedded* inside the physical and social worlds (Raworth, 2017). Raworth calls to move beyond GDP growth, building economies that are regenerative and distributive by design, fitting human needs within planetary limits (De Balie, 2018). The Doughnut Economics model allows one to see the social shortfall and ecological overshoot of nations at the same time (A. L. Fanning et al., 2021). The doughnut concept is simple and deep at the same time, a useful as social object to enable starting conversations with people from all walks of life, independent of their politics leanings. As Raworth calls it, it's a "*self-portrait of humanity in the beginning of the 21st century*". Combining the *SDGs (Sustainable Development Goals)* inside the doughnut and the *Planetary Boundaries* (Earth's ecological ceiling) outside the doughnut, leaves a space inside the donut represents a state of equilibrium and balance on spaceship Earth.

In some ways this Doughnut Economics can be described as a movement. Doughnut Action Labs enable local communities to build local doughnuts customised to local problems. While the ideas have not yet been implemented on a country-level, smaller scale doughnut economics' success stories have inspired cities to take a comprehensive view of the doughnut of their own city with several EU cities adopting the vision (Jordan G. Teicher, 2021). While critics say doughnut economics would expand the role of the government (Horwitz, 2017), doughnut practitioners in Brussels believe everything can be adapted to the place and context (BrusselsDonut, 2022; Oikos Denktank, 2021).

The city of Amsterdam is developing shorter food chains (which save CO<sub>2e</sub>) and linking residents with food production and reconnecting people to the food which foster collaboration in the community (Circle Economy, 2021). Amsterdam has also built comprehensive dashboards called the Circular Economy Monitor which makes it easy for anyone to see the progress being made towards the Dutch goal to be a circular economy by 2050 (Gemeente Amsterdam, 2022; Ministerie van Infrastructuur en Waterstaat, 2019).

Table 82: Circular Economics in Amsterdam's Food Industry (Circle Economy, 2021).

Shortening Food Chains in Amsterdam
Spatial planning for food place-making in the city
Circular agriculture
Regionally produced food
Collaboration between chain members
Food education

*In his 2015 paper Regenerative Capitalism*, John Fullerton, an investor and a capital markets and derivatives expert, builds his economic theory on the ideas of Club of Rome and the Limits to Growth (Meadows & Club of Rome, 1972) as well as taking inspiration from R. Buckminster Fuller.

*“Nature is a totally efficient, self-regenerating system. If we discover the laws that govern this system and live synergistically within them, sustainability will follow and humankind will be a success.”* (Fuller, 1983)

“[H]uman civilization is embedded in the biosphere,” Fullerton’s ideas aim to balance efficiency with resiliency, so the whole system doesn’t become brittle and break (Confino, 2015; John Fullerton, 2011, 2022). While regenerative capitalism recognizes the need for economic growth it also deems “[t]he quality of growth matters” (*Regenerative Capitalism*, 2023). For example, he cites the example of Triodos Bank which already in the 1980s focused on sustainable banking championing responsibility, transparency, and business ethics. A member of the Global Alliance for Banking on Values, Triodos finances projects in nature preservation and restoration (GABV, 2023).

#### 11.4.7 Decarbonization Scenarios

The possibility of decoupling economic growth from CO<sub>2</sub>e emissions (also known as decarbonizing the economy or eco-economic decoupling) or is hotly debated (pun intended) among scientists. (Keyßer & Lenzen, 2021) provides several scenarios for low, medium, and high levels of decoupling titled Degrowth, IPCC, and Dec-Extreme.

Looking at the United Kingdom, (harrisson, 2019) concludes UK’s CO<sub>2</sub>e emissions have fallen 43% from 1990 to 2017 through the use of less carbon-intensive energy sources and argues for moderate policies in (Hausfather & Peters, 2020).

Meanwhile the cumulative CO<sub>2</sub>e emissions trend in the UK in the same time-frame show the historic responsibility of UK (Global Carbon Budget, 2023).

CO<sub>2</sub>e emissions and GDP growth per capita follow a similar path in the BRICS countries (Brazil, Russia, India, China, South Africa) as well as in Vietnam and Somalia (Raihan et al., 2024; Viana Espinosa De Oliveira & Moutinho, 2022; Warsame et al., 2024).

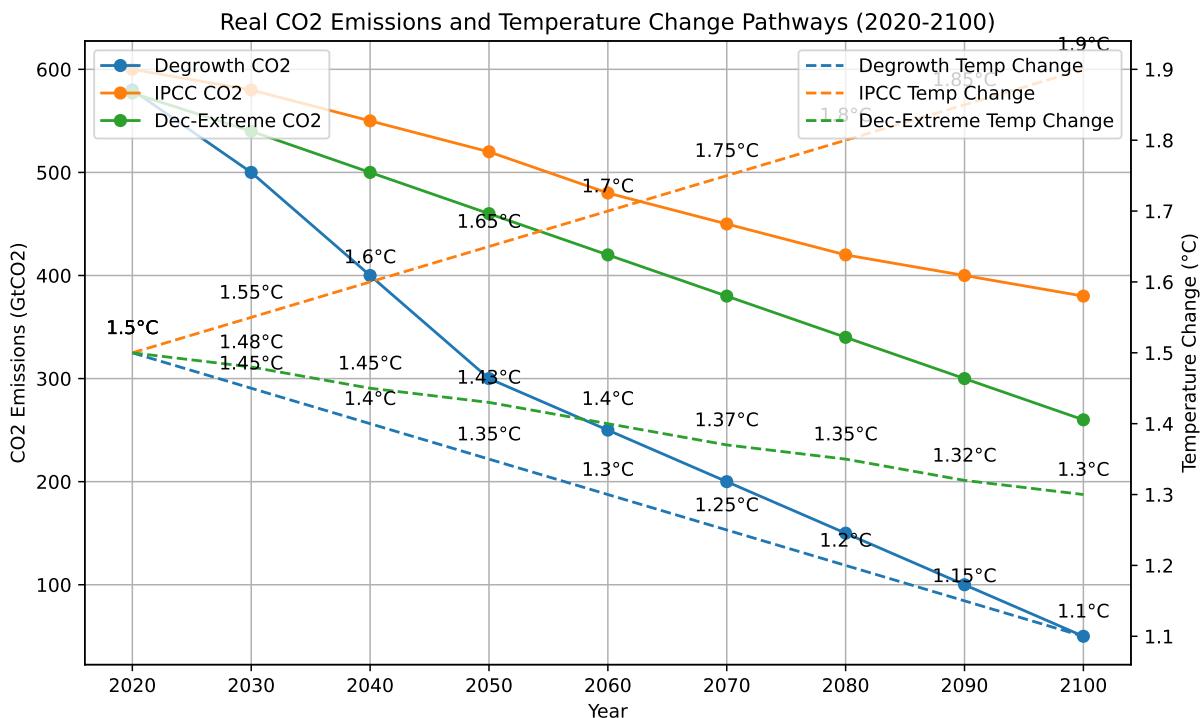


Figure 92: Climate Scenarios

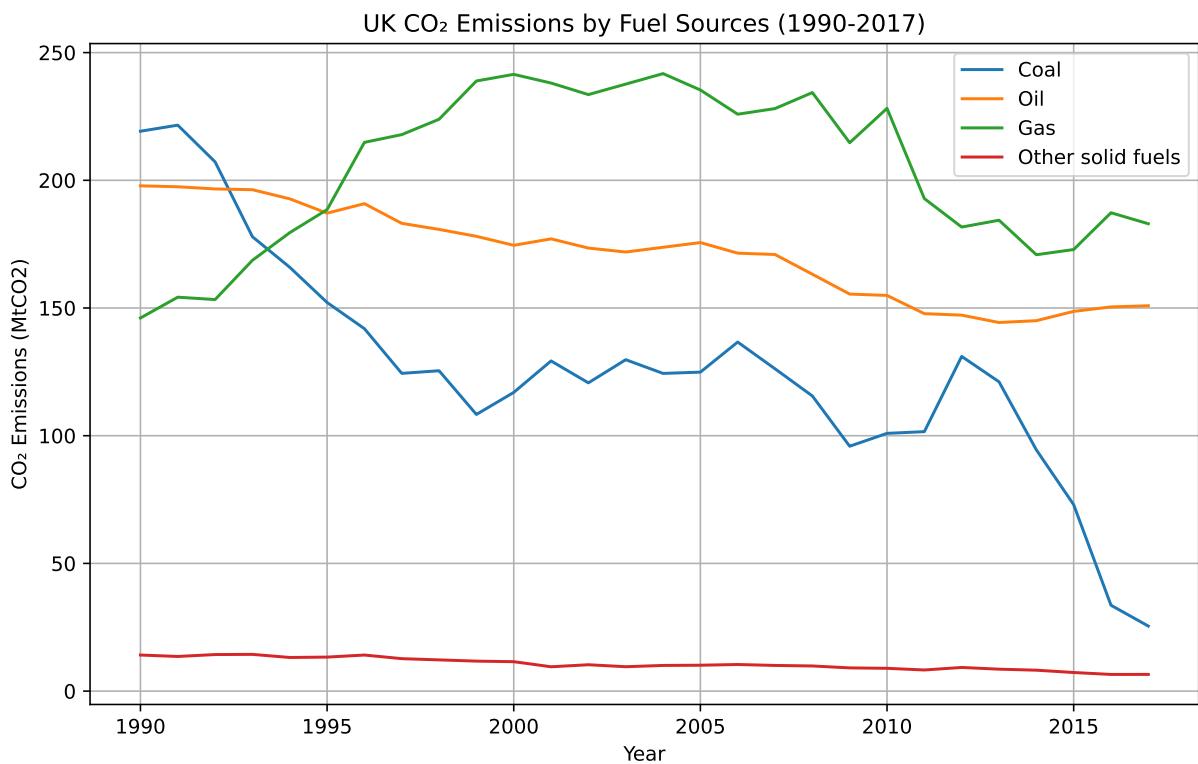


Figure 93: UK Energy Emissions' Trends

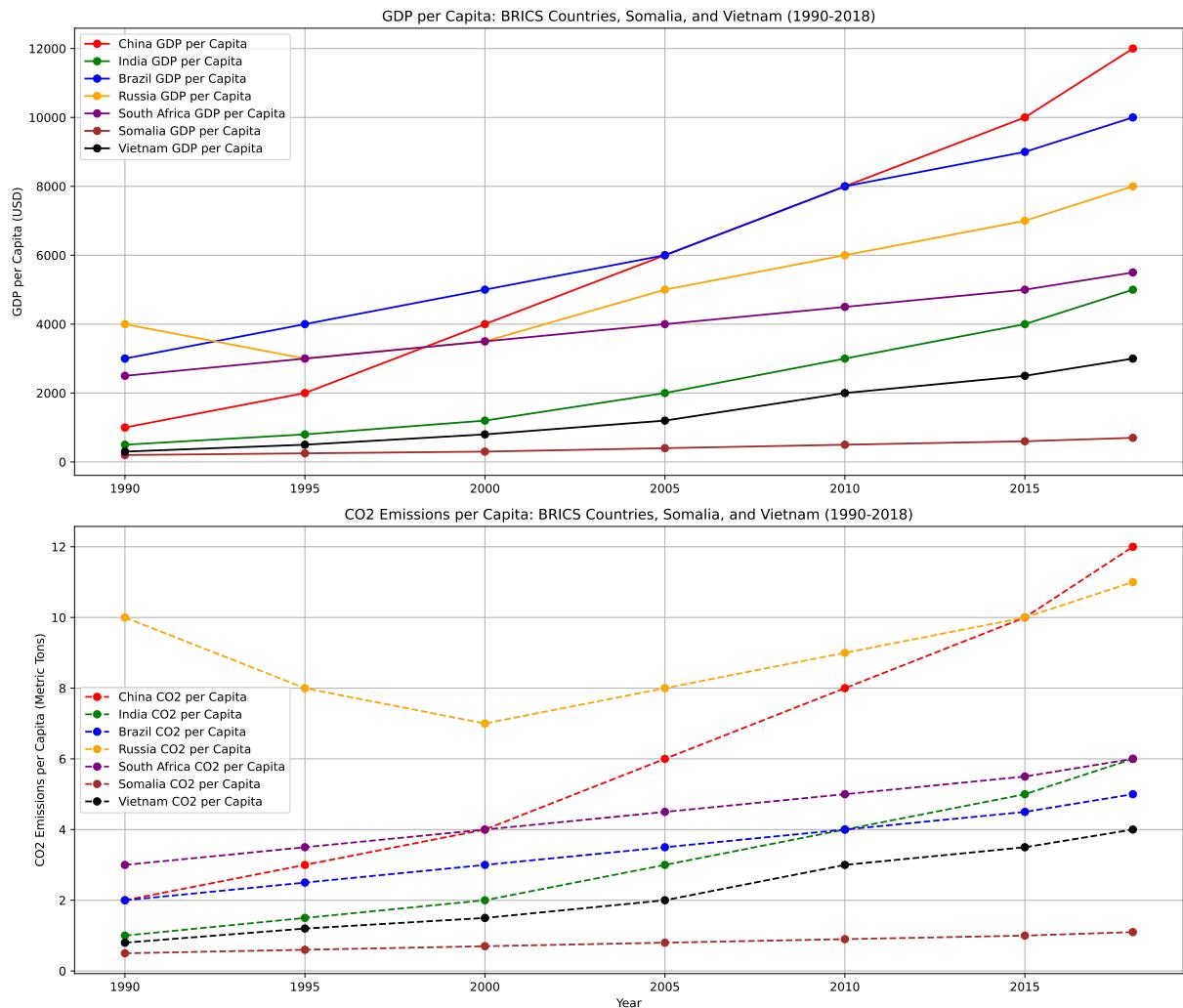


Figure 94: BRICS Emissions' vs GDP Growth Trends

In practice, there's ample evidence from several countries suggesting moving to renewal energy brings environmental benefits. In Bangladesh, (Amin et al., 2022) suggests "*removing fossil fuel subsidies and intra-sectoral electricity price distortions coupled with carbon taxes provides the highest benefits*" for both the economy and the environment. In other words, green energy is a win-win solution, for both the environmental health and financial wealth.

There are still low-hanging fruits to be picked in terms of energy efficiency. (Devlin & Yang, 2022) analysed regional steel supply chains between Australia and Japan, finding that co-locating steel manufacturing with renewable energy sources would provide the highest energy efficiency, reducing energy consumption by up to 45%; moreover, a carbon tax of 43-123 USD per tonne of CO<sub>2</sub>eq would mitigate the "green premium". (Stefan Klebert, 2022) CEO of GEA, a large producer of machinery and heat pumps, highlights that heating and cooling account for between 50-90% of energy use in processing plants; deploying state-of-the-art heat pump technology can half CO<sub>2</sub>eq emissions; large-scale carbon-neutral manufacturing is already possible with existing technologies.

One example is Innocent's Rotterdam juice plant, which operates a carbon-neutral facility (in terms or energy use for processing) by integrating heat pumps to capture and reuse waste heat across the production process; the article does not cover emissions from the juice source materials (*Innocent Opens £200m Carbon-Neutral Factory in Rotterdam - Investment Monitor*, n.d.). Palsgaard, a large producer of emulsifiers and stabilisers for food industries, reports similar results of carbon-neutral production, through using advanced heat-management and green energy (hydro-power in Denmark) sources (*CO2-neutral Factories*, n.d.). The Green Transition Denmark think-thank has published a report calculating that the complete decarbonization of Denmark by 2040 would cost about 6.2 billion Danish krone (close to \$1 Billion USD) per year, achieving full net-zero emissions, full electrification of road transport, electrification of 75% of industry and 30% of heating, capping biomass use at 10.5 PJ (petajoules) to boost forest carbon storage by 1.6 Mt CO<sub>2</sub>, expand forests by 290 000 ha, and reduce farmland by 34%, while producing 90 PJ of green fuels (Møller & Tang, 2024).

Already in 2019, Alois Müller built an example "Green Factory" in Ungerhausen, where a 1.1 MW rooftop photovoltaic system supplies 2/3 of the electricity (feeding excess power to the grid), combined with a heat and power boiler powered by biogas and pellets (note: pellets have become very controversial as their sustainability highly depends on the source material), a 100000 liter buffer tank for waste heat, and a 230 kWh lithium battery (VDI Zentrum Ressourceneffizienz, 2020).

Advances in sensors, AI, and robotics, increasingly enable *lights-out manufacturing*, which leverages full automation, producing 24/7, with minimal to no human interaction, while increasing productivity and efficiency (Eric fogg, 2020).

#### **11.4.8 Reducing the Gap Between Climate Science and Climate Economics**

William Nordhaus won a Nobel Prize in 2018 for attempting to combine climate change and economics in a single, integrated assessment model, named *Dynamic Integrated Climate-Economy*

(DICE), however his predictions are considered inaccurate by climate scientists, underestimating the risk of catastrophic warming, tippings points, and the probability of higher temperatures leading to mass death (Jones & Steffen, 2019; Kemp et al., 2022; Ketcham, 2023; Stern et al., 2022; Stern, 2022a; Y. Xu & Ramanathan, 2017).

Energy and climate change economist Noah Kaufman says economists don't understand climate and climate scientists don't understand economics; and calls out economic calculations which try to estimate climate damages over hundreds of years or find a price for climate equilibrium, as nonsensical (dessler2, 2024). Instead, in a recent paper, co-written with another Nobel prize-winning economist, Joseph Stiglitz, they argue economics can solve climate change through a risk-management approach for policy support, focusing on lowering climate risk by achieving net-zero carbon emissions (Stiglitz et al., 2024).

While Nordhaus has been criticized for his numbers, the general idea of his early book titled “The Climate Casino” doesn’t disagree. Nordhaus himself likens the current trajectory of climate change to humanity entering a “climate casino,” where we’re is gambling with the planet’s future (Nordhaus, 2013). Written a decade later, Nordhaus asks if we can still exit the casino, and is much more pessimistic than in his early work (Institute of International and European Affairs (IIEA), 2023).

Although over 100 different scientific journals now publish work on sustainability economics, the field remains highly fragmented, with little interaction between research clusters. A bibliometric study of 1987–2013 publications found 11 largely self-contained research clusters, with minimal cross - citation; for example the Nordhaus - style integrated - assessment - modeling literature had almost no overlap with another prominent researcher, Elinor Ostrom, whose work focuses on commons governance within sustainability economics (Drupp et al., 2020).

Kaufman decries the lack of real-world data in the economic-climate models, and believes the simple assumptions should be replaced with much more complex scientific analysis (dessler2, 2024).

(T.-P. Wang & Teng, 2022) conducted a systematic comparison of 3 leading integrated assessment models (IAMs) to quantify climate change damages globally and for China specifically, valued as percentage of GDP; the models are as follows FUND (Framework for Uncertainty, Negotiation and Distribution), RICE (Regional Integrated model of Climate and the Economy) and PAGE (Policy Analysis of the Greenhouse Effect)

Table 83: Quantifying climate damage scenarios using integrated assessment models (T.-P. Wang & Teng, 2022).

Climate Damage	Value	Context
Climate damage per 1 °C warming (China)	≈ 1.5 % of China's GDP	Average estimate across FUND, RICE and PAGE
Climate damage per 1 °C warming (global)	≈ 0.7 % of world GDP	Average estimate across FUND, RICE and PAGE

Climate Damage	Value	Context
Average reduction in climate damage: 2 °C target (China)	93 % reduction	vs business-as-usual in average-case scenario
Average reduction in climate damage: 2 °C target (global)	87 % reduction	vs business-as-usual in average-case scenario
Worst-case reduction in climate damage: 2 °C target (China)	80 % reduction	vs business-as-usual in the worst-case damage scenario
Worst-case reduction in climate damage: 2 °C target (global)	84 % reduction	vs business-as-usual in the worst-case damage scenario

## 11.5 Efforts to Curb Greenwashing: Data-Driven Benchmarks and the Fight for Transparency

Because corporate hypocrisy is a blocker of sustainable action, both the European Commission and the Chair of U.S. Securities and Exchange Commission (SEC) Gary Gensler have called for more legislation to curb business greenwashing practices. “*If it’s easy to tell if milk is fat-free by just looking at the nutrition label, it might be time to make it easier to tell if ‘green’ or ‘sustainable’ funds are really what they say they are*” says Gensler (US Securities and Exchange Commission, 2022).

Upcoming EU greenwashing legislation hopes to curb misleading communications by companies. The EU regulation for standardizing sustainability reporting, called the Corporate Sustainability Reporting Directive (CSRD) entered into force on 5 January 2023 and will be phased in across fiscal years 2024 to 2026 (with reports due in 2025 through 2027), requiring companies to comply with the new European Sustainability Reporting Standards for detailed environmental, social and governance disclosures (Normative, 2025). Environmental information legislation generally entitles all individuals to access environmental data through environmental information disclosure (EID), and the notion of “environmental information” spans a wide variety of topics (Oelkers, 2020).

EU’s Ecodesign Regulation for Sustainable Products (ESPR) requires mandatory documentation of environmental impacts for all product categories, bans self-declared green claims by, and sets out specific design criteria, including durability, repairability, recycled content, remanufacturing, lifecycle impacts, and waste prevention (Nastaraan Vadoodi, 2022). Until new legislation is ramped up to shift from linear to circular product development, building consumer awareness is crucial as currently most emission-reduction programs are voluntary and thus affected only by consumer demand (André & Valenciano-Salazar, 2022). Greenwashing is widespread in company social media communications (Geoffrey Supran, 2022). A number of new AI-based tools aim to find instances of greenwashing. ClimateBert AI finds rampant greenwashing (Bingler et al., 2021; Sahota, 2021).

*“Make benchmark methodologies more transparent when it comes to ESG & put forward standards for the methodology of low-carbon and ESG benchmarks in EU”*  
(European Commission, 2019b).

While the EU has proposed legislation to curb greenwashing, EU climate policy itself has been criticized for greenwashing. Sometimes greenwashing comes under legislative protection, due to oversight or private business interests and lobbyists (Frédéric Simon, 2020; Kira Taylor, 2021). (Booth, 2022) describes how wood pellets may be counted as a sustainable energy source, even though they cause deforestation:

*“A recent investigation shows illegal logging of protected areas in eastern European countries that supplies residential wood pellets in Italy. Belgium, Denmark, and the Netherlands are importing pellets from Estonia, where protected areas are logged for pellets and the country has lost its forest carbon sink, despite large-scale wood pellet plants being certified ‘sustainable’ by the Sustainable Biomass Program”* - (Booth, 2022).

While new EU legislation for deforestation-free products may eventually solve this issue (or at least mitigate the worst outcomes), the application of these laws is delayed as of writing (European Commission, 2024a; Parrish, 2025). In the US, a large wood pellet producer Enviva filed for bankruptcy protection after being sued for misleading the public about the sustainability of its products, yet managed to survive and is now again expanding its biomass business; likewise, Drax Group, another large pellet producer managed continues business after a public backlash (Catanoso, 2024; Diver, 2025; Millard, 2025).

In recycling systems,(Purkiss et al., 2022) highlights the confusion between compostable and biodegradable plastics and public misunderstanding what happens to these plastics when they reach the landfill: “[m]ost plastics marketed as *home compostable* don’t actually work, with as much as 60% failing to disintegrate after six months”. Shopping bags marketed as *biodegradable* don’t show deterioration after 3 years in salt-water sea environment (Napper & Thompson, 2019).

Green investing only makes sense if it’s possible to distinguish sustainable investments from not sustainable ones. If humans feel as if choosing green is useless, they easily give up. Sustainable investing is firstly about changes in legislation which set stricter sustainability standards on companies (as discussed above). Secondly, increased transparency, new metrics, and new tools make it feasible to differentiate more sustainable companies from less sustainable ones.

If I may conclude with a list:

- Sustainable investing is based on data.
- Greenwashing is a large detractor from environmental action as it’s difficult to know what is sustainable and what is not.
- Greenwashing disturbs sustainable capital allocation.
- Greenwashing erodes trust.
- Greenwashing has a negative impact on credibility.

The promise of ESG is to counter misinformation with transparency.

### **11.5.1 Anti-Greenwashing Efforts in Taiwan**

The Taiwanese Financial Supervisory Commission, the Ministry of Environment, the Ministry of Economic Affairs, the Ministry of Transportation and Communications, and the Ministry of the Interior collaborated on the “*Reference Guidelines for the Identification of Sustainable Economic Activities*” to encourage the financial industry to assist enterprises in their transition to sustainable carbon reduction” (金管會 & Financial Supervisory Commission, 2022)

The Taiwanese Corporate Governance Sustainable Development Roadmap published by the Corporate Governance Reform Task Force established by the Executive Yuan (Taiwanese Government), identifies *lack of diversity and independence in boards* and *insufficient ESG and financial information transparency* as key issues (Taiwan Stock Exchange Corporation, 2023).

The Taiwanese Green Citizens Action Alliance published a comprehensive report in 2024 tracking Taiwanese Corporate Sustainability Reporting focused directly at fighting corporate greenwashing (綠色公民行動聯盟, 2024).

### **11.5.2 Product Databases as a Precursor for Traceability and Supply Chain Mapping**

In order to consider the sustainability on a product level, there should be a directory of all the world’s products - a world product database. GS1 is the organization responsible for issuing EAN/UPC barcodes found on most consumer products worldwide (GS1, n.d.). However, while the UPC stands for Universal Product Code, there is no truly centralized, authoritative database of all UPCs, which has led to duplication and inconsistency across products sharing the same codes, especially with the rise of e-commerce marketplaces (Semantics3, 2017). As early as 2016, (Håkon Bogen, 2016) raised questions whether a global database of all EAN (European Article Number) barcoded products could be created. Barcodes help identify products within supply chains and retail systems, but they do not alone create a central product registry. On a basic level, standardized product codes ensures product inventory, traceability, automated checkout, and support global trade. All the world’s products already are subject to one or another standard, and although they are not uniform, some documentation does exist about every product.

A number of specialized product databases have been created to fill specific needs. The Open Product Database maintained by Datakick (Datakick, n.d.) aimed to crowdsource product information but faced limitations and is no longer widely active. WIPO GREEN, the global green technology database, catalogs environmentally sustainable innovations (WIPO GREEN, n.d.). The World Packaging Database provides detailed information about product packaging worldwide, important for understanding material impacts (Packaging World, n.d.).

In a similar vein, (Konrad, n.d.) imagines the possibility of an internet-wide directory of purchasable products, akin to how platforms like Spotify have made nearly all the world’s music easily searchable and accessible. However, despite the obvious need, attempts to build such directories have faced significant challenges. For example, the Open Knowledge Foundation’s

Open Product Data initiative (*Open Product Data*, n.d.) was eventually shut down, highlighting how difficult it is to maintain open, comprehensive, and up-to-date product information at a global scale.

While some infrastructure exists, including bar and QR-codes, standards, and partial databases, the world still lacks a unified, reliable, open-access product database. Building such a system could be improved sustainability assessments, supply chain transparency, and informed consumer choices at the global scale.

### 11.5.3 Indices, Certifications and Sustainability Standards Enable Product Comparisons

Research shows certification does matter. In Europe, consumers are willing to pay more for bio-based products: “*72% of Europeans are willing to pay more for environmentally friendly products. The study identifies a ‘green premium’ and a ‘certified green premium,’ indicating increased WTP for bio-based and certified bio-based products*” (Morone et al., 2021). Particularly in Italy, a study of consumer awareness of sustainable supply chains shows Italian consumers have a strong preference for antibiotic-free meat (Mazzocchi et al., 2022).

Open ESG data platform WikiRate currently lists 4316 different metrics, essentially questions which companies should answer (Wikirate, 2025).

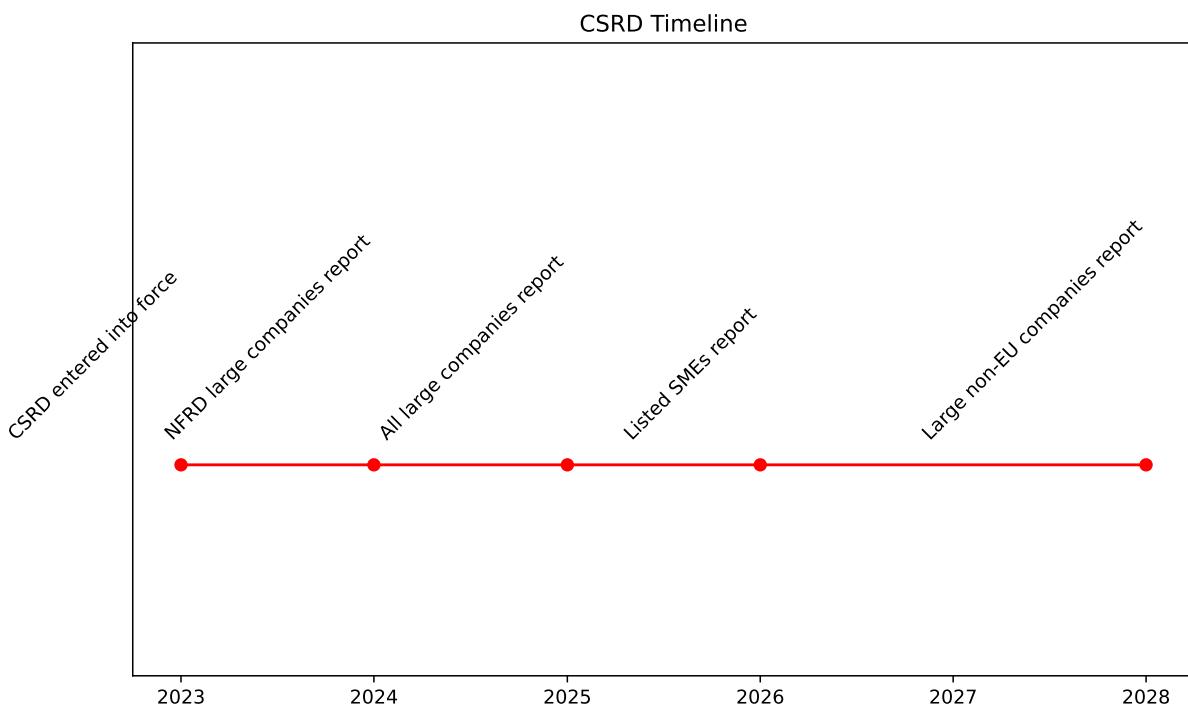


Figure 95: Corporate Sustainability Reporting Directive (CSRD) Timeline

Companies assess customer's credit score to decide credit-worthiness, however inversely, how can customers rate companies? Indices make comparing companies possible. There are many-

many indexes, scoring systems, ratings, certifications, etc. Most sustainable companies. Make a database?

Sustainability indices need transparency and standardization (Bolognesi et al., 2024).

Based on Corporate Knights data (Corporate Knights, 2024)

Energy productivity and carbon productivity are measures of how energy intensive a product is per unit of productivity. There are people working on improving efficiency; for example (J. Luo et al., 2022) suggests using reinforcement learning to reduce energy use in cooling systems.

Energy productivity

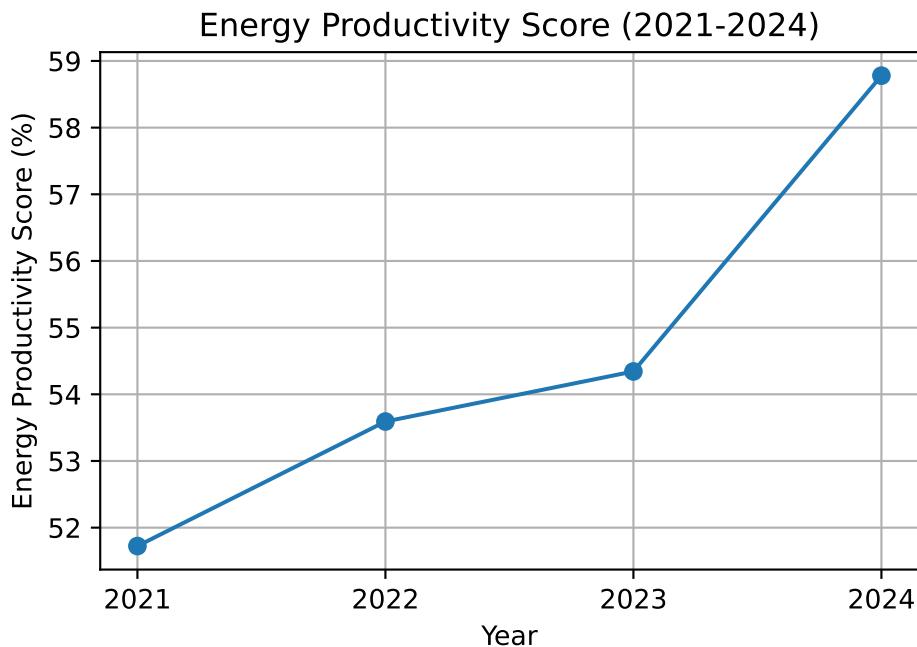


Figure 96: Energy Productivity

Carbon productivity

There are many standards. (International Trade Centre, 2022) currently lists 334 different sustainability standards: “Towards a meaningful economy” “The world’s largest database for sustainability standards”, “We provide free, accessible, comprehensive, verified and transparent information on over 300 standards for environmental protection, worker and labor rights, economic development, quality and food safety, as well as business ethics.”

Table 84: Sustainability Certification Systems

Type	Rating System	What It Does?
Certificate	B Corporation ESG	B Impact Assessment

Type	Rating System	What It Does?
Certificate	Fair Trade	
Ranking	Responsible Business Index	Responsible Business Index ( <i>Estonian Responsible Business Index</i> , n.d.)
Index	Greenly	Greenly Decarbonization Index (Greenly, 2023)
	Science-Based Targets	Science-Based Targets initiative (SBTi) provides step-by-step guidance per economic sector to help companies get started with meeting climate criteria and emission reduction requirements.
Certificate	Green Web Foundation	The Green Web Foundation certifies how sustainable is the web hosting used by websites ( <i>The Green Web Foundation</i> , 2023). Also tests website CO <sub>2</sub> emissions (Wholegrain Digita, 2023).
	Leafscore for product	Sustainability rating for products (LeafScore, 2023)
Rating	Ethical Consumer Ratings	Ethical shopping and sustainability criteria ( <i>About Ethical Consumer   Ethical Consumer</i> , 2018)
Standard	1% For the Planet Climate Neutral Certified Standard	
Standard	The Conservation Alliance	(Climate Neutral Certified, 2023)
Index	Impakter Sustainability Index	

There are many different certifications for sustainable brands. Existing rankings include fashion brand ratings and ethical shopping. The Top 100 Consumer Brands report showing brands ranked by consumer sustainability preferences from the largest consumer goods companies (*Top 100 Consumer Goods Companies of 2021*, n.d.).

The Ethical Consumer Research Association active since 1989 publishes a magazine and keeps an active list of boycotts, which currently (as of May 15, 2025) includes 47 boycott campaigns (*About Ethical Consumer | Ethical Consumer*, 2018; *Boycotts List | Ethical Consumer*, 2018).

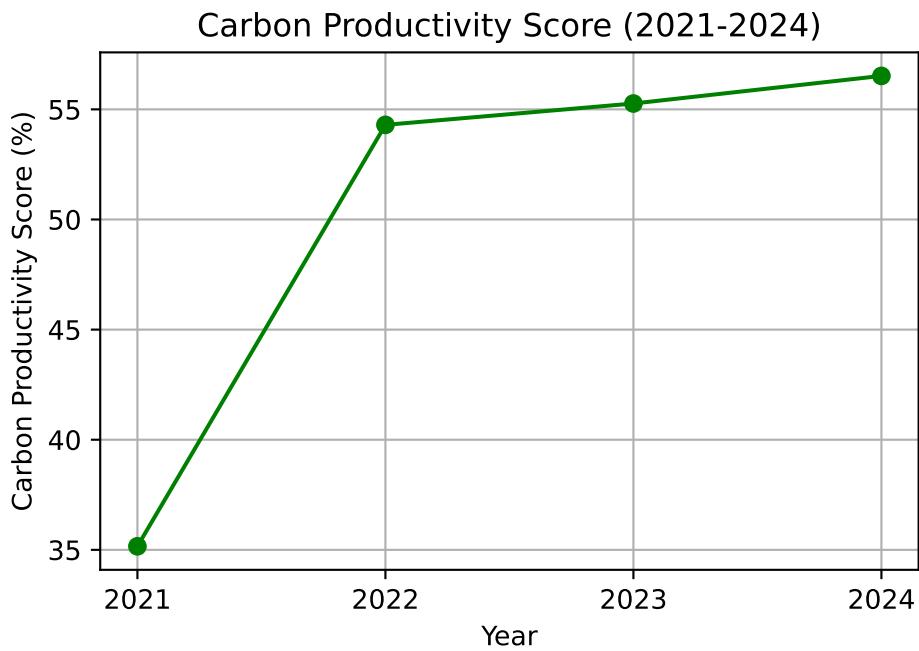


Figure 97: Carbon Productivity

Table 85: Boycotts - Active Boycotts Against Companies

Target	Category	Organizer	Launch
Airbnb	Human Rights	BDS National Committee	2016
Amazon	Human Rights	BDS National Committee	2024
Amazon (tax-avoidance)	Tax Avoidance	Ethical Consumer	2012
AXA	Human Rights	BDS National Committee	2019
Barclays Bank	Human Rights	Palestine Solidarity Campaign	2024
Booking.com	Human Rights	BDS National Committee	2024
Burger King	Human Rights	BDS National Committee	2024
Chevron	Human Rights	BDS National Committee	2022
Coca-Cola Coconut milk (from Thailand)	Human Rights Animal Rights	Friends of Al-Aqsa PETA	2014 2022

Target	Category	Organizer	Launch
Crufts dog show	Animal Rights	PETA	2014
Disney / Marvel	Human Rights	BDS National Committee & allies	2023
Ecover	Animal Testing	Naturewatch Foundation	2018
eToro	Human Rights	Tech for Palestine	2024
Expedia	Human Rights	BDS National Committee	2024
Get Your Guide	Animal Rights	World Animal Protection	2023
Google	Human Rights	BDS National Committee	2024
Groupon	Animal Rights	World Animal Protection	2023
Hewlett Packard Enterprise (HP)	Human Rights	BDS National Committee	2012
Israeli dates	Human Rights	American Muslims for Palestine	2012
Israeli produce in supermarkets	Human Rights	BDS National Committee	2005
JCB	Human Rights	BDS National Committee	2024
Kellogg's	Environment	GMO-Free USA	2012
L'Oréal	Animal Testing	Naturewatch Foundation	2000
"Made in China" goods	Human Rights	Friends of Tibet & others	2020
McDonald's	Human Rights	BDS National Committee	2024
Method	Animal Testing	Naturewatch Foundation	2018
Mitie	Human Rights	Women for Refugee Women	2023
Nestlé (baby-milk)	Human Rights	Baby Milk Action	1977
Nestlé (water extraction)	Environment	Lakota People's Law Project	2018
Papa John's	Human Rights	BDS National Committee	2023
Pizza Hut	Human Rights	BDS National Committee	2023
Russia (national boycott)	Oppressive Regimes	Government of Ukraine	2022

Target	Category	Organizer	Launch
Sabra Hummus	Human Rights	BDS National Committee	2010
Siemens	Human Rights	BDS National Committee	2022
SodaStream	Human Rights	BDS National Committee	2012
Starbucks	Habitats & Resources	Lakota People's Law Project	2023
Tesco Bank	Human Rights	Palestine Solidarity Campaign	2024
Texaco	Human Rights	BDS National Committee	2022
Trip.com	Animal Rights	World Animal Protection	2023
Tui	Animal Rights	World Animal Protection	2023
X / Twitter	Human Rights	Stop Toxic Twitter coalition	2022
Unilever (Russia operations)	Human Rights	B4Ukraine	2024
Volvo (AB Volvo trucks)	Human Rights	BDS National Committee	2024
Wendy's	Workers' Rights	Coalition of Immokalee Workers	2005
Wix	Human Rights	Tech for Palestine	2023
World Wildlife Fund (WWF)	Human Rights	WTF WWF coalition	2020

OpenCorporates attempts to map all the companies around the world - “*the largest open database of companies in the world*,” - as per their tagline, launched a collaboration with the UNSD (United Nations Statistics Division) and the OECD (Organization for Economic Co-operation and Development) to close the information gap on the 500 largest multinational enterprises (termed *MNEs*) to tackle the problem (as per their tweet on X, formerly known as Twitter): “*Hidden data is a big problem, and it's limiting our understanding of the world's largest #Multinational enterprises*” (Communications, 2023; opencorporates [@opencorporates], 2024)

WikiRate, started in 2010, is a tool for checking green credentials and “[t]he largest open registry of corporate sustainability data in the world” (Mills et al., 2016; WikiRate, 2023). Transparency is about culture but also mechanisms and tools, which is why WikiRate defines Data Sharing Archetypes (WikiRate, 2021).

Table 86: Data Sharing Archetypes defined by WikiRate.

Type	Example
Transparency Accountability	
Advocate	
Compliance Data Aggregator	
Data Intelligence Hub	
Worker Voice Tool	(Caravan Studios, 2022): “ <b>Worker Connect</b> ”
Traceability tool	trustrace.com
Open data platform	
Knowledge sharing platform	business-humanrights.org

At the 2023 Scottish AI Summit, practitioners demoed how AI pipelines can analyze modern slavery statements to flag missing disclosures, suggesting how humans and machines can “scale corporate accountability” like never before (Laureen van Breen et al., 2023). Meanwhile, WikiRate’s Facility Checker uncovers living-wage gaps in real time for advocacy organizations (Wikirate, 2022a)

Certified B Corporations undergo a rigorous B Impact Assessment (only those scoring 80 or above can earn the B Corp seal) and adhere to strict sustainability practices, which gives as placement in the B Lab global directory. Stakeholders can explore B Corps by country and industry, complete with verified impact scores and performance details. This digital platform is used by over 150 thousand businesses to manage their ESG performance (B Corp, 2025).

Maintaining that trust matters. In 2017, Etsy lost the certification after failing to convert a public company into a public benefit company for fear of shareholder reaction (Alba, 2017; Silverman, 2017). Instead, Etsy launched a campaign to focus on transparency, called “Made Mistakes”, publicly sharing user-experience errors to build trust (*Etsy Made Mistakes, but Its Commitment to Social Responsibility Wasn’t One of Them*, 2017).

Citywealth’s “*ESG branding with B-Corps*” guide shows how companies can leverage their B Corp status—using consistent logo placement, stakeholder storytelling, and transparent impact data to avoid greenwashing and attract impact-focused investors (Citywealth, 2021). (*Social Enterprises, B Corps, Benefit Companies, ESG*, 2025) explains how the true social and financial value of mission-driven enterprises comes from aligning the documentation with the reality.

## 11.6 Navigating Complexity with Data: Probabilistic Risk-Based Assessment of Sustainability

In order to make a difference in sustainability, with large capital flowing into the environment at scale to deliver climate action, the markets for ecosystem assets would need to scale urgently, starting with carbon credits. **BeZero** is a startup innovating in the Voluntary Carbon Credit Market (VCM) by providing *risk-scoring*, a language financial professionals are accustomed

to working with other types of asset classes (BeZero, 2022b; *Navigating Net Zero with Co-founder of BeZero Carbon*, 2023). The VCM is limited by immature market structures, which means market participants still struggle to price and manage risk properly; BeZero ratings frame carbon credits in a probabilistic, risk-based language familiar to large investors who oversee roughly 200 trillion USD of global assets (BeZero, 2022a).

*“The challenge is to make these instruments as recognizable as tradable assets, as measurable as financial securities, and as investable as other asset classes. Efficient financial markets allocate and manage risk based on effective price mechanisms, and this relies on access to credible information.”* (BeZero, 2022b)

Founded a few months before BeZero in early 2020, **Sylvera** tackles the same quality-signal problem in carbon, utilizing a scientific toolkit including analysis of high-resolution satellite imagery, LiDAR point clouds, and machine-learning models to assign granular AAA–D scores that break out carbon efficacy, additionality, permanence, and co-benefits; the company is active world-wide, including opening a regional hub in Singapore and holding an event earlier this year in Taiwan to promote carbon credit accountancy as a pathway to sustainability in collaboration with the Welhunt Group (Sylvera, 2023; Welhunt, 2025).

Bottleneck in VCM	BeZero	Carbonmark
Hard to gauge quality and downside risk	Provides probabilistic ratings investors already understand	N/A
Fragmented, slow, OTC trading	N/A	Consolidates registries, offers 24 / 7 liquidity and smart-contract settlement
Need to move big capital fast	Gives financiers a common risk language	Cuts friction so large orders can clear quickly

#### *Bottlenecks in Carbon Markets*

Sustainability is a complex web of interconnections. To treat nature as commodity is a category mistake: it is impossible to bring back already destroyed biodiversity that took millennia to develop. Humans create hugely complex systems using technology, instead of simply conserving nature. In a sense, climate action as an asset-liability problem, however the assets are non-fungible. They are rare and incredibly valuable.

## 12 RESULTS

“Research shows that showing people research doesn’t work,” John Sterman (P. Tan, 2018)

It is famously difficult to convince humans of anything using facts, logic, and sound argumentation. However, at the same time, humans are fallible to manipulation. This section will focus on the facts, while the next section (Discussion) will attempt to operationalize some of the findings.

### 12.0.1 Survey and Data Analysis Overview

- A survey of Taiwanese college students, covering attitudes towards shopping, saving, investing, economy, nature, sustainability, and AI.
- The survey was open from October 13th 2023 to May 31 2025
- 3000 cards with a QR code printed out
- Distribution conducted at 21 universities handing out the cards
- 1644 people started the survey, and 658 quit
- 986 people completed the whole survey
- Data after filtering 675 people aged 18-29 Gen-Z; Taiwanese; current students; respondents studying in BA (large majority), MA (small minority) or PhD level (very few).
- 36 likert fields, 5-point scale, used for clustering the students into 3 personas with K-means clustering-
- 14 product features multiple-choice used for Kmodes clustering
- 4 choice experiments
- 2 option ranking questions
- 10 qualitative text fields used to enrich the personas
- K-Means clustering was used on quantitative survey data to build similarity-based personas. K-Means is akin to vector distances for similarity, used in large language models (LLMs), word embeddings, and deep learning.

### 12.0.2 Quotes from the Survey

Even though most of the survey questions were numeric, the respondents did have the opportunity to write more in open-ended questions. Here are some selected quotes:

“I worry whether info from AI is trustworthy, whether politics or business bend it, and whether my own data steers the algorithm and reshapes what I see.”, anonymous student at National Taiwan University

“Right now I care most about how carbon emissions could raise future costs for companies, so when I invest I look at whether their carbon liabilities outweigh their carbon assets.”, anonymous student at Taichung Feng Chia University

“People will only focus on sustainability if they can afford to. When a family’s budget is tight, putting food on the table beats caring about the planet.” anonymous student at Tainan National Cheng Kung University.

“When we were kids, Dad made us bring a shopping bag and reuse it. Even if it got dirty, we could turn it into a trash bag.”, anonymous student at Taoyuan Ming Chuan University.

“Take our school as an example. We boast about being the top green university in the country, and we run plenty of green research projects, yet students’ eco-awareness has not really improved. Even with constant green messaging, the cafeterias are still flooded with ‘eco’ chopsticks and plastic spoons.”, anonymous student at National Pingtung University of Science and Technology (NPUST)

“Every purchase is a vote for our own future. College students can keep choosing green brands and changing their habits. Paying attention to these issues puts pressure on companies and pushes them toward cleaner production.”, anonymous student at Fu Jen Catholic University (FJU)

“AI can handle the time-consuming math and analysis, but I can only use it effectively if I have baseline knowledge of what I am asking.”, anonymous student at National Taiwan University (NTU)

“If eco-friendly products use fewer materials, they ought to be cheaper. No one should strong-arm me into buying something expensive.”, anonymous student at National Chung Hsing University (NCHU)

“Probably eco-education. Taiwan’s education system is lousy in many ways, yet the part that builds environmental awareness in students is actually useful.”, anonymous student at Fu Jen Catholic University (FJU)

“Let’s talk about why people want sustainability, what benefits it brings to the environment, how we can see the results, and how much worse things get if we ignore it.”, anonymous student at Chang Gung University (CGU)

“Your survey is interesting, but in my opinion most Taiwanese citizens will find it hard to fill out. There are specialized terms without explanations. Otherwise, it is great. A few typos could be fixed, but you are a foreigner, you are already doing awesome.”, anonymous student at National Dong Hwa University (NDHU)

“You could ask Taiwanese friends to review the survey’s wording. Keep going. Thank you for your bright smile, a smile can advance sustainability. I believe in the power of the spirit.”, anonymous student at National Tsing Hua University (NTHU)

There are many, the above is a sample of the responses.

## 12.1 Respondent Demographics

### 12.1.1 Study Level

	Study Level	Number of Students
0	學士	780
1	碩士	88
2	博士	8

Figure 98: Study Level

### 12.1.2 Age Distribution

	Age	Number of Students
0	18.0	214
1	21.0	167
2	19.0	163
3	20.0	146
4	22.0	82
5	23.0	45
6	24.0	25
7	25.0	17
8	29.0	6
9	26.0	6
10	27.0	4
11	28.0	1

Figure 99: Age Distribution

### 12.1.3 University

### 12.1.4 Field of Study

Fields of study have not been normalized: there may be several expressions of the same academic department, written slightly differently.

### 12.1.5 Personality Type

	University	Number of Respondents
0	國立成功大學 National Cheng Kung University (NCKU)	188
1	輔仁大學 Fu Jen Catholic University (FJU)	159
2	銘傳大學 Ming Chuan University (MCU)	134
3	國立臺灣大學 National Taiwan University (NTU)	101
4	逢甲大學 Feng Chia University (FCU)	52
5	國立東華大學 National Dong Hwa University (NDHU)	45
6	國立臺東大學 National Taitung University (NTTU)	24
7	長榮大學 Chang Jung Christian University (CJCU)	22
8	國立臺南大學 National University of Tainan (NUTN)	19
9	南臺科技大學 Southern Taiwan University of Science a...	18
10	國立中興大學 National Chung Hsing University (NCHU)	15
11	開南大學 Kainan University (KNU)	14
12	國立高雄師範大學 National Kaohsiung Normal University ...	9
13	嘉南藥理大學 Chia Nan University of Pharmacy and Sci...	8
14	臺南應用科技大學 Tainan University of Technology (TUT)	7
15	僑光科技大學 Overseas Chinese University (OCU)	5
16	國立屏東科技大學 National Pingtung University of Scien...	4
17	國立臺灣科技大學 National Taiwan University of Science...	4
18	國立清華大學 National Tsing Hua University (NTHU)	3
19	國立政治大學 National Chengchi University (NCCU)	3
20	國立中央大學 National Central University (NCU)	3
21	國立臺灣師範大學 National Taiwan Normal University (NTNU)	3
22	臺北醫學大學 Taipei Medical University (TMU)	2
23	東海大學 Tunghai University (THU)	2
24	高雄醫學大學 Kaohsiung Medical University (KMU)	2
25	國立臺灣海洋大學 National Taiwan Ocean University (NTOU)	2
26	中華醫事科技大學 Chung Hwa University of Medical Techn...	1
27	國立臺北大學 National Taipei University (NTPU)	1
28	南台科技大學	1
29	國立中正大學 National Chung Cheng University (CCU)	1
30	國立嘉義大學 National Chiayi University (NCYU)	1
31	國立高雄科技大學 National Kaohsiung University of Scie...	1
32	元智大學 Yuan Ze University (YZU)	1
33	我是台南一中的高三生	1
34	國立臺東專科學校 National Taitung Junior College (NTC)	1
35	東吳大學 Soochow University (SCU)	1
36	國立臺南藝術大學 Tainan National University of the Art...	1
37	明道大學 MingDao University (MDU)	1
38	國立臺北科技大學 National Taipei University of Technol...	1
39	玉山神學院	1
40	國立金門大學 National Quemoy University (NQU)	1
41	台南應用科技大學	1
42	南港高中	1
43	經國管理暨健康學院 Ching Kuo Institute of Management an...	1
44	國立暨南國際大學 National Chi Nan University (NCNU) <sup>287</sup>	1
45	佛光大學 Fo Guang University (FGU)	1
46	亞洲大學 Asia University (ASIA)	1
47	國立中山大學 National Sun Yat-sen University (NSYSU)	1

	Field of Study	Number of Students
0	犯罪防治學系	26
1	影像傳播學系	20
2	影像傳播	17
3	華語文學系	13
4	外文系	12
...	...	...
407	英文	1
408	行銷流通系	1
409	科技管理研究所	1
410	行流系	1
411	保健營養系	1

Figure 101: Field of Study

## 12.2 Shopping Attitudes

Interpreting the findings.

Question	Interpretation
<i>Would you still buy a tomato if you suspected it was picked by forced labor?</i>	Most respondents chose <b>2</b> or <b>1</b> which I interpret as “ <i>Nope, I wouldn’t buy it.</i> ” - only a small fraction of the respondents choosing 4-5 would ignore the labor issue.
<i>Do you care about food safety?</i>	The choices peaks at <b>4</b> , then <b>5</b> . Nearly everyone is on the caring side; indifference and denial are tiny.
<i>Will you buy a car within 7 years?</i>	The mode is <b>1</b> , plus decent counts at <b>2</b> . A clear majority of respondents do <b>not</b> expect to purchase a car soon. My interpretation: maybe they’re fine with their scooter (!= car, see the question about how they arrive to school), use public transit or are just broke students.
<i>Will you buy a house within 7 years?</i>	Even more lopsided: a mountain at <b>1</b> . Housing feels out of reach for the respondents.
<i>Do you know if a product is environmentally friendly when shopping?</i>	Bell-ish curve peaking at <b>3-4</b> . People feel <b>some</b> awareness, but confidence isn’t universal. This might also reflect they don’t fully understand the question.
<i>Do you think companies with environmental certifications are better?</i>	Strong skew right: bars climb from <b>3</b> → <b>4</b> → <b>5</b> . The badge matters and most respondents see certified firms as the good guys.
<i>Do you support a meat tax?</i>	Centered on <b>3</b> , with noticeable flanks at <b>2</b> and <b>4</b> . Opinion is split; lots are neutral, some yay, some nay. Again, this might indicate respondents don’t fully understand the question.

Question	Interpretation
<i>Do you care about the living conditions of chickens you consume?</i>	Mode at <b>3</b> , healthy bump at <b>4</b> . People lean caring, but not super strongly.
<i>Do you avoid eating meat?</i>	Tall stack on <b>1</b> , smaller on <b>2</b> . So most <b>do not</b> avoid meat; only a sliver sits at 4-5.
<i>Do you think your spending affects the environment?</i>	Big jump at <b>4</b> , next at <b>5</b> , tiny left tail. Consensus: “My wallet choices matter.” This is an important finding to justify <i>Green Filter</i> .

The following charts show the results including data from the partially-filled surveys. The extra ~300 partial responders barely move the needle, with every question’s modal answer staying exactly the same, and all the peaks and valleys shift by at most 1–2 percentage points. If anything, the full-sample ( $n \approx 1,180$ ) show more neutrality (slightly fewer “strong disagree” or “strong agree” ticks) and a tiny uptick in agreeing that certified companies are better and that your spending matters.

Design implications:

- A majority of the respondents don’t plan to buy a house or car within 7 years: don’t focus on these categories
- Majority don’t fly much: don’t focus on flights.

### 12.2.1 Boycott Count (Overall)

Option	Count	Share of sample
沒有 – <i>Never boycotted</i>	<b>537</b>	~61 %
有 – <i>Have boycotted</i>	<b>339</b>	~39 %

About 2 out of 5 college students have actively refused to buy from at least one brand, while a clear majority hasn’t taken that step.

### 12.2.2 Why Boycott?

Top motives among the 339 “Yes” answers.

- Food-safety scandals (>70 mentions: 食安問題, 地溝油, 黑心油...)
- General ethics / “黑心” distrust (~30)
- Political stance / human-rights issues (~10)
- Environmental harm (~8)
- Personal dislike (taste, price, service) (individual cases)

	MBTI Type	Number of Students
0	INFP	121
1	INFJ	91
2	ENFP	63
3	不知道	55
4	ISFJ	48
5	ENFJ	39
6	INTP	37
7	ISFP	31
8	ENTP	29
9	ESFJ	23
10	ESFP	22
11	INTJ	20
12	ESTJ	16
13	ISTJ	15
14	ESTP	11
15	ISTP	11
16	ENTJ	9
17	INTJ, INFJ	2
18	INFP, INTP	2
19	INFP, ISFP	2
20	INFP, ENFP	1
21	INTP, INFP	1
22	ISTJ, 不知道	1
23	ESFP, ENFP	1
24	ESTJ, ENFP, ENTP, ESFJ, ESTP, ESFP, INTP, INFP	1
25	ENTP, ENFP	1
26	ISFJ, INFP	1
27	ISFJ, ESFJ	1
28	INFJ, ISFP, INFP	1
29	ESFJ, ENFJ	1
30	ENTJ, ISTJ	1

Figure 102: Personality Type (MBTI)

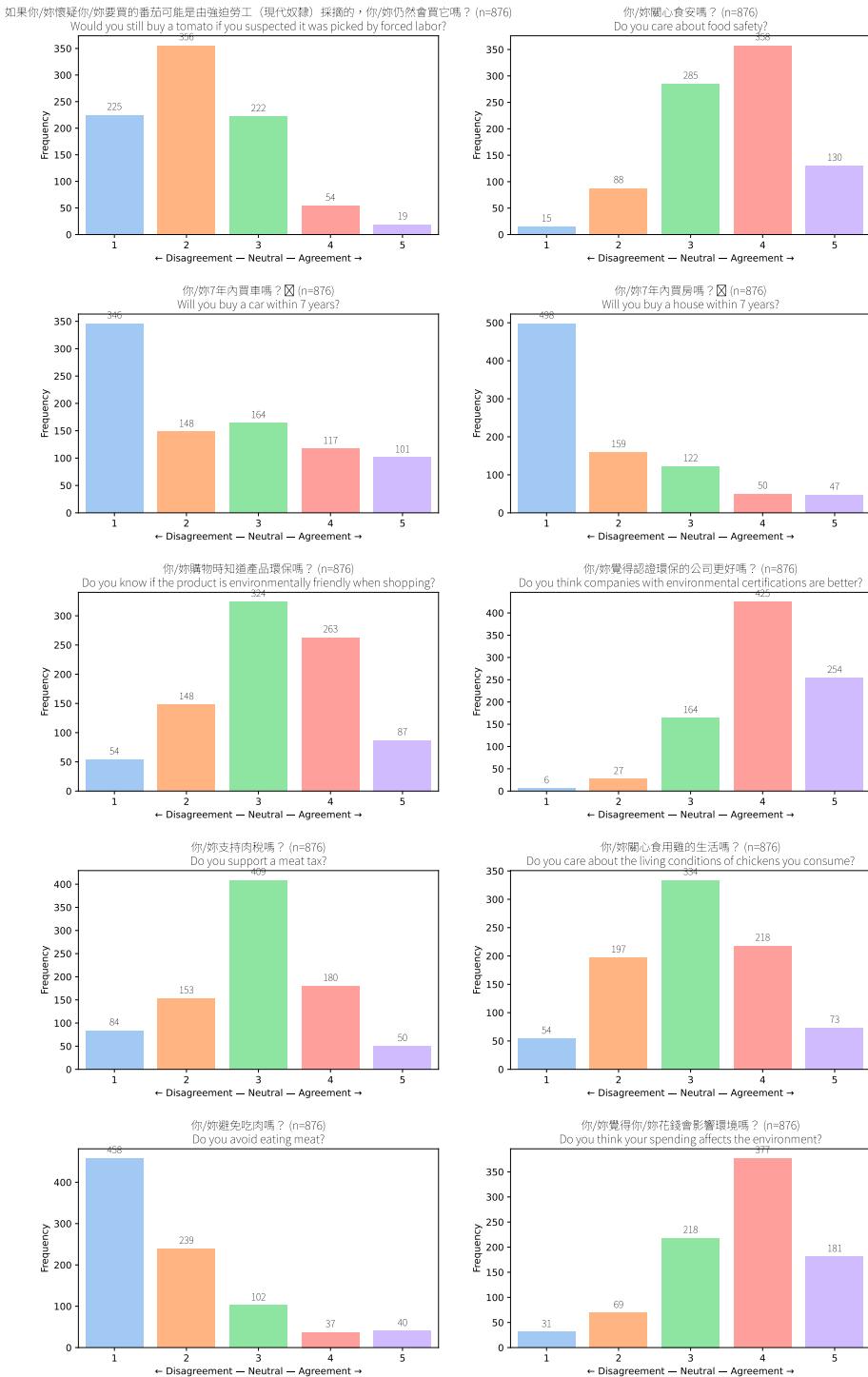


Figure 103: College Student Attitudes Towards Shopping

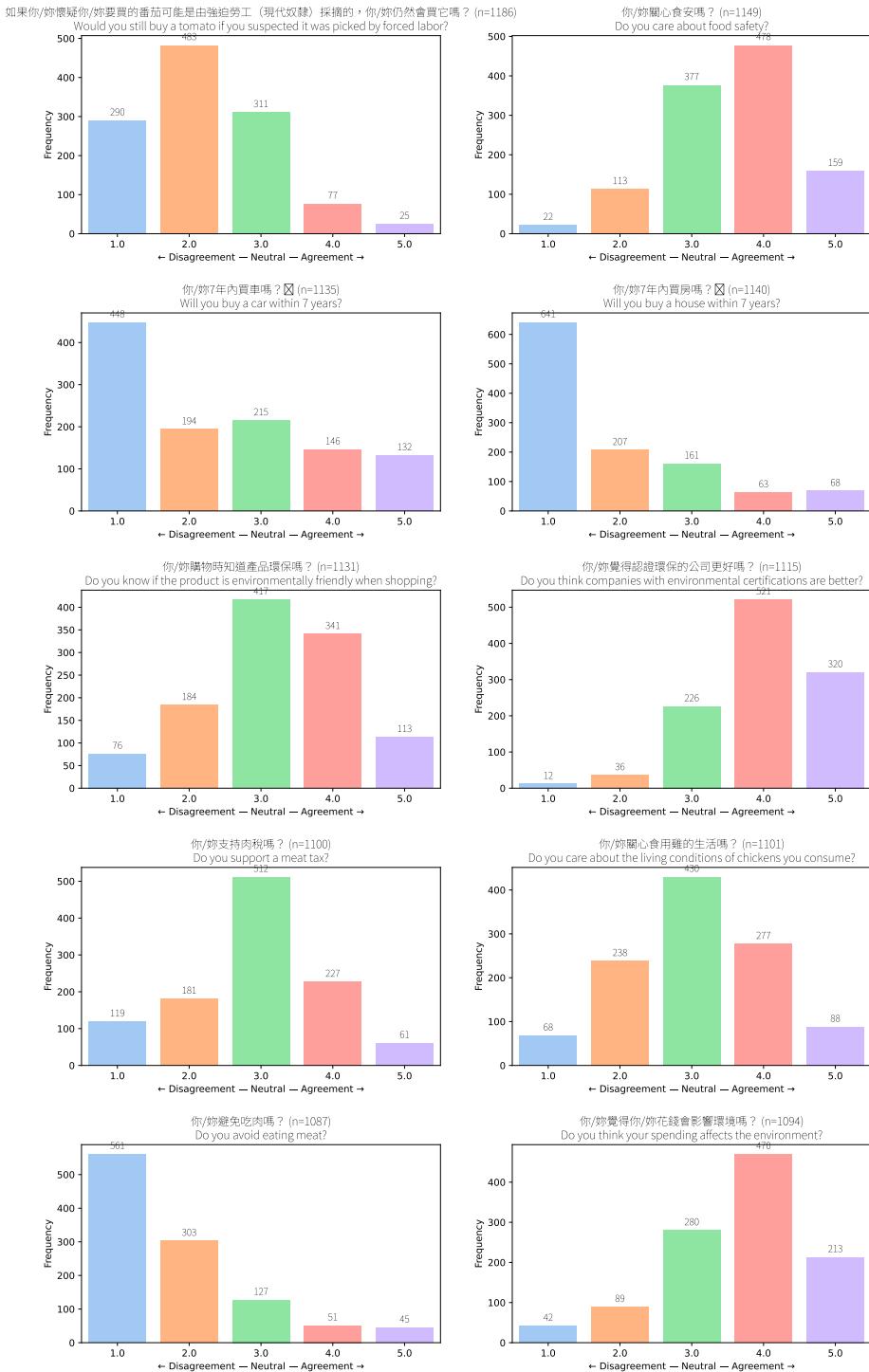


Figure 104: Partial: College Student Attitudes Towards Shopping

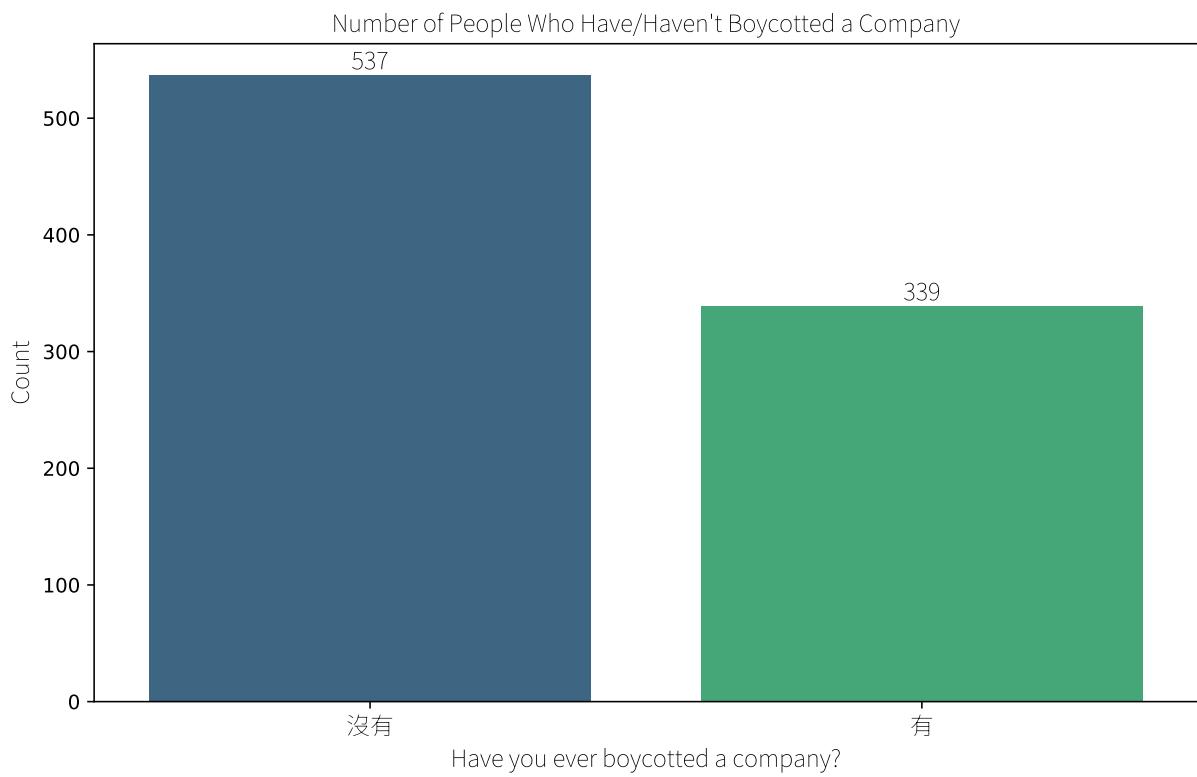


Figure 105: College Students Boycott Experience

	Reason	Count
0	食安問題	40
1	地溝油	12
2	黑心油	10
3	食安	8
4	政治因素	4
...	...	...
219	喜好問題	1
220	因為我覺得它們不好	1
221	沒有社會企業良心	1
222	因為黑心	1
223	有食安問題，避免自己吃了出事	1

Figure 106: College Students Boycott Reasons

### 12.2.3 Trusted Brands

	Brand	Count
246	No trusted brand	421
247	Have but not specified	68
0	義美	48
1	Apple	14
2	光泉	9
...	...	...
109	garena	1
110	Lego	1
111	Canon	1
112	統一企業	1
124	muji	1

Figure 107: College Student Trusted Brands

The following responses were counted as “no brand”: “無”, “沒有”, “沒有特別”, “無”, “目前沒有”, “No”, “沒”, “沒有特別關注”, “沒有特別信任的”, “不知道”, “無特別選擇”, “目前沒有完全信任的”, “沒有特定的”, “沒有特定”, “沒有特別研究”, “目前沒有特別關注的品牌”, “N”, “none”, “無特別”, “目前無”, “沒有特別想到”, “沒有固定的”, “x”, “沒在買”, “nope”, “一時想不到…”, “沒有特別注意”, “無特別的品牌”, “無絕對信任的品牌”, “不確定你說的範圍”, “還沒有”

Response category	Count	Share of all students
<b>No trusted brand</b> (any variant of “none / don’t have / can’t think of one”)	<b>421</b>	<b>48 %</b>
<b>Have trust but didn’t name it</b> (e.g., “有”)	68	8 %
<b>Named a specific brand</b>	387	44 %
<b>Total</b>	876	100 %

Rank	Brand	Count	% of all
1	義美 (I-Mei Foods)	48	5.5 %
2	Apple	27	3.1 %
3	MUJI	14	1.6 %
4	Nike	11	1.3 %
5	光泉 (Kuang Chuan Dairy)	9	1.0 %
6	統一 (Uni-President)	7	0.8 %
7	里仁 (LiRen organic)	6	0.7 %

Rank	Brand	Count	% of all 876
8	NET (Taiwanese fashion chain)	5	0.6 %
9	主婦聯盟 (Moms in Union co-op)	5	0.6 %
10	全聯 (PX Mart)	4	0.5 %

Top-10 mentioned brands (after normalising obvious duplicates). After the top three, the distribution flattens quickly; in total, 248 different brand names were entered. High “no-brand” rate (48 %): Students are sceptical and reserve trust; they need a strong safety/ethics signal before committing loyalty.

### 12.3 Choice Experiments

Product & Attributes	Choices	Respondents	Share	Interpretation
<b>Tomatoes</b> (Price × Forced-labor Risk)	500 TWD/kg (5% risk)	<b>507</b>	<b>58%</b>	<b>Sweet-spot:</b> most college students accept a mid price if risk is < 10%.
	300 TWD/kg (15% risk)	301	34%	<b>Price-first:</b> about 1/3 of the respondents sacrifice ethics for a 40% discount.
	700 TWD/kg (2% risk)	68	8%	<b>Ethical Premium:</b> fewer than 1/10 of the respondents will pay +40% for the safest pick.
<b>Milk</b> (Price Only)	85 TWD	<b>363</b>	<b>41%</b>	Slightly higher-priced carton wins; may signal perceived quality.
	72 TWD	339	39%	Hardcore bargain hunters—pure price play.
	108 TWD	174	20%	Small niche is fine paying +27 % (brand / organic cue?).

Product & Attributes	Choices	Respondents	Share	Interpretation
<b>Eggs</b> (Price × Animal-welfare Label)	66 TWD / 10 eggs (no hen-welfare info)	<b>414</b>	<b>47%</b>	Baseline: half of the respondents choose the cheapest “unknown welfare” tray.
	102 TWD / 10 eggs (no hen-welfare info)	269	31%	Some will pay +54% even without extra welfare signal (brand/quality?)
	160 TWD / 10 eggs (cage-free label)	193	22%	About 1/5 of the respondents would pay +142% when hen welfare is certified.



Figure 108: College Student Shopping Choice Experiment

## 12.4 Taiwanese College Student Attitudes (Overall)

These are student attitudes across all 36 likert fields without clustering. Clustered results are available under the Personas section.

### 12.4.1 Economy

Table 100: Interpreting the economic attitudes of college students.

Question	Dis-	Neu-	Interpretation
	agree 1-2	tral 3	
“Taiwan’s economic goal is growth.”	19%	31%	<b>50%</b> Half the college students see GDP growth as the main national KPI.
“Environmental degradation is a prerequisite for that growth.”	<b>39%</b>	26%	34% Split opinions: a large percentage of the respondents rejects this trade-off, but 1/3 thinks wrecking nature is the price of progress.
“Taiwan’s growth helps protect the environment.”	<b>40%</b>	31%	29% Skeptic mode: more students <i>disagree</i> than buy the “growth = green” story.
“The economy can keep growing without emitting CO <sub>2</sub> .”	<b>45%</b>	24%	28% Decoupling doubters outnumber believers almost 2:1.
“Economic growth has material limits.”	10%	26%	<b>64%</b> Clear majority says “Planet > infinite GDP” - limits are real.

Data from partial surveys.

### 12.4.2 AI Use

Data from partial surveys.

台灣的經濟 Total Respondents (Gen-Z Current College Students): 876

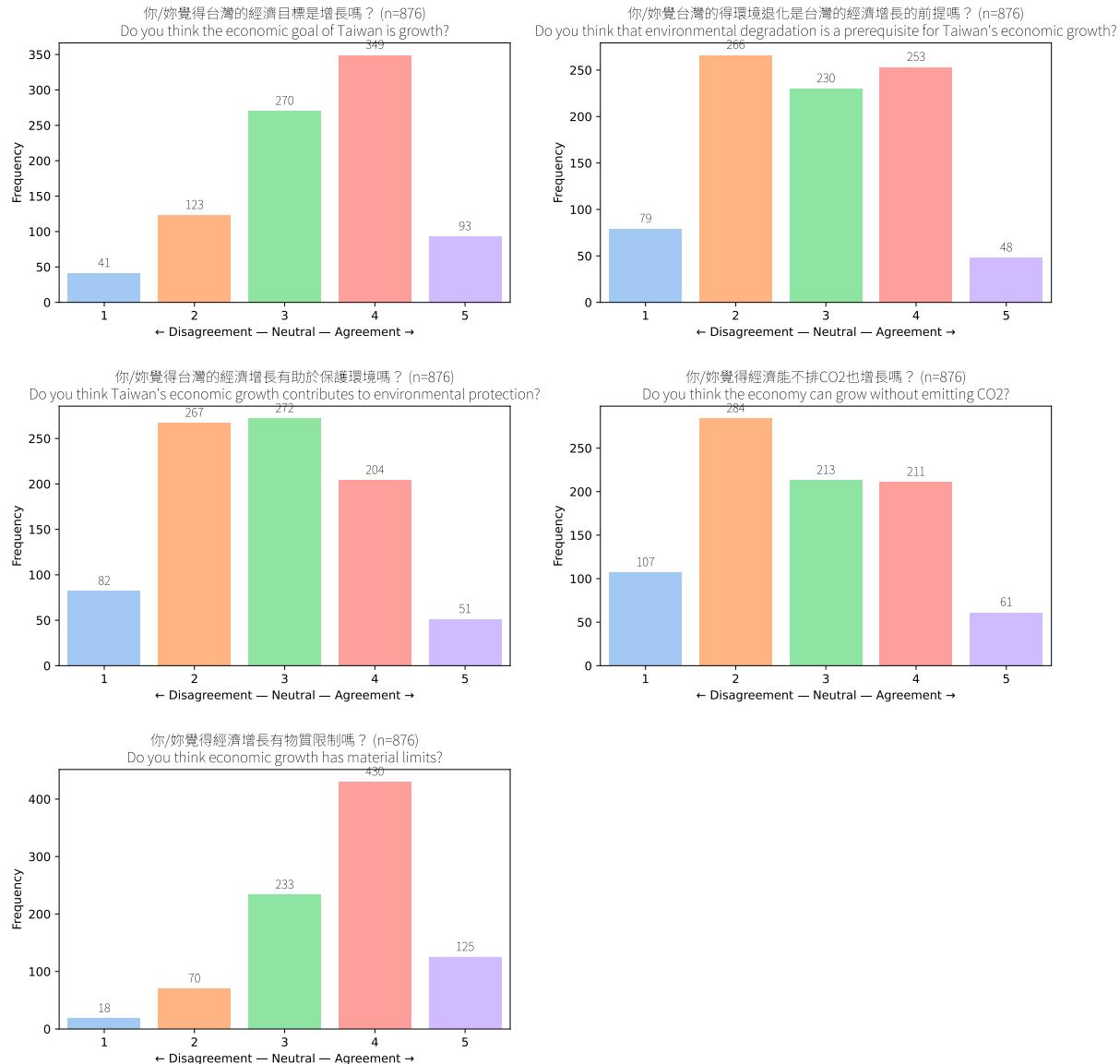


Figure 109: Student Attitudes Towards Economics Issues

台灣的經濟 Total Respondents (Gen-Z Current College Students): 1065

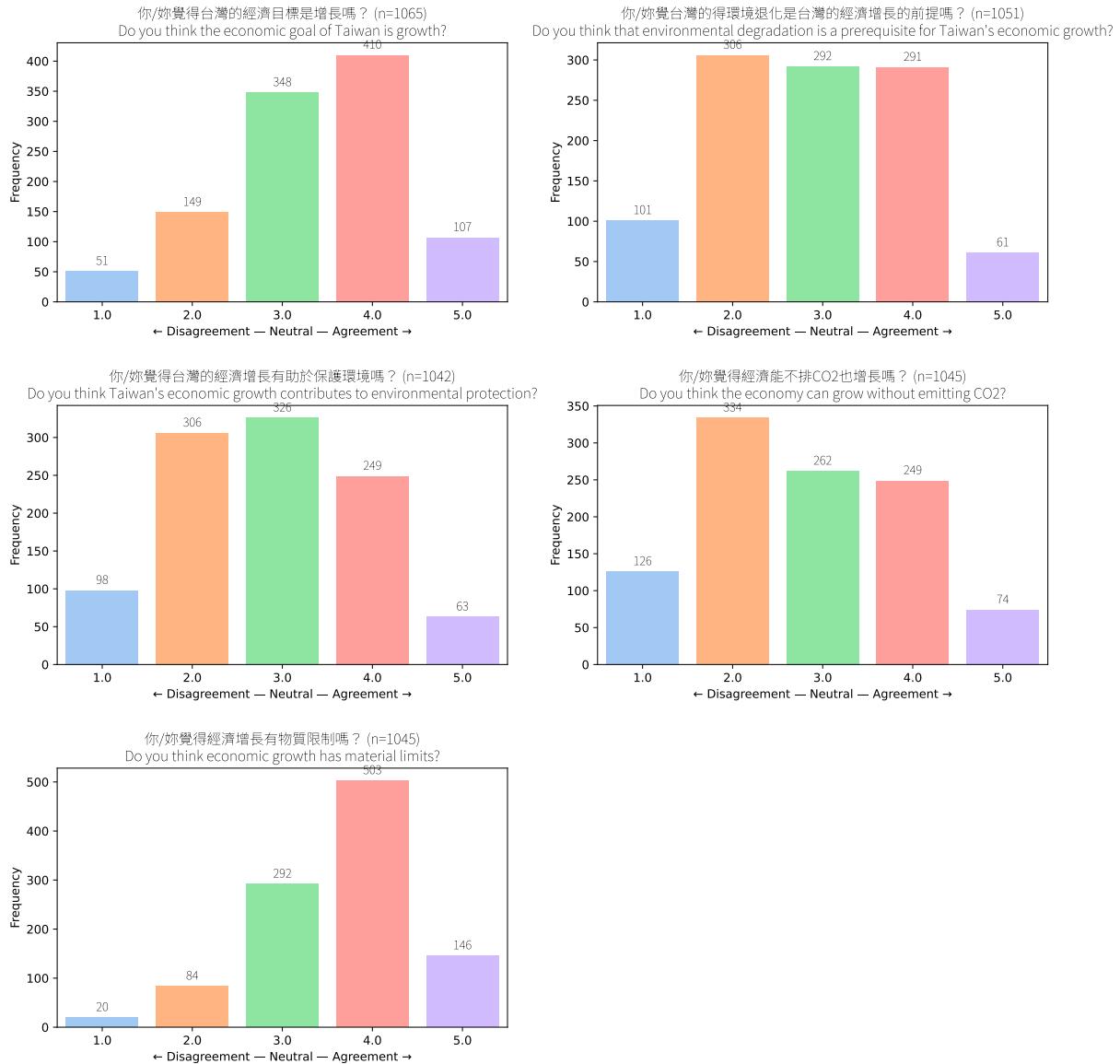


Figure 110: Partial: Student Attitudes Towards Economics Issues

AI使用習慣 Total Respondents (Gen-Z Current College Students): 876

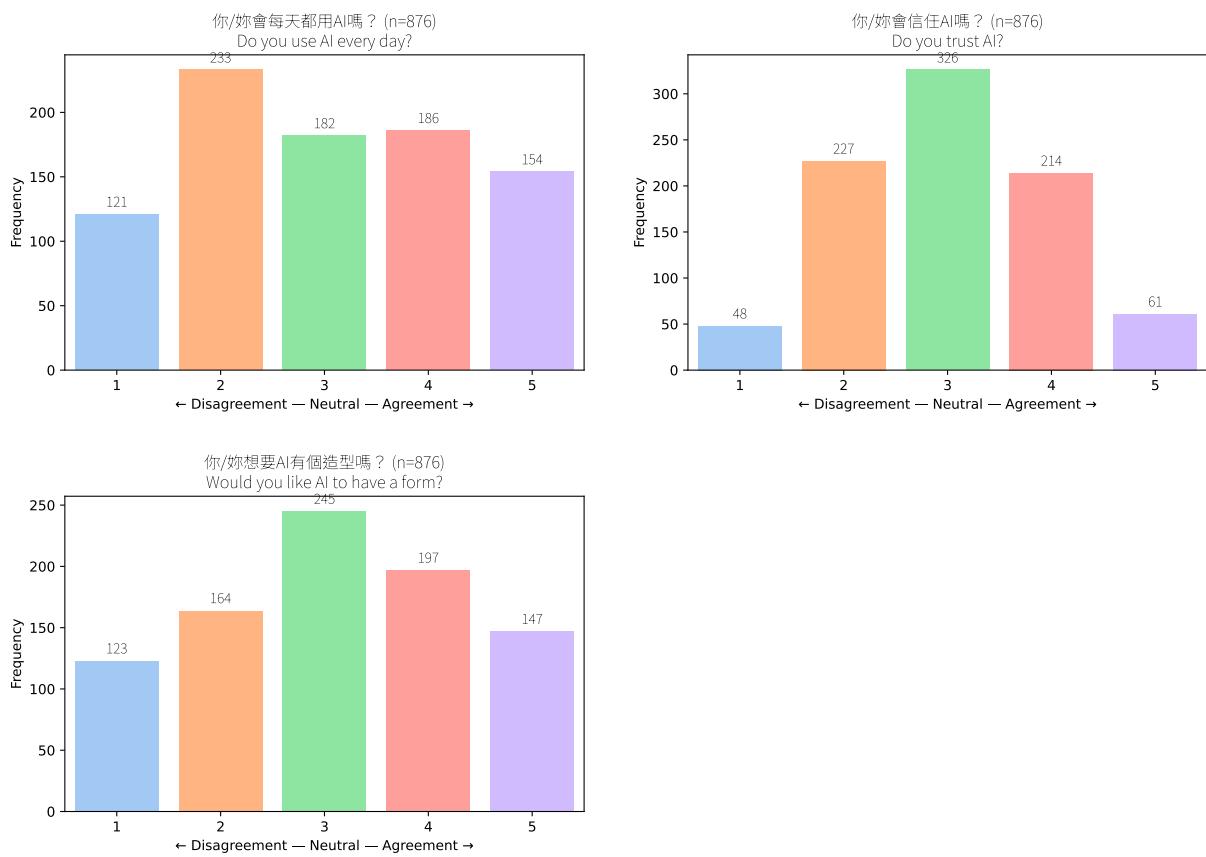


Figure 111: Student Attitudes Towards AI Use

AI使用習慣 Total Respondents (Gen-Z Current College Students): 1040

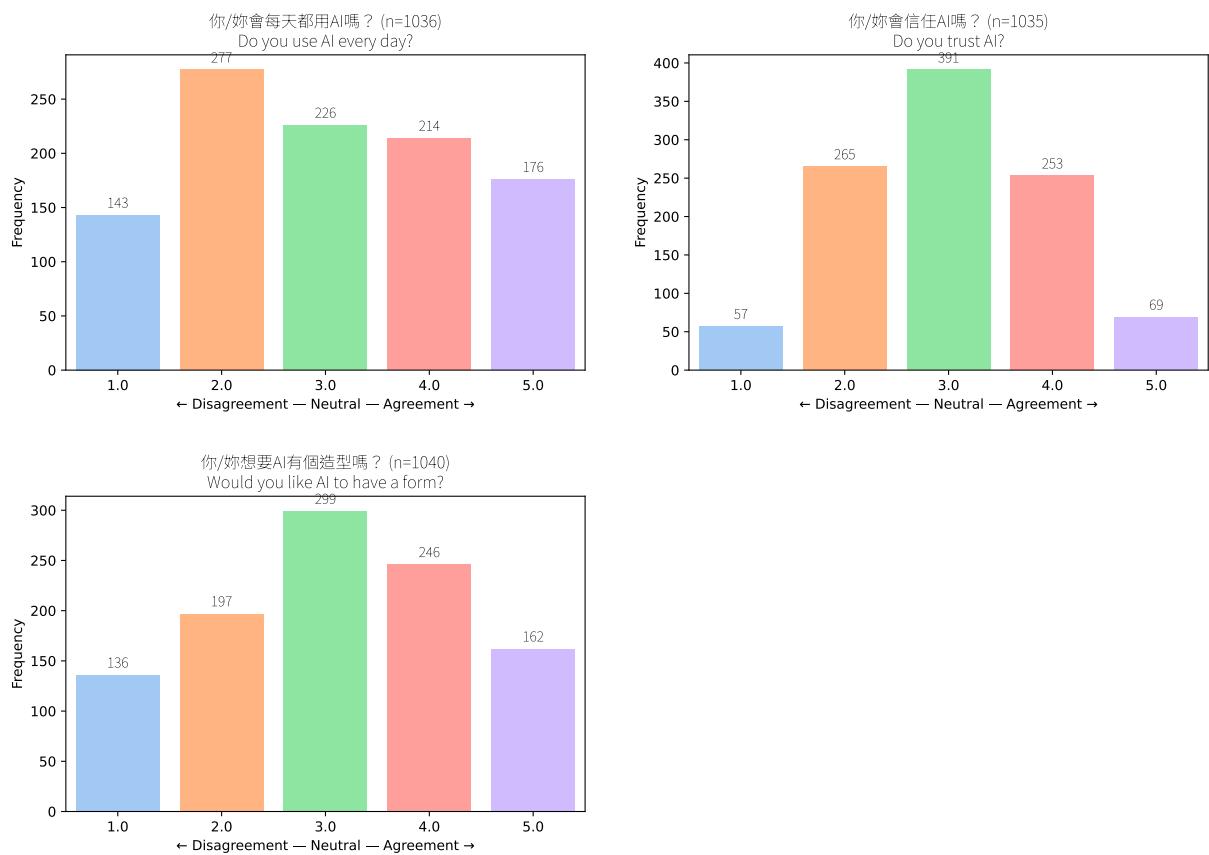


Figure 112: Partial: Student Attitudes Towards AI Use

台灣的大自然 Total Respondents (Gen-Z Current College Students): 876

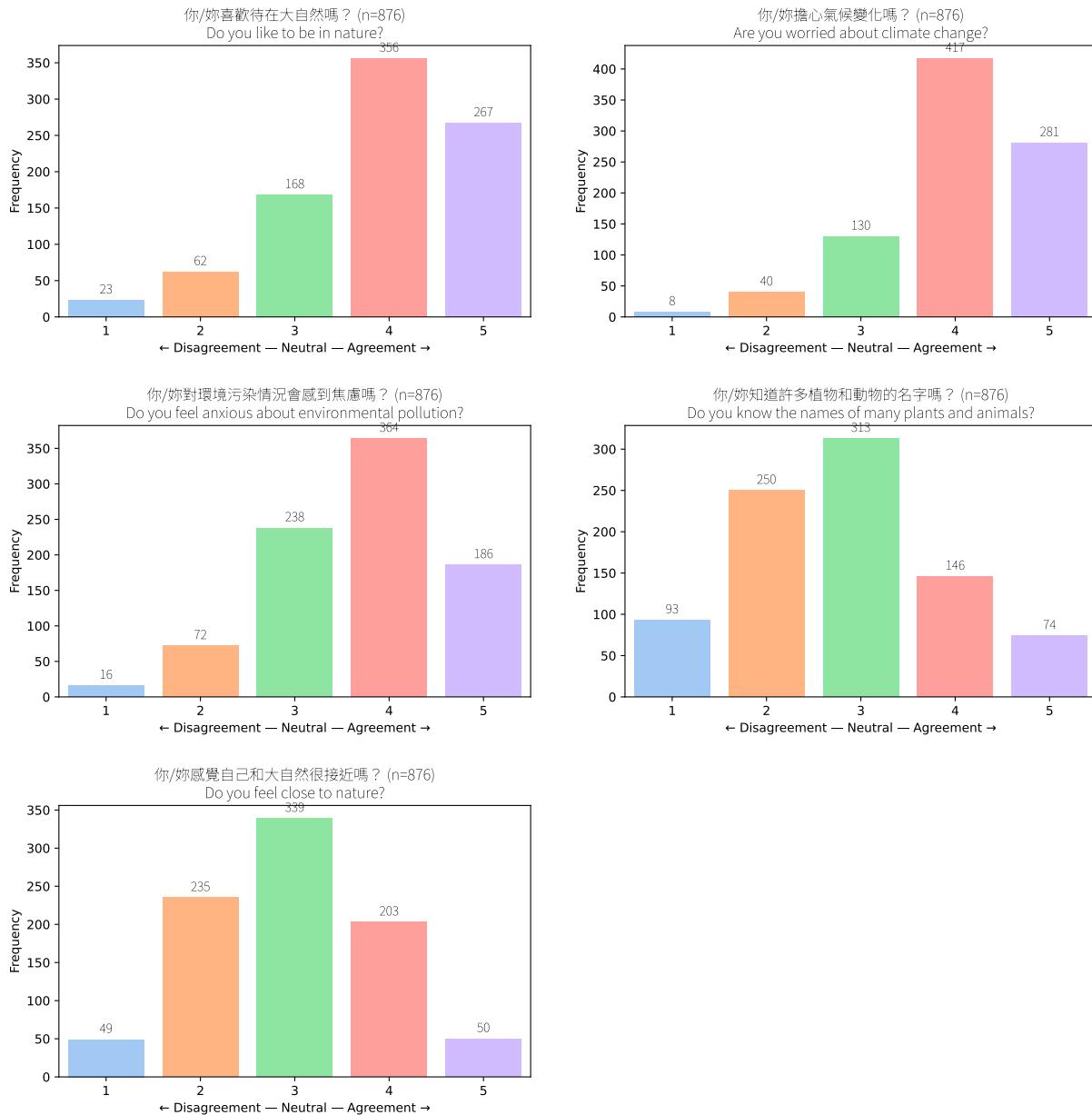


Figure 113: Student Attitudes Towards Nature

環保習慣 Total Respondents (Gen-Z Current College Students): 876

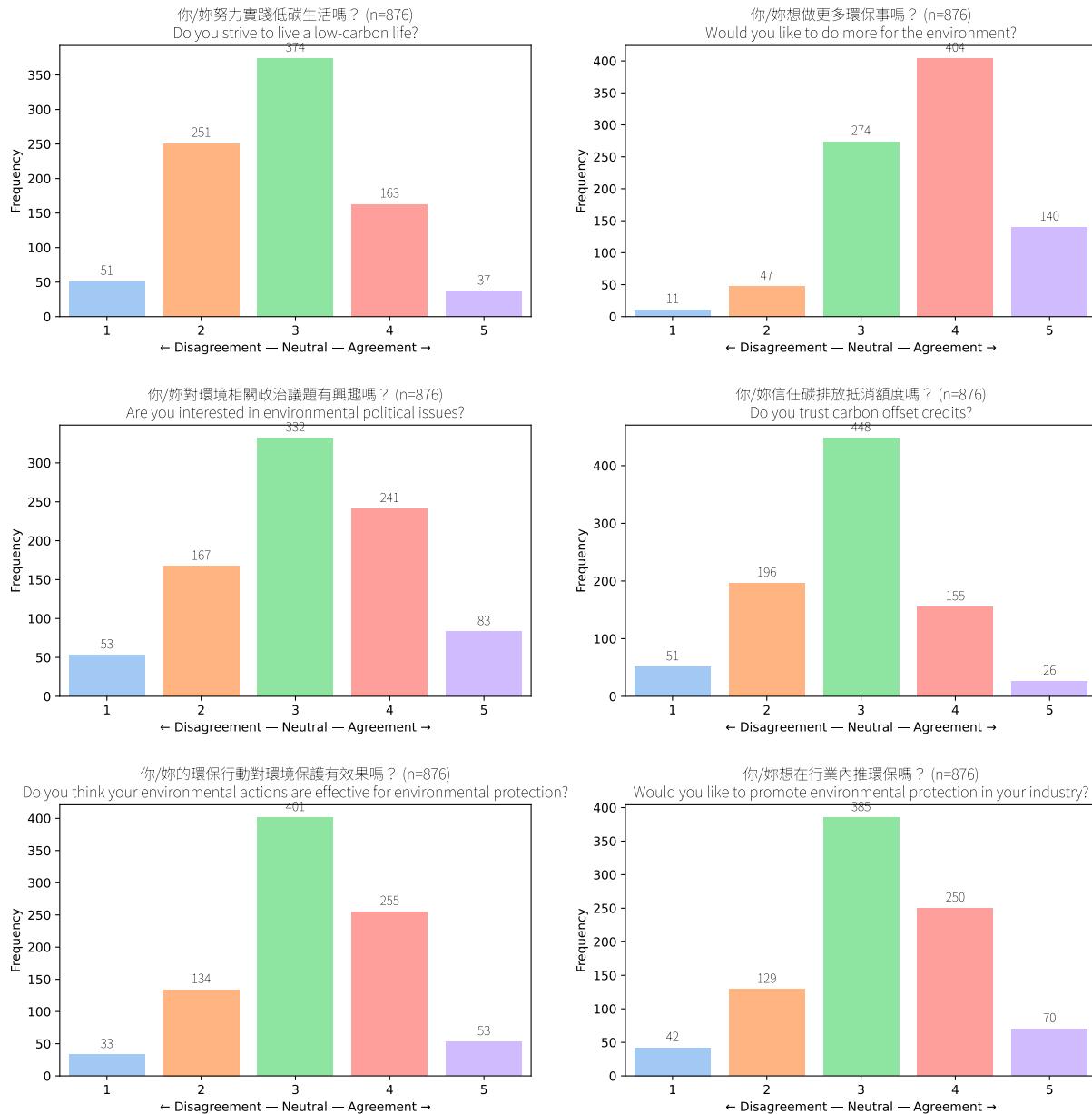


Figure 114: Student Attitudes Towards Environmental Protection

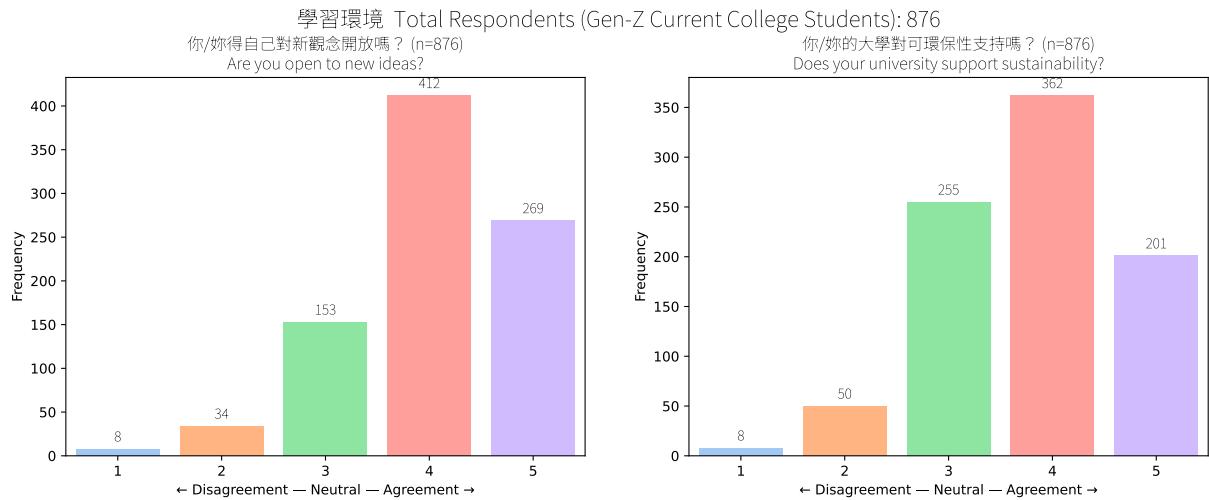


Figure 115: Students' Learning Environment

#### 12.4.3 Nature

#### 12.4.4 Environmental Protection

#### 12.4.5 Learning Environment

#### 12.4.6 Correlations Between Fields

Correlations between fields allow clustering similar groups of students.

Correlation Network



Figure 116: Correlations Between Student Attitudes

Cluster	Key Questions	Interpretation
<b>Green Engagement</b>	<ul style="list-style-type: none"> <li>- 你/妳想做更多環保的事嗎？ <i>Would you like to do more for the environment?</i></li> <li>- 你/妳的環保行動對於環境保護有成效嗎？ <i>Do you think your actions help the environment?</i></li> <li>- 你/妳努力才讓低碳生活嗎？ <i>Do you strive to live a low-carbon life?</i></li> <li>- 你/妳對環境污染流露出焦慮嗎？ <i>Do you feel anxious about environmental pollution?</i></li> <li>- 你/妳對環境相關政治議題有興趣嗎？ <i>Are you interested in environmental politics?</i></li> </ul>	Core “green mindset” cluster. Students who feel climate anxiety are also motivated and politically curious. Likely early adopters of sustainable tools.
<b>Nature Identity</b>	<ul style="list-style-type: none"> <li>- 你/妳喜歡待在大自然嗎？ <i>Do you like being in nature?</i></li> <li>- 你/妳覺得自己和大自然很接近嗎？ <i>Do you feel close to nature?</i></li> <li>- 你/妳知道許多植物和動物的名字嗎？ <i>Do you know many species?</i></li> </ul>	Emotionally grounded, biodiversity-aware students. More connected to <i>nature as place</i> , not just “climate change” as a concept. Great for nature-learning features.
<b>Tech &amp; System Trust</b>	<ul style="list-style-type: none"> <li>- 你/妳相信碳排放抵換機制嗎？ <i>Do you trust carbon offset credits?</i></li> <li>- 你/妳相信AI嗎？ <i>Do you trust AI?</i></li> </ul>	Openness to abstract or institutional systems (AI, offsets). Users here are more likely to accept algorithmic tools or fintech solutions.
<b>Change-maker Confidence Cluster</b>	<ul style="list-style-type: none"> <li>- 你/妳覺得自己創新想法會被採用嗎？ <i>Do you believe your ideas will be adopted?</i></li> <li>- 你/妳的大學可支援你性支持嗎？ <i>Does your university support you?</i></li> </ul>	Belief in innovation and institutional support. A smaller but important group—ideal for leadership roles or student-led sustainability challenges.

Cluster	Key Questions	Interpretation
<b>Financial Habits</b>	- 你/妳會省錢嗎？ <i>Do you save money?</i> - 你/妳會在意錢嗎？ <i>Do you care about money?</i>	Practical, price-sensitive users. Likely to respond to cost-saving sustainability nudges (e.g. “eco ≠ expensive” framing).

#### 12.4.7 Environmental Knowledge Ranking Experiment

Testing student knowledge about the environment. College students see coral reefs, tropical rainforests, and wetlands as the most sensitive ecosystems, aligning with global climate narratives. However, the long tail of unique combos suggests mixed ecological knowledge and a strong opportunity to educate and personalize ecosystem awareness, especially in a Taiwanese context.

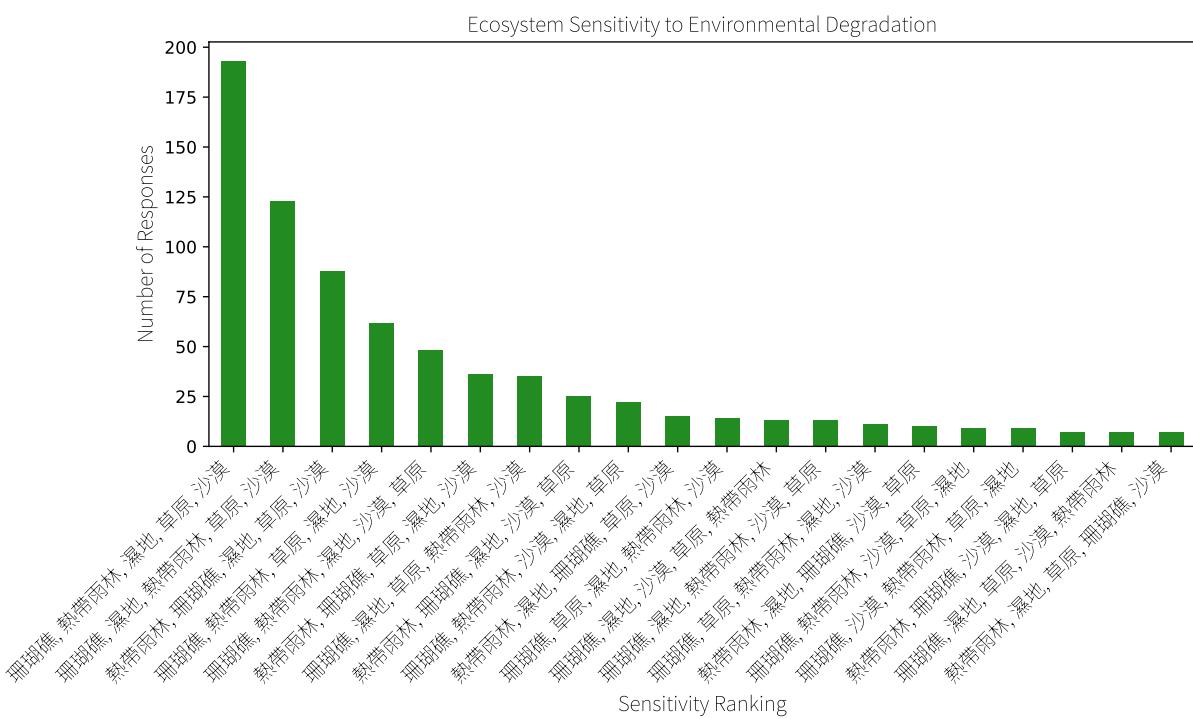


Figure 117: Students' Environmental Knowledge

Rank (most-to-least chosen)	Ecosystem that sits at that rank	$\approx$ Share of all answers	Take-away
1	珊瑚礁 ( <b>Coral reefs</b> )	$\approx 68\%$ (599 votes)	Reefs are the textbook fragile ecosystem in students' minds. Think bleaching clips all over IG and TikTok.
2	熱帶雨林 ( <b>Tropical rain-forests</b> )	$\approx 26\%$ (225)	Deforestation stories keep rain-forests firmly in the spotlight.
3	沙漠 ( <b>Deserts</b> )	$\approx 2.4\%$ (21)	Only a small crew sees deserts as sensitive – lots of folks still picture them as “already tough”.
4	濕地 ( <b>Wetlands</b> )	$\approx 2.4\%$ (21)	Same low share as deserts. Wetlands might be off the radar unless you’re into birdwatching or flood news.
5	草原 / 草地 ( <b>Grasslands</b> )	$\approx 1.1\%$ (10)	Grasslands barely register, even though they store heaps of carbon. Room for awareness-boosting.
6 +	Other rankings or blanks	< 1 % each	Everything outside the top five is statistical noise in this data set.

In summary, reefs dominate students mind share, with nearly 7 in 10 students putting coral reefs in the pole position. Rain-forests still matter. One quarter see them as the next-most fragile, a solid silver medal. Everything else is background noise. Deserts, wetlands, and grasslands together grab < 6 %. That’s a massive perception gap I could tackle in outreach or app content.

## 12.5 Saving

The following charts are based on the 你/妳覺得目前有任何投資嗎？ and 你/妳覺得目前有任何投資嗎？ boolean (Yes / No) fields. The data shows correlation between saving levels and investing: the students with higher level of saving invest more.

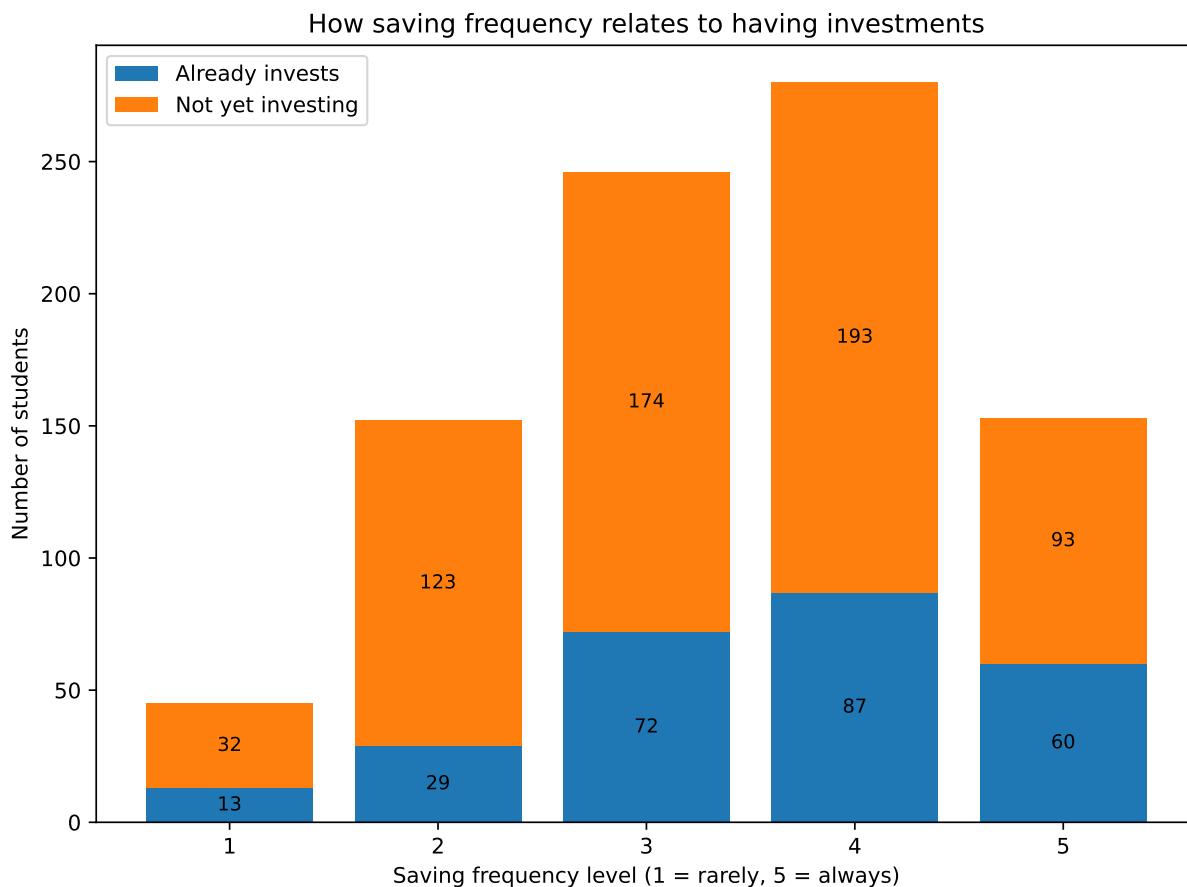


Figure 118: Correlation Between Saving Levels and Investing (Sankey)

The same data plotted as a Sankey chart.

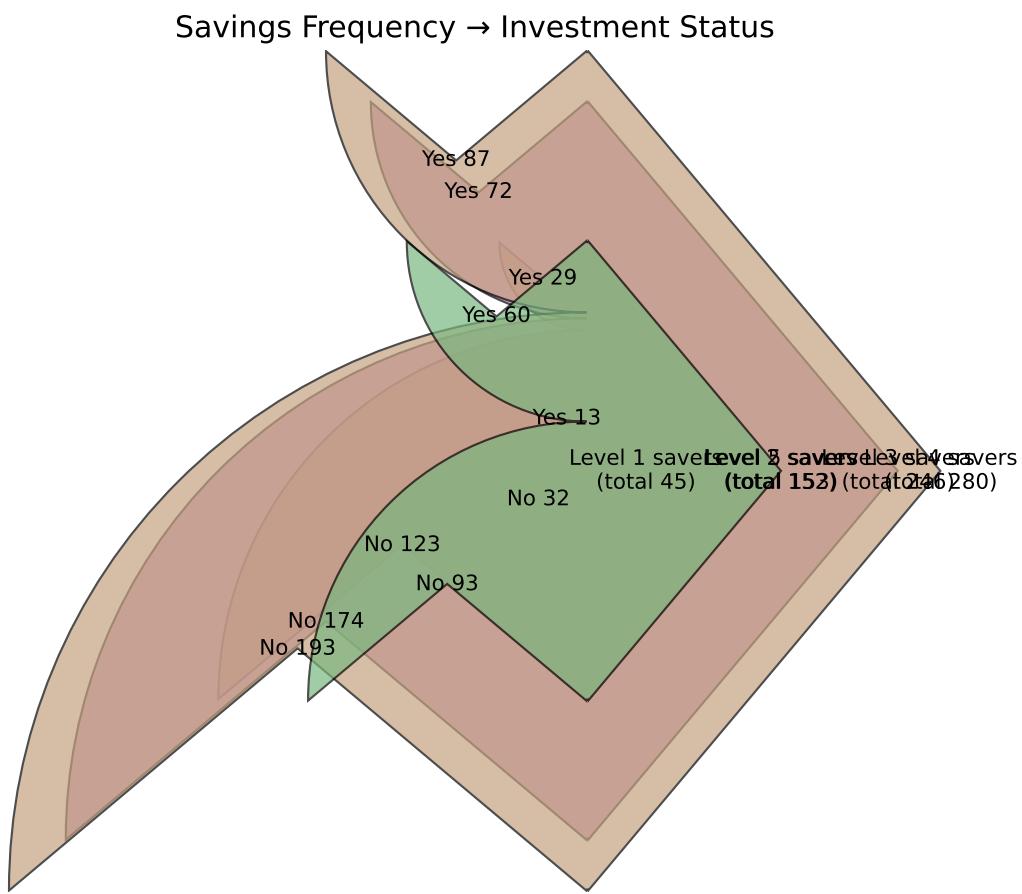


Figure 119: Correlation Between Saving Levels and Investing (Sankey)

## **12.6 Investing**

Student attitudes towards investing.

### **12.6.1 Saving and Investing**

### **12.6.2 Investing Experience (Overall)**

## **12.7 Choice Experiment**

Question: 你/妳選哪個投資？ Which investment do you choose?

存錢和投資習慣 Total Respondents (Gen-Z Current College Students): 876

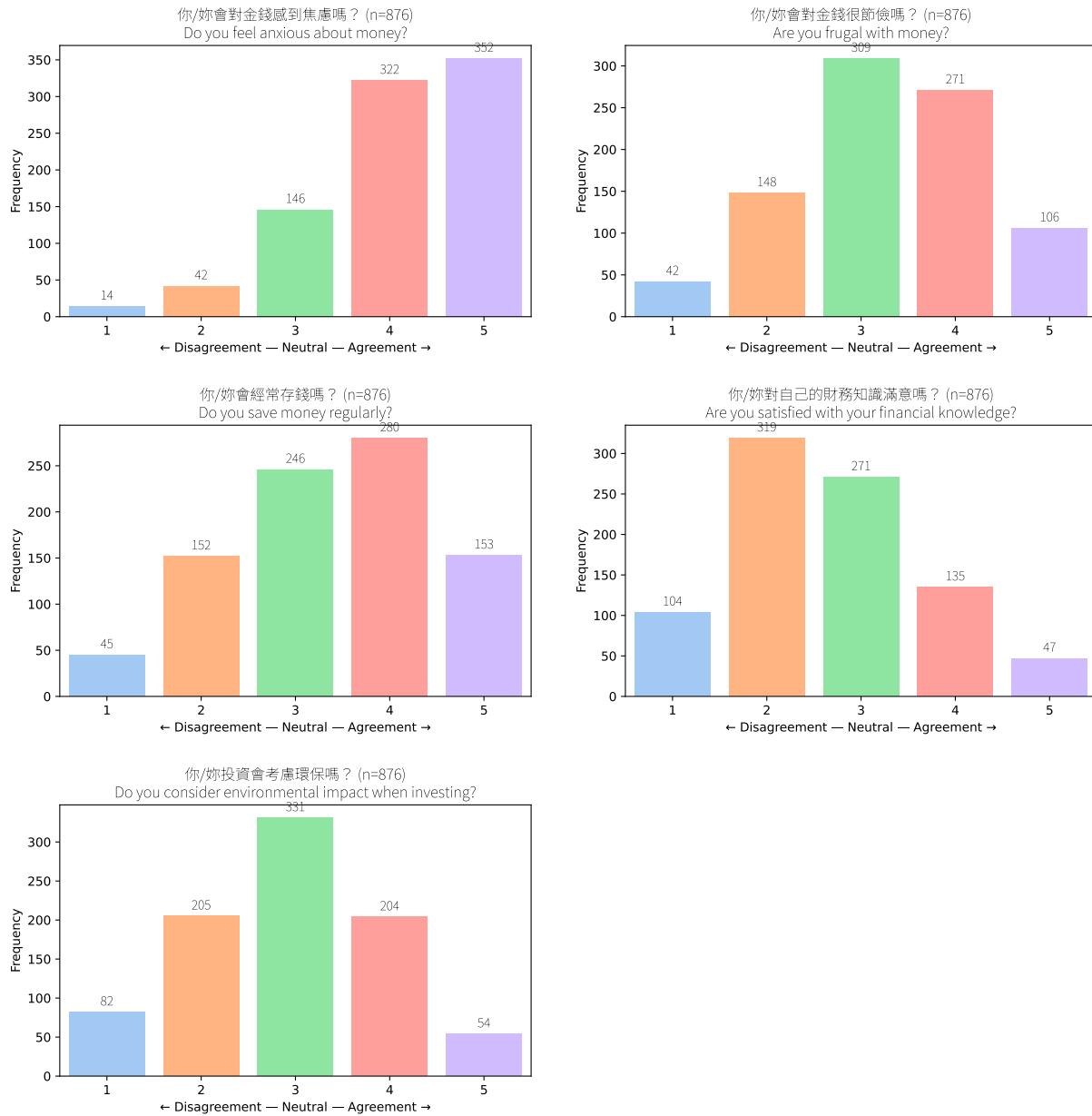


Figure 120: Student Attitudes Towards Saving and Investing

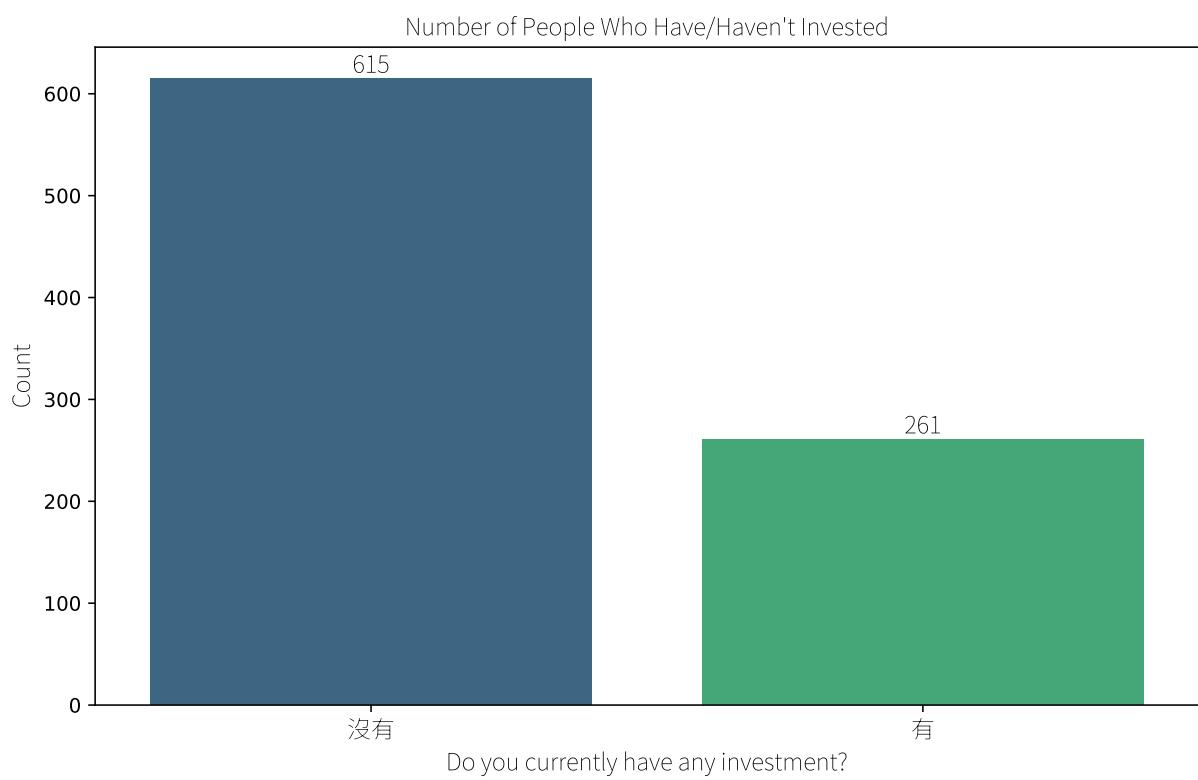


Figure 121: Students' Investing Experience



Figure 122: Investing Choice Experiment

## 12.8 Personas

### 12.8.1 Clustering Students to Build Personas

Customer segmentation

Personas are created using K-means clustering, an unsupervised machine learning algorithm, which clusters college students based on their responses across 36 Likert scale fields in the online survey. Clusters are visualized using Principal Component Analysis (PCA), where the principal component loadings on the X and Y axes represent the weights of the original Likert scale fields, transformed into the principal components that capture the most variance.

The Likert scale is a psychometric scale developed by Rensis Likert already in the 1930s, and it's commonly used to this day in questionnaires to measure respondents' attitudes, opinions, and perceptions (Sullivan & Artino, 2013). K-Means, K-Modes, and K-Prototypes are unsupervised machine learning algorithms, used for finding patterns in the data. Here I've opted to use K-Means and Principal Component Analysis (PCA), which is used to convert data to lower dimension space (this is a simpler predecessor of *embeddings* used in large-language models).

Persona	Color/marker	Rough attitude signal along PC 1	Cluster Centre (PC 1, PC 2)	Size
<b>1. Eco-Friendly</b>	blue ★	Leans pro-environment, willing to pay or act for green goals	(~ +2.2, +0.7)	n = 278
<b>2. Moderate</b>	orange ★	Sits in the middle, balanced or undecided on most trade-offs	(~ 0.0, -1.5)	n = 356
<b>3. Frugal</b>	green ★	Cost-first, cautious about spending for eco causes	(~ -2.0, +0.8)	n = 242

### 12.8.2 Persona 1: “Eco-Friendly”

Questions Most Affecting Persona Creation include...

### 12.8.3 Persona 2: “Moderate”

Questions Most Affecting Persona Creation include...

### 12.8.4 Persona 3: “Frugal”

Questions Most Affecting Persona Creation include...

## 12.9 Clustering Heatmap

## 12.10 Mean Answer Scores

Mean response values for each Likert question in each cluster:

## 12.11 Agreement Between Personas

There is some similarity between clusters. All 3 personas report a high level of financial anxiety and below-average satisfaction with their financial literacy. Highest agreement between personas is about health, safety, pollution and climate concerns.

Rank	Category (Mean <sup>1</sup> )	Why the take mostly holds	Any nuance to note
1	<b>Health &amp; Safety (4.20)</b>	Highest average → students <i>actively</i> click with personal well-being.	The spread is tight; nearly everyone agrees, so messaging can be broad.

Rank	Category (Mean <sup>1</sup> )	Why the take mostly holds	Any nuance to note
2	<b>Climate &amp; Pollution (4.00)</b>	Strong support for big-picture environmental stakes.	Scores cluster a hair lower than #1, but difference isn't huge.
3	<b>Env. Awareness &amp; Action (3.80)</b>	They <i>like</i> the idea of acting green, just slightly less pumped than broad "save the planet" statements.	Some questions in this bucket may have asked for concrete effort (reuse cups, etc.), which drags the mean a bit.
4	<b>Personal Finance &amp; Investment (3.50)</b>	Mid-3s says "interested, not obsessed." Your "money talk sits mid-tier" line is spot-on.	Variance is wider; a sub-segment rates it high, others shrug.
5	<b>Ethical Consumption &amp; Labor (3.20)</b>	Agreement exists but lags — real people far away feel abstract.	If you spotlight specific worker stories, expect this score to climb.
6	<b>Tech &amp; AI Engagement (3.10)</b>	Curiosity tempered by caution, exactly as you wrote.	The topic is newer, so opinions are still forming.
7	<b>Economic Growth vs Sustainability (2.90)</b>	Lowest mean = hardest sell; "trade-off" framing pushes folks to neutral/disagree.	If you rephrase questions to show win-win economics, this block can leap upward.

In summary, *Safety > Planet > Personal Eco-action*. Students first protect themselves (food safety, health), then the planet, then think about their habits. Money talk sits mid-tier. Finance topics aren't ignored (3.5 / 5) but aren't hype either. Ethical labor & AI still feel abstract. Sweatshop worries and AI curiosity land in the low-3's. Economic trade-offs are the hardest sell. When sustainability sounds like "sacrifice growth," support tanks (< 3).

*Design Implications:* Frame eco-features around personal health wins to boost engagement. App idea: Link sustainable investing to tangible health or climate outcomes to lift enthusiasm. Communications angle: Storytelling about real human impact behind labor issues and show AI as a practical helper, not sci-fi. Policy framing: Highlight win-win scenarios (green jobs, savings) instead of "growth vs. green" rhetoric.

## 12.12 Notable Quotes from the Survey

The survey also included textual fields where college students could express their ideas in their own words. Here are some quotes, which show the attitudes and feelings of the students.

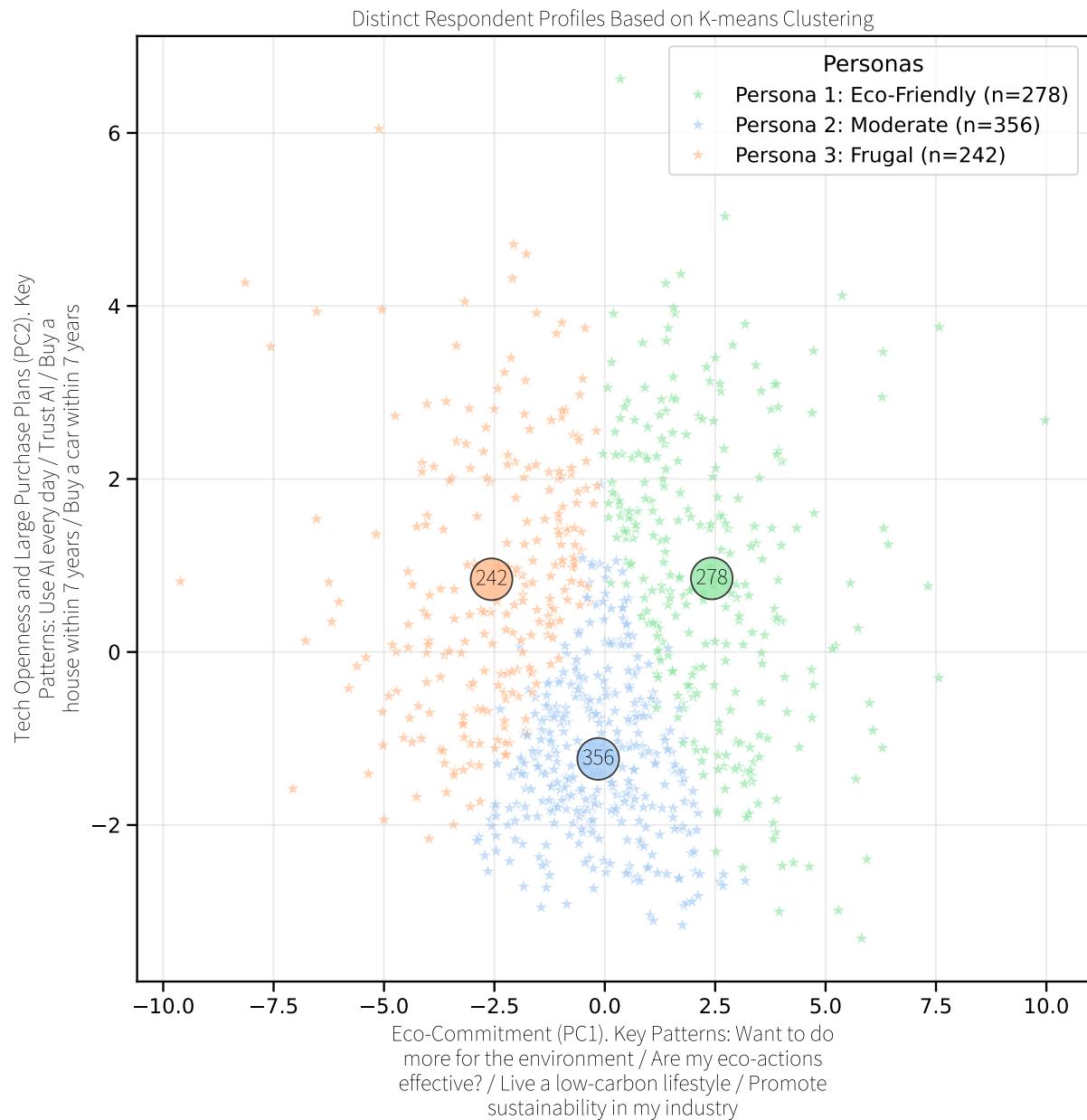
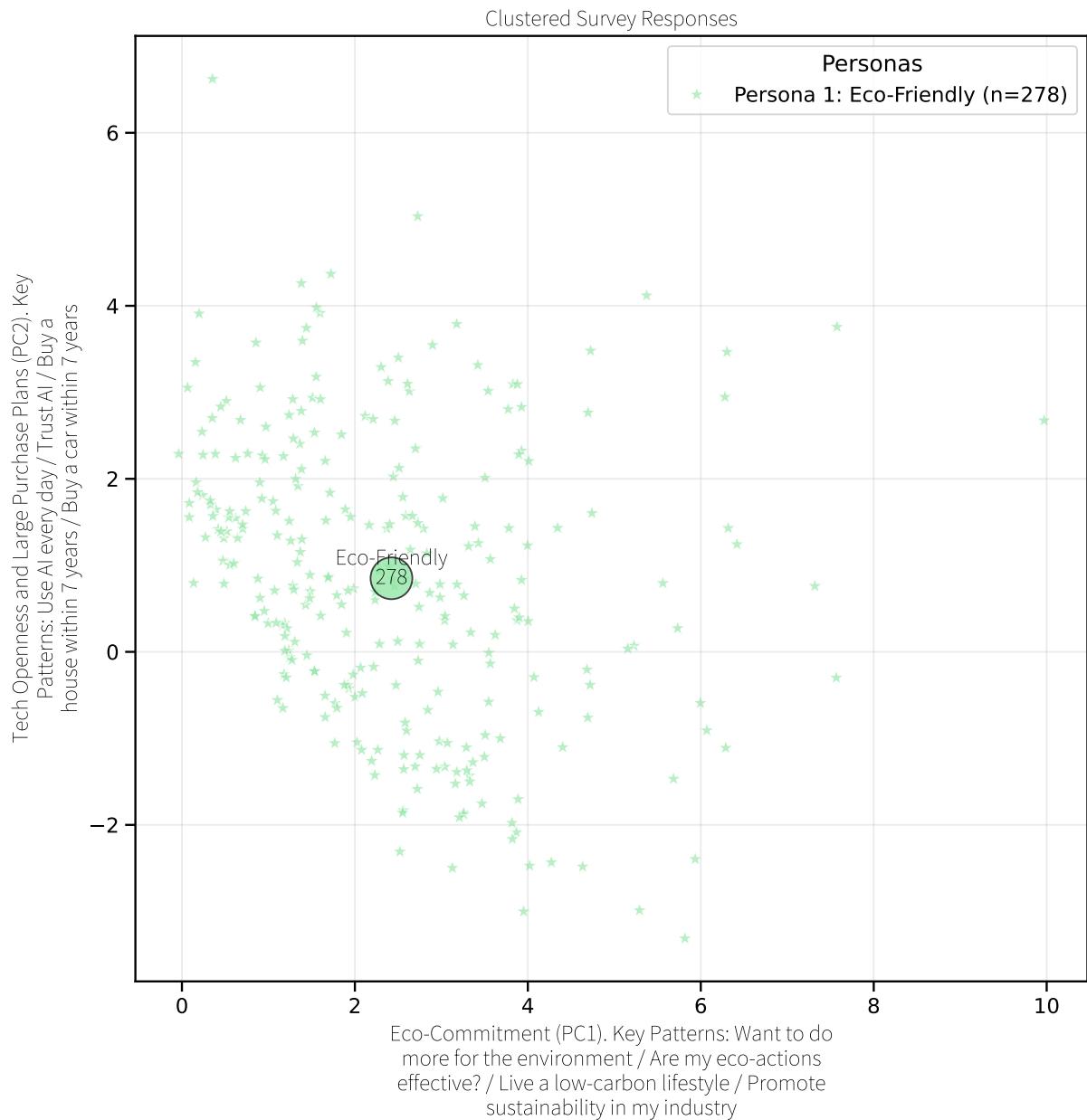
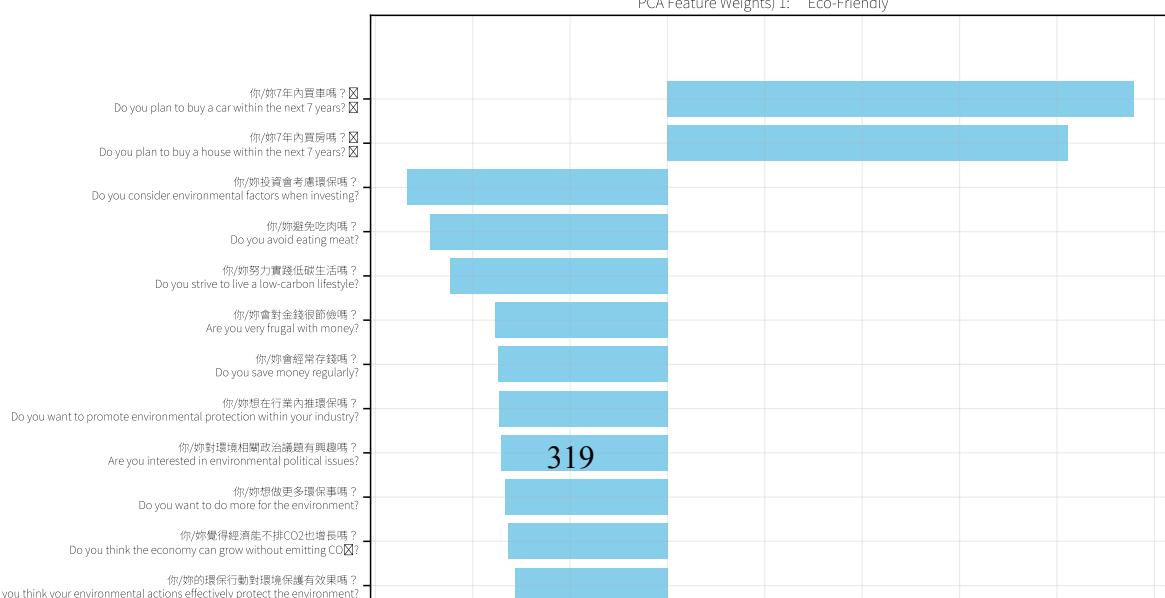


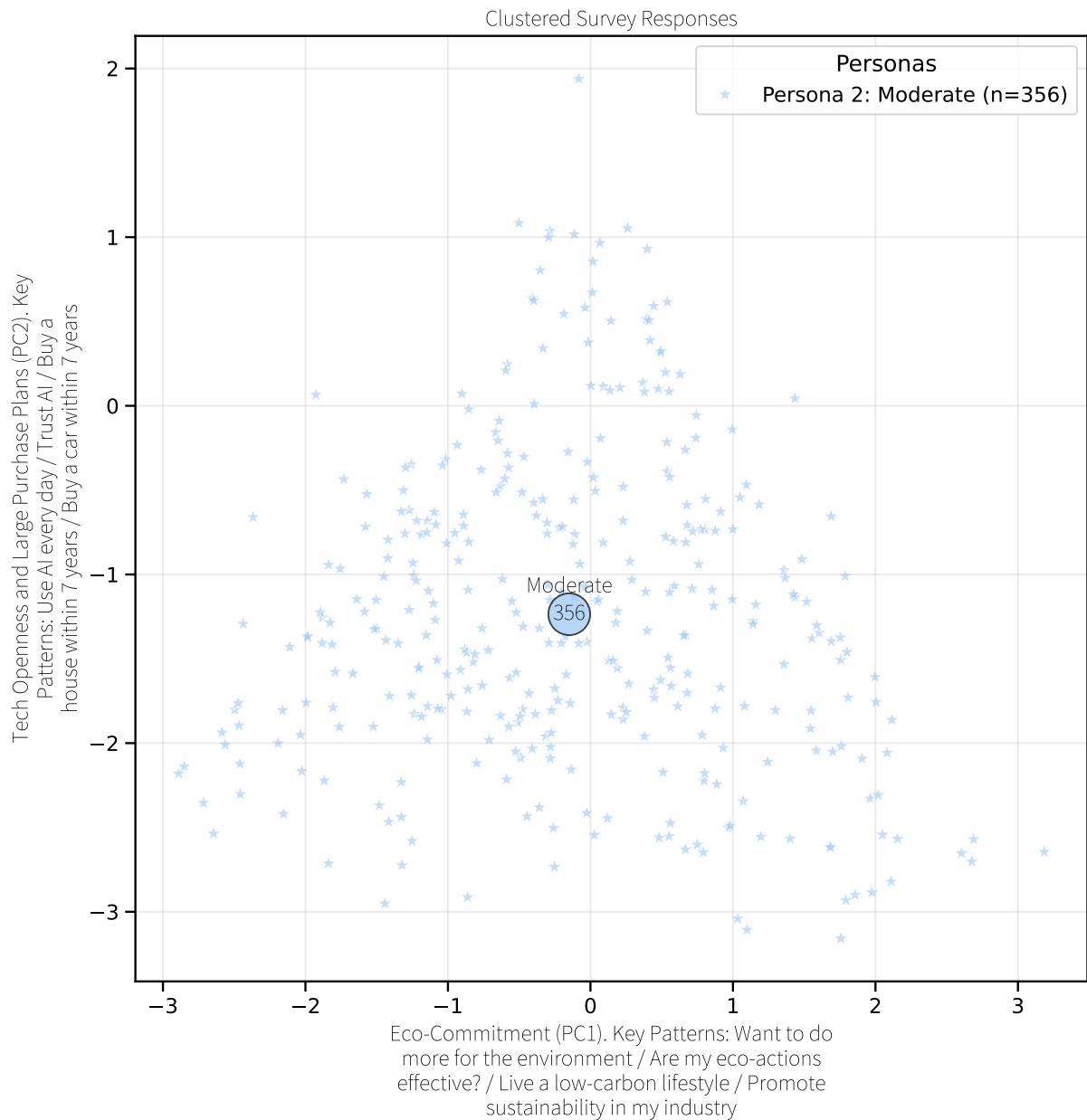
Figure 123: College Student Personas



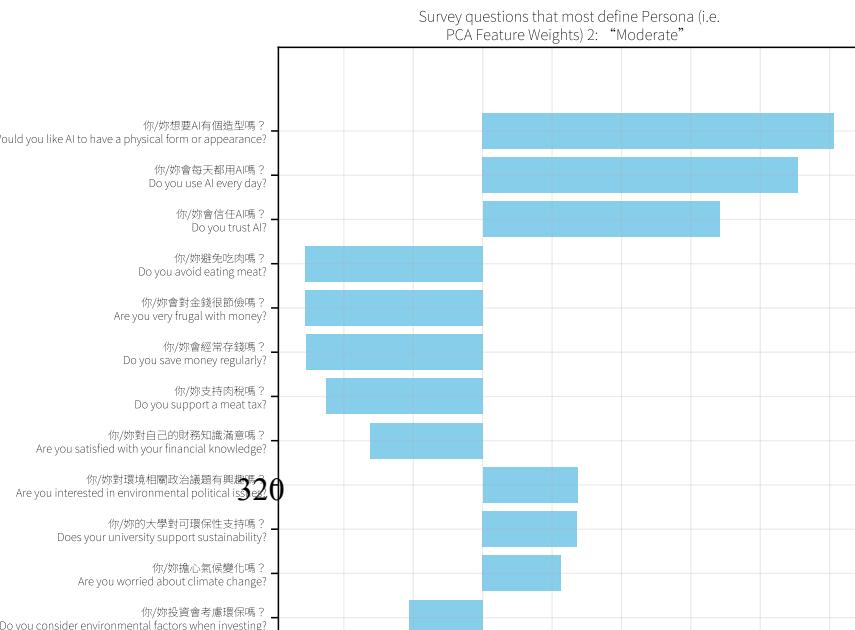
(a) Persona 1 - Eco-Friendly

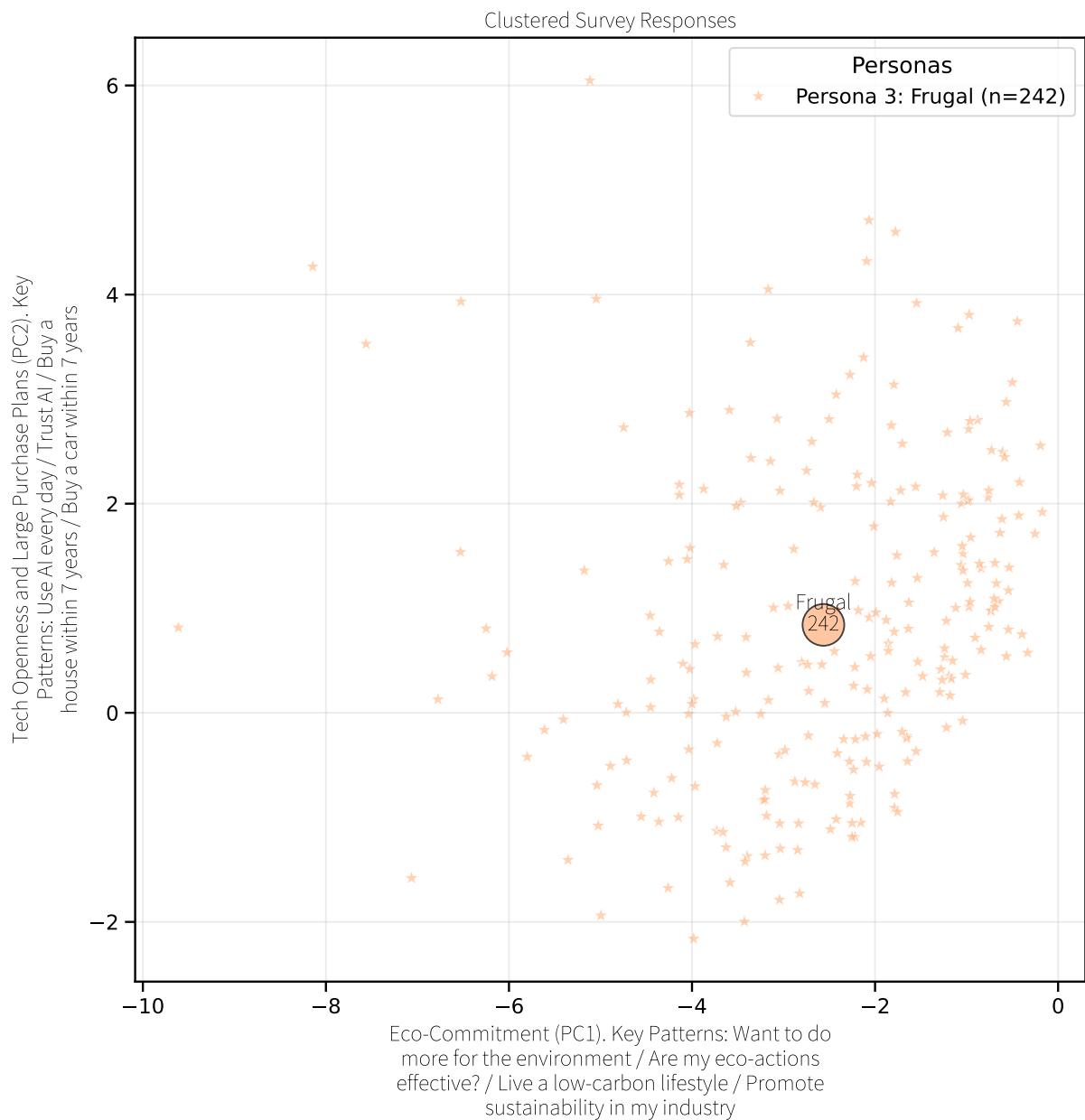
Survey questions that most define Persona (i.e.  
PCA Feature Weights) 1: "Eco-Friendly"





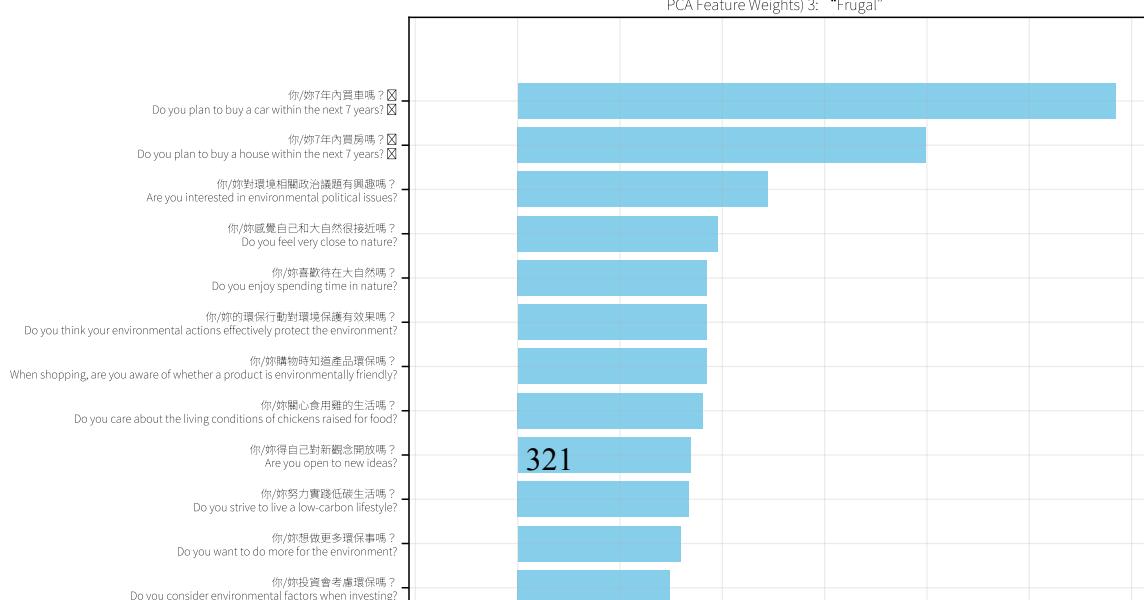
(a) Persona 2 - Moderate





(a) Persona 3 - Frugal

Survey questions that most define Persona (i.e. PCA Feature Weights) 3: "Frugal"



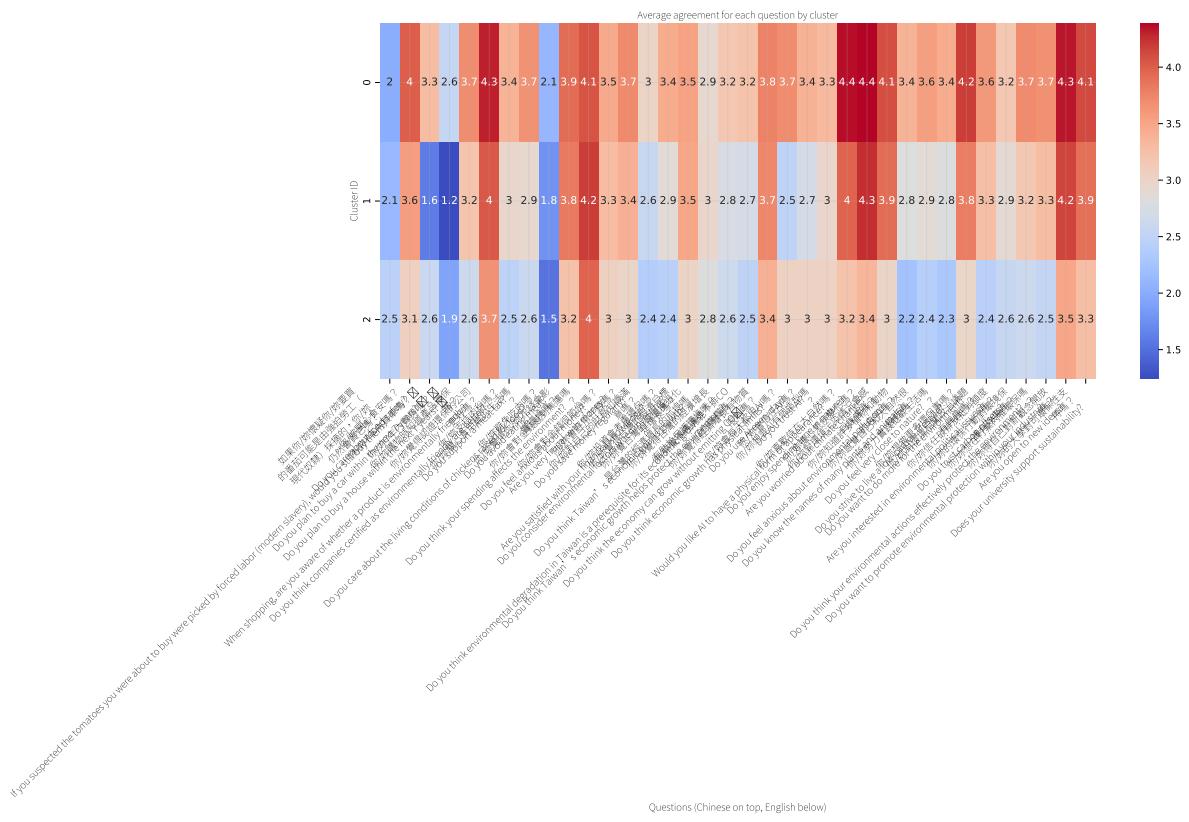


Figure 127: College Students' Clustering Heatmap

Cluster	如果你/妳懷疑你/妳要買的番茄可能是由強迫勞工（現代奴隸）採摘的，你/妳仍然會買它嗎？
0 0.00	2.01
1 1.00	2.14
2 2.00	2.45

Figure 128: Mean Values of Survey Responses

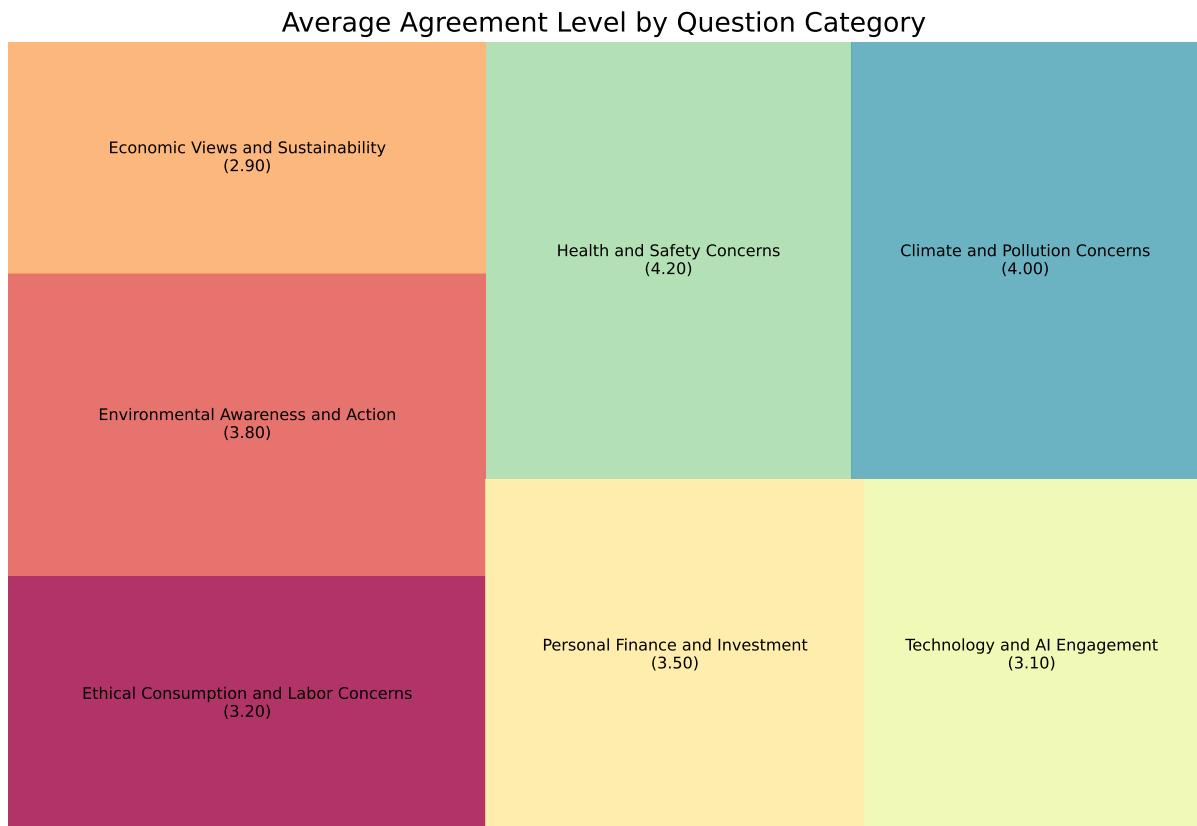


Figure 129: Topics With Highest Agreement Between Personas

Original Quote (Chinese)	English Translation	Category
黑心商品不健康或老闆品德不佳	“Black-hearted products are unhealthy, and the boss has poor morals.”	Opinionated/Emotional
因為味全以前使用黑心油所以再也不買他們家的產品	“Because Wei Chuan used gutter oil in the past, I will never buy their products again.”	Emotional
有食安問題、政治立場不同	“They have food safety issues and [hold] different political stances.”	Thematic (Food safety/Political)
對環境造成破壞或是對人不健康	“It causes damage to the environment or is unhealthy for people.”	Thematic/Opinionated
公司使用地溝油來製造產品	“The company uses gutter oil to manufacture its products.”	Thematic (Food safety)
分享心情，提供建議，像是跟朋友聊天，但不用擔心秘密被知道	“Share feelings and give advice, like chatting with a friend, but without worrying that secrets will be revealed.”	Emotional
一個指令一個動作即可。太厲害的反應會擔心哪一天被反撲取代	“One command at a time is enough. If its responses become too powerful, I worry it could one day turn against us and replace us.”	Unique perspective / Fearful
支持致力於永續環保的企業，抵制不具環保意識的公司。	“Support companies committed to sustainability and environmental protection, and boycott those lacking environmental awareness.”	Thematic
很多大學會有產學合作課程，公司在招募人才的時候應該也希望聽到年輕人對現當代行業的想法，所以我認為本來就會有一定的影響！	“Many universities have industry-school cooperation programs. When companies recruit talent, they likely want to hear young people’s ideas about modern industries, so I believe there will inherently be some influence!”	Thematic / Optimistic
老實說影響力可能很有限，不過可能可以透過有前景的提案或是具有經濟價值的行動	“Honestly, our influence might be very limited, but perhaps we can act through promising proposals or actions with economic value.”	Realistic / Opinion
網路上理性發表意見，影響到社交圈，藉由輿論改變公司方針	“Post opinions rationally online, influence your social circle, and change company policy through public opinion.”	Thematic (Activism)
戰爭、人們不再相愛、世界末日	“War, people not loving each other anymore, the end of the world.”	Emotional (Dramatic fear)
核電廠爆掉	“A nuclear power plant explodes.”	Emotional/Fearful
氣候失控、地緣政治風險	“Uncontrolled climate and geopolitical risks.”	Thematic (Climate/Politics)
冰山融化，海平面上升	“Icebergs melting and sea levels rising.”	Thematic (Climate)

Original Quote (Chinese)	English Translation	Category
小時候爸爸出門都會跟我們說要帶購物袋，並重複利用，就算髒了也可以再拿去當垃圾袋。	“When I was little, my dad would always tell us to bring our own shopping bags and reuse them; even if they got dirty, we could still use them as trash bags.”	Nostalgic / Moral
Podcast: 百靈果的每個禮拜的國際新聞與來賓訪談，他們用有趣的方式讓我知道好多好多事愛因斯坦相對論，特別是在談視界 (event horizon)，這顯著影響我的哲學思考。	“Podcast: ‘Bailingguo’ does weekly international news and guest interviews – they let me learn so much in such an interesting way.”	Unique / Memorable
高中老師努力推行環保，跟我們分享台灣的珊瑚礁有多寶貴，然後現在面臨什麼樣的風險。	“Einstein’s theory of relativity, especially discussing event horizons, has significantly influenced my philosophical thinking.”	Intellectual Inspiration
我認為要人民注重環保的先決條件是經濟狀況，假如一個家庭的經濟收入非常拮据，他們優先考慮的通常不是環保而是吃飽。	“My high school teacher worked hard to promote environmental protection, sharing with us how precious Taiwan’s coral reefs are and what risks they currently face.”	Inspirational/Educational
以屏科大為例，它宣揚自己是全國綠色大學第一名，並且發展許多環保或綠色議題的研究，但就細節而言，實際上學生的環保觀念並無太大提升，即便這個環境一直在宣傳環保議題，可是學生餐廳內仍然充斥著許多環保筷、塑膠湯匙等用具。	“I think the prerequisite for people to care about the environment is their economic situation. If a family’s income is very tight, their priority is usually not the environment but having enough to eat.”	Thematic (Socioeconomic)
	“For example, Pingtung University of Science and Technology promotes itself as the country’s top green university and conducts much environmental research. But in detail, students’ environmental awareness hasn’t really improved; even though the campus constantly promotes green issues, the cafeteria is still filled with many disposable chopsticks and plastic spoons.”	Opinionated (Campus vs. Practice)

## 12.13 AI Companion

### 12.13.1 Likert-Based Clustering

AI-assistant feature choices per Likert-based Personas

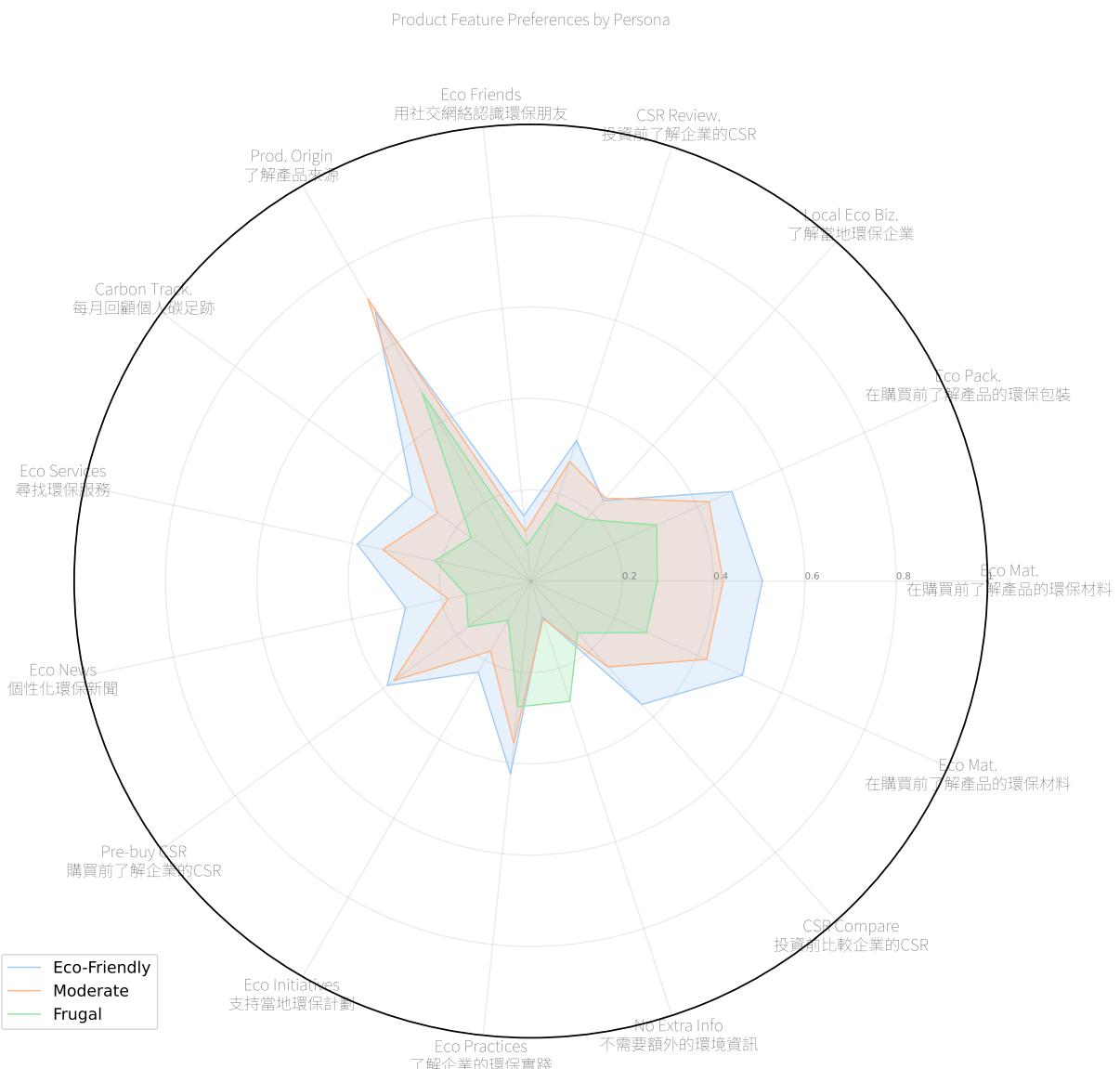


Figure 130: AI-Assistant Feature Choices per Likert-based Personas

This chart visualizes three distinct personas based on 36 Likert answers: Eco-Friendly (n=340), Moderate (n=215), and Frugal (n=126) based on their overall sentiment profiles.

Want: - Product origin - Product materials - Product packaging

Don't Want: - News - Carbon tracking - Eco-friends - ...

## 12.14 Feature-Based Clustering

Clustering students based on AI-assistant feature choices.

Want: - Product origin - Product materials - Product packaging - Eco services

### 12.14.1 Feature Preferences (Overall)

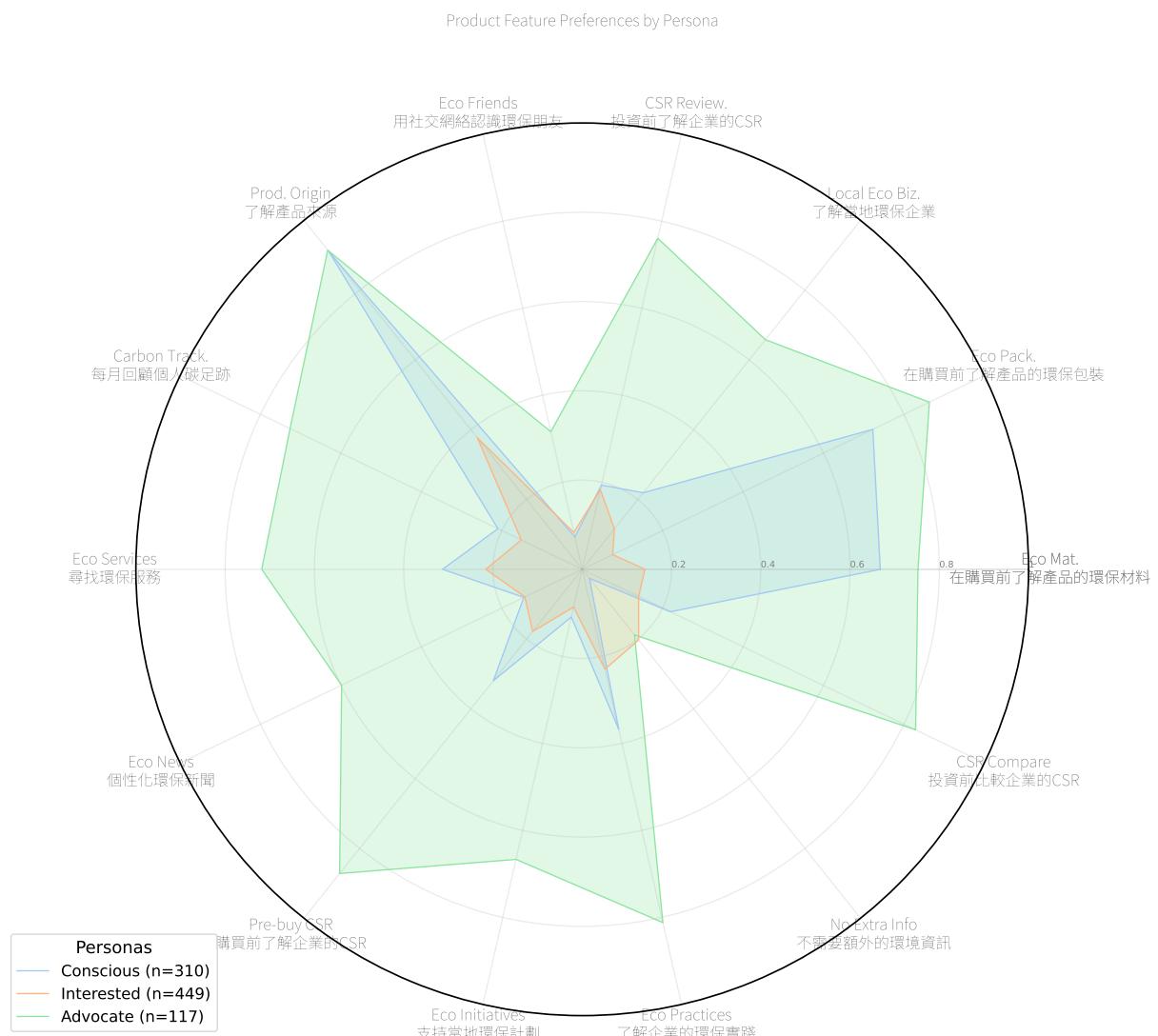


Figure 131: AI-Assistant Feature Preferences (Overall)

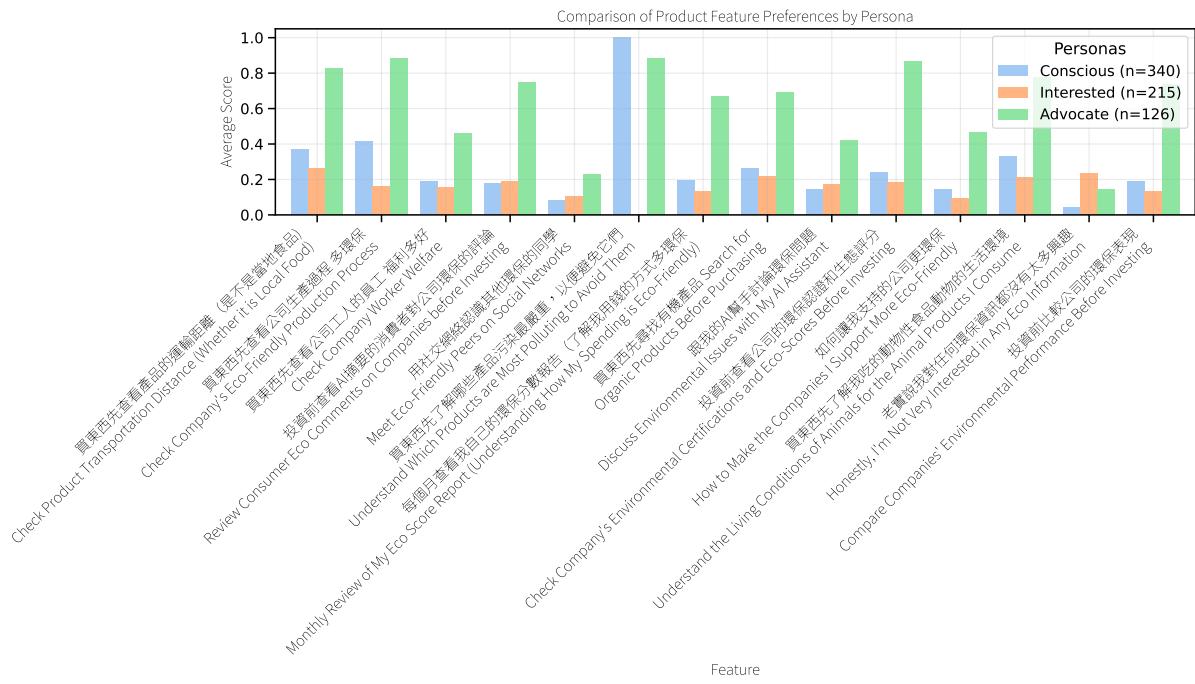


Figure 132: AI-Assistant Feature Preferences (By Cluster)

## 12.15 Feature Preferences (By Cluster)

## 12.16 Preferred AI Roles (Overall)

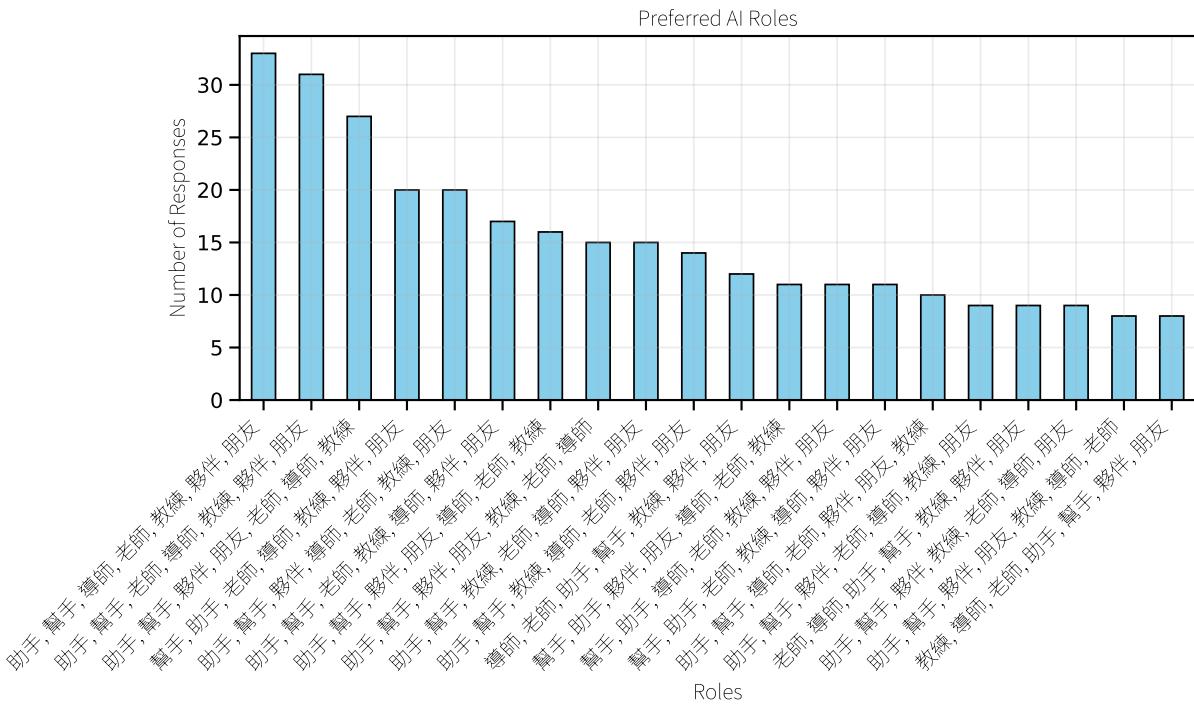


Figure 133: AI-Assistant Role Preferences

### 12.17 First Wave of Experts (2023-2024)

Analysis of recorded conversation from 7 experts. Thematic content analysis using ATLAS.ti for labeling/coding the data for grounded theory. Conversations were recorded and transcribed using Google Meet, Fireflies AI, and WhatsApp. Labeling and thematic analysis was performed using Atlas.ti. Visualizations were produced using Atlas.ti and Python.

For thematic analysis, I conducted 2 types of coding: -

- Unsupervised AI-coding which discovered topics and patterns in the interviews.
- Intentional AI-coding, directed by my own judgment towards keywords most relevant to developing my AI assistant.

Table 107: Overview of the experts interviewed.

Interviewee	Expertise	Thematics Codes
Chen-Ying Huang	Economics, Behavioral Research, Survey Design	3
Cathy Wang	Interaction Design, Business & Org Dev	25
Audrey Tang	Digital Democracy, Civic Tech, Policy	36
Yuping Chen	Economics, UX Research, Information Systems	3

Interviewee	Expertise	Thematics Codes
Peijing Li	Accounting, Data Analysis, Governance,	28
Jessica Cheng	Venture & Service Design, Strategy	22
Carlos Serra	Sustainability, Environmental Law, Zero Waste, Circular Economy	23

### 12.17.1 Interview 1: Designer - Cathy Wang

Date: 2023-11-10 Expert: Cathy Wang is a designer and business leader with 20 years of experience in bringing hyper-growth and hundreds of millions of EUR in revenue in digital transformation of industry. Country: Taiwan / Canada Topics: Design, Business.

*“Design is more of a mindset for me... how do you actually unpack a problem? How do you think about the problem... and find the different intricate parts in a very system thinking way to be able to find a solution?”* - Cathy Wang

Thematic Analysis.

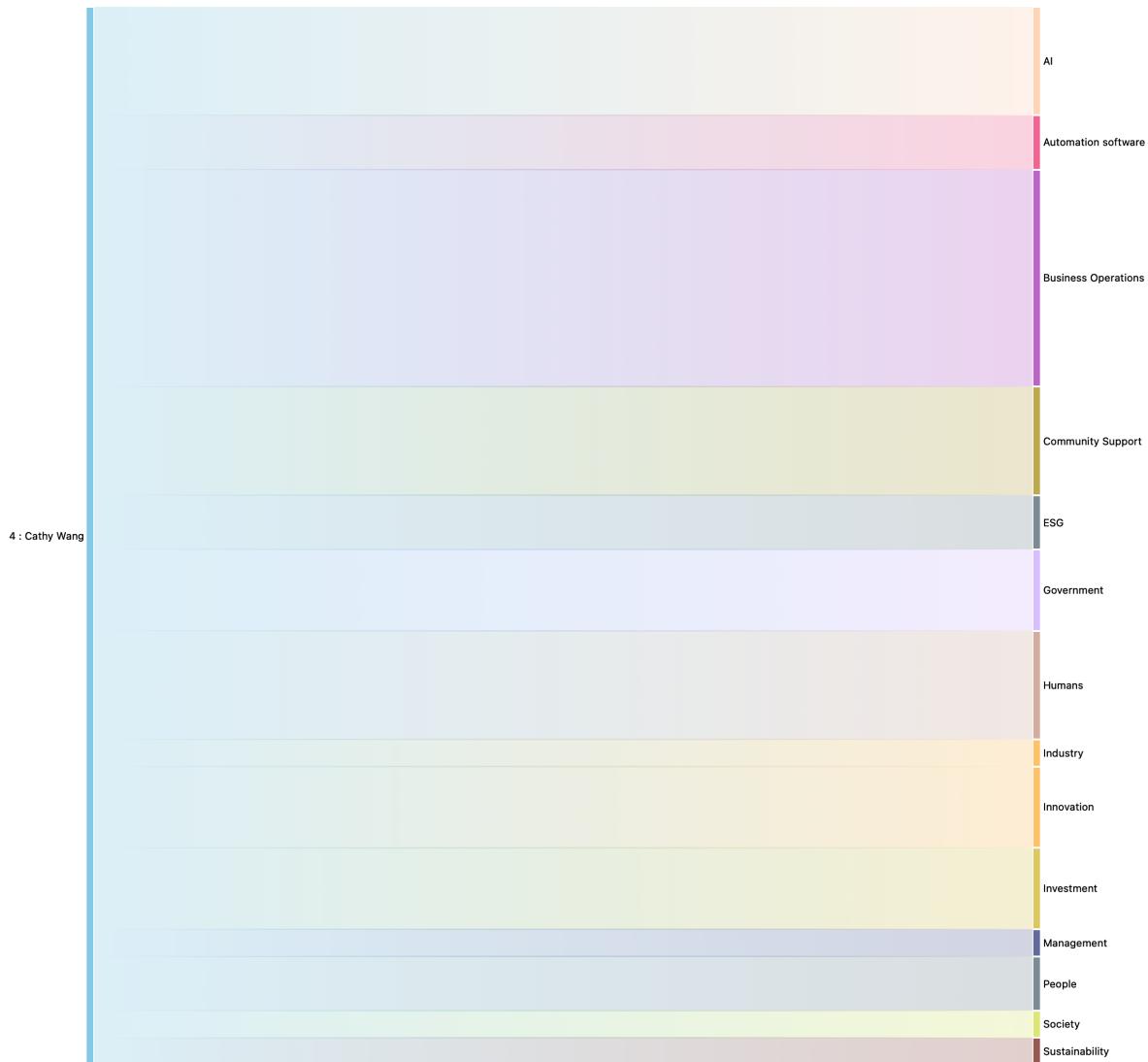


Figure 134: Cathy Wang

### 12.17.2 Interview 2: Accountant - Peijing Li

Date: 2023-11-18 Expert: Peijing Li is an accomplished financial controller and accountant with experience in varied industries from dairy to education. Country: New Zealand Topics: Economics

Thematic Analysis.

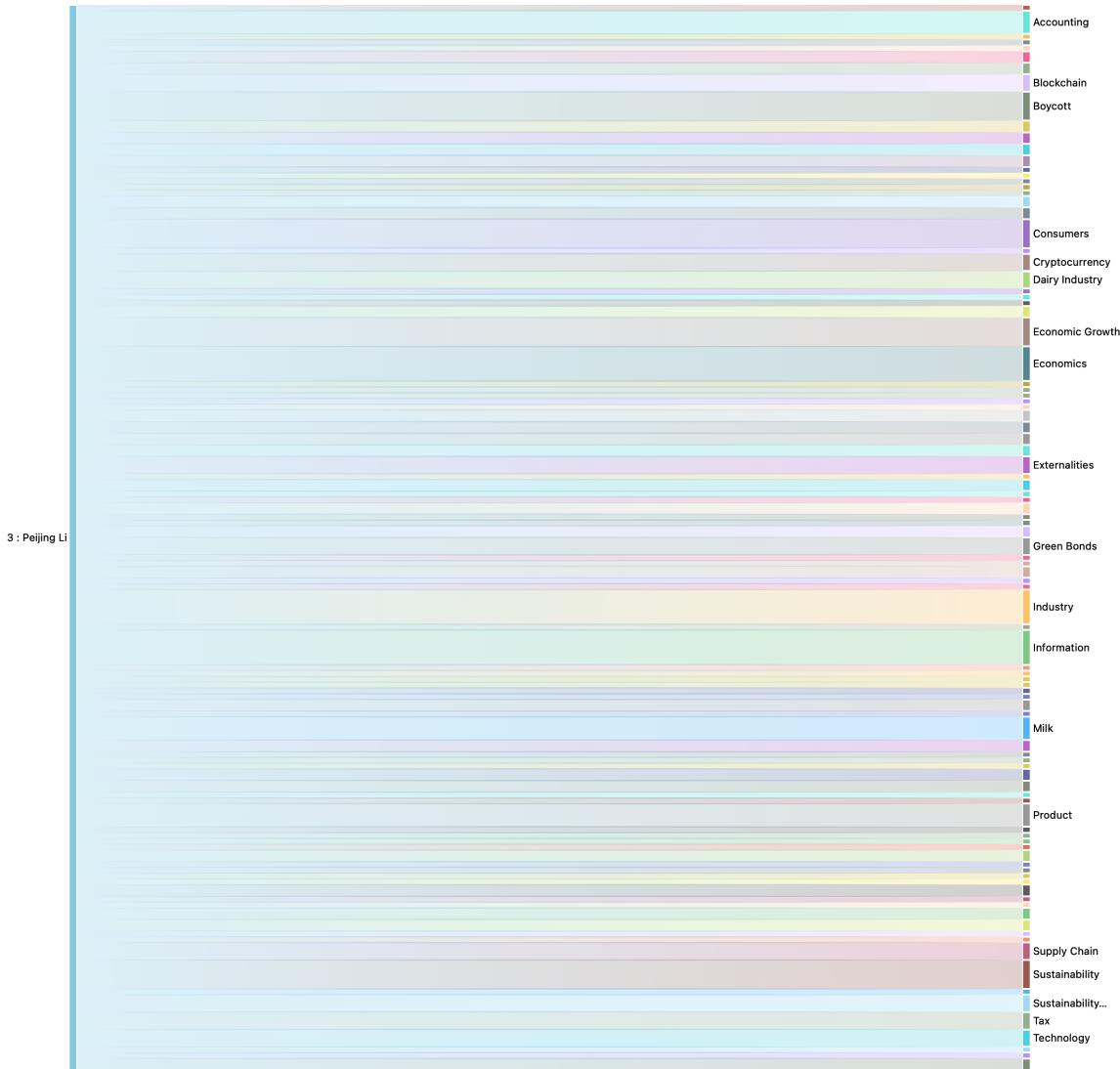


Figure 135: Peijing Li

### 12.17.3 Interview 3: Designer - Jessica Cheng

Date: 2023-12-04 Expert: Jessica Cheng is a designer with cross-industry experience from the UK and Taiwan. Country: Taiwan Topics: Design, Business

“Design whichever kind of design methodology is more like a mindset rather than just a tool to use... how you observe things and how you empathize — that is really important.” - Jessica Cheng

Thematic Analysis.

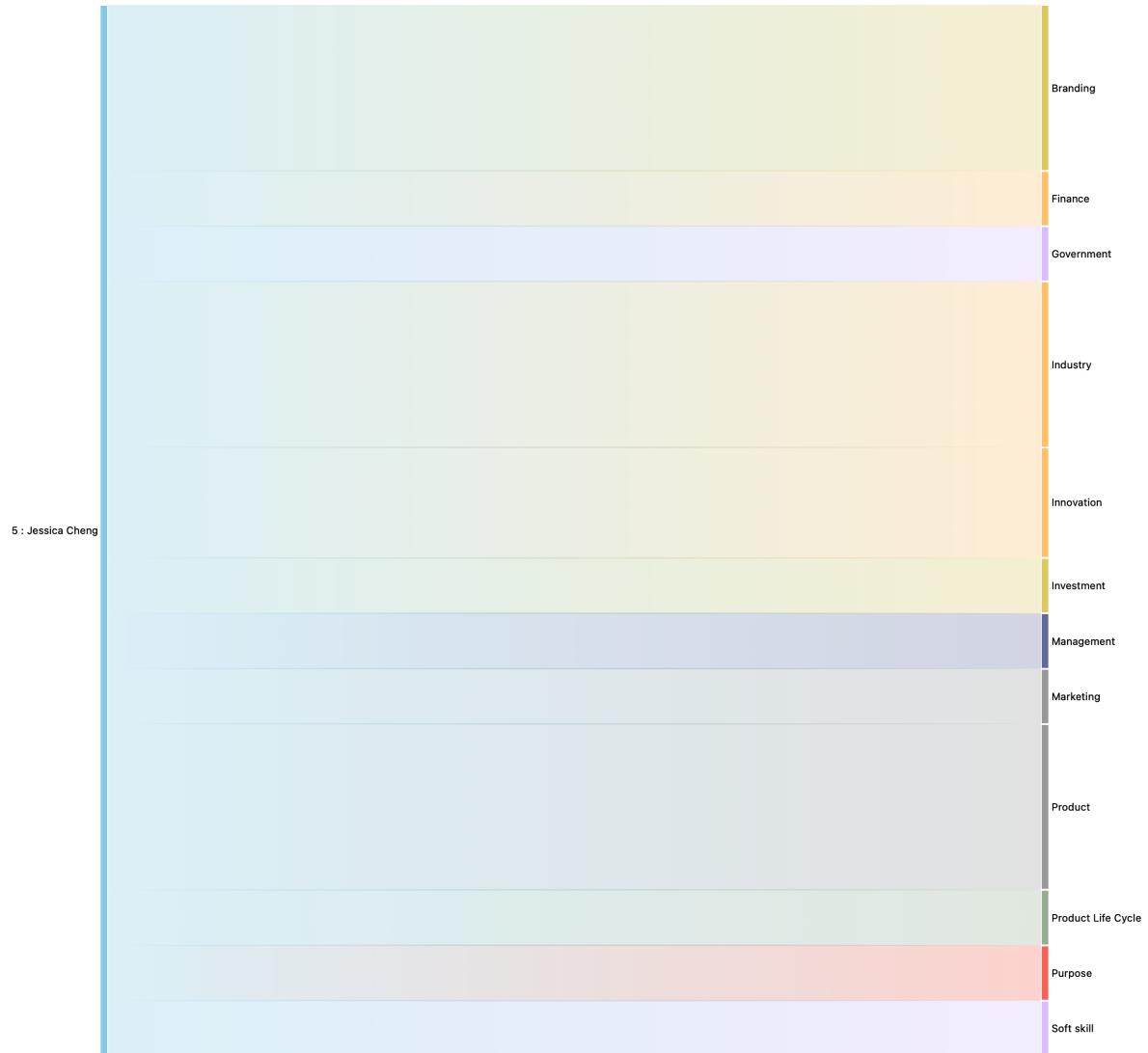


Figure 136: Jessica Cheng

#### 12.17.4 Interview 4: Economist - Chen-Ying Huang

Date: 2024-05-19 Expert: Chen-Ying Huang is an economist and professor at National Taiwan University. Country: Taiwan Topics: Economics

“I’m really lazy when shopping... if it’s easier to get the information that I don’t have to click on the button... it’s more likely that I will even pay attention to that.”  
- Chen-Ying Huang

Thematic Analysis.

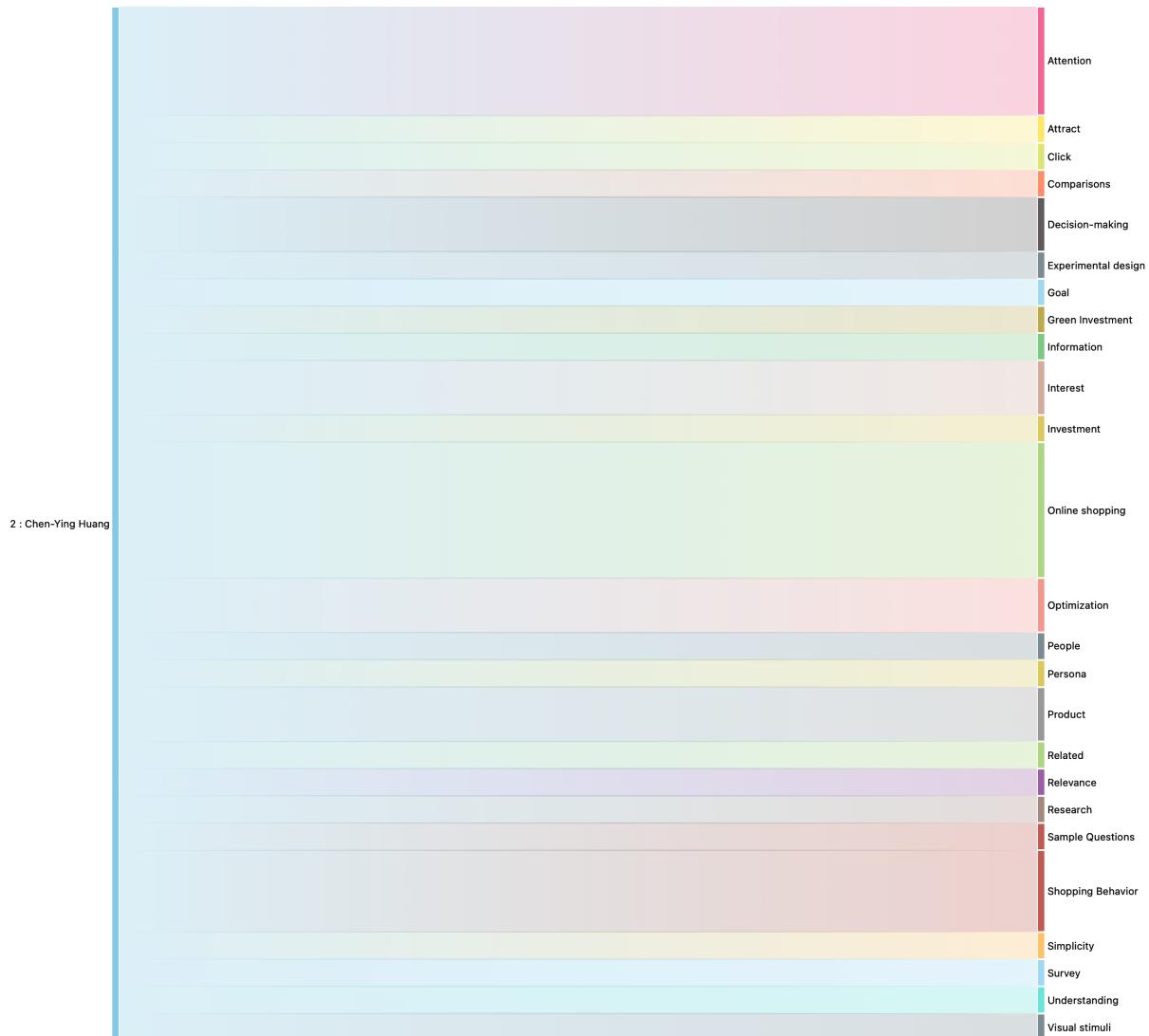


Figure 137: Chen-Ying Huang

### 12.17.5 Interview 5: Economist - Yuping Chen

Date: 2024-06-04 Expert: Yuping Chen is an economist and professor at National Taiwan University with a focus on marketing and online shopping. Country: Taiwan Topics: Economics, Online Shopping.

Key learnings: “I think you are targeting experts instead of a general consumer”

“I tried the Green Filter by myself and I find the information was overwhelming... I cannot pay attention to every detail.” - Yuping Chen

Thematic Analysis.

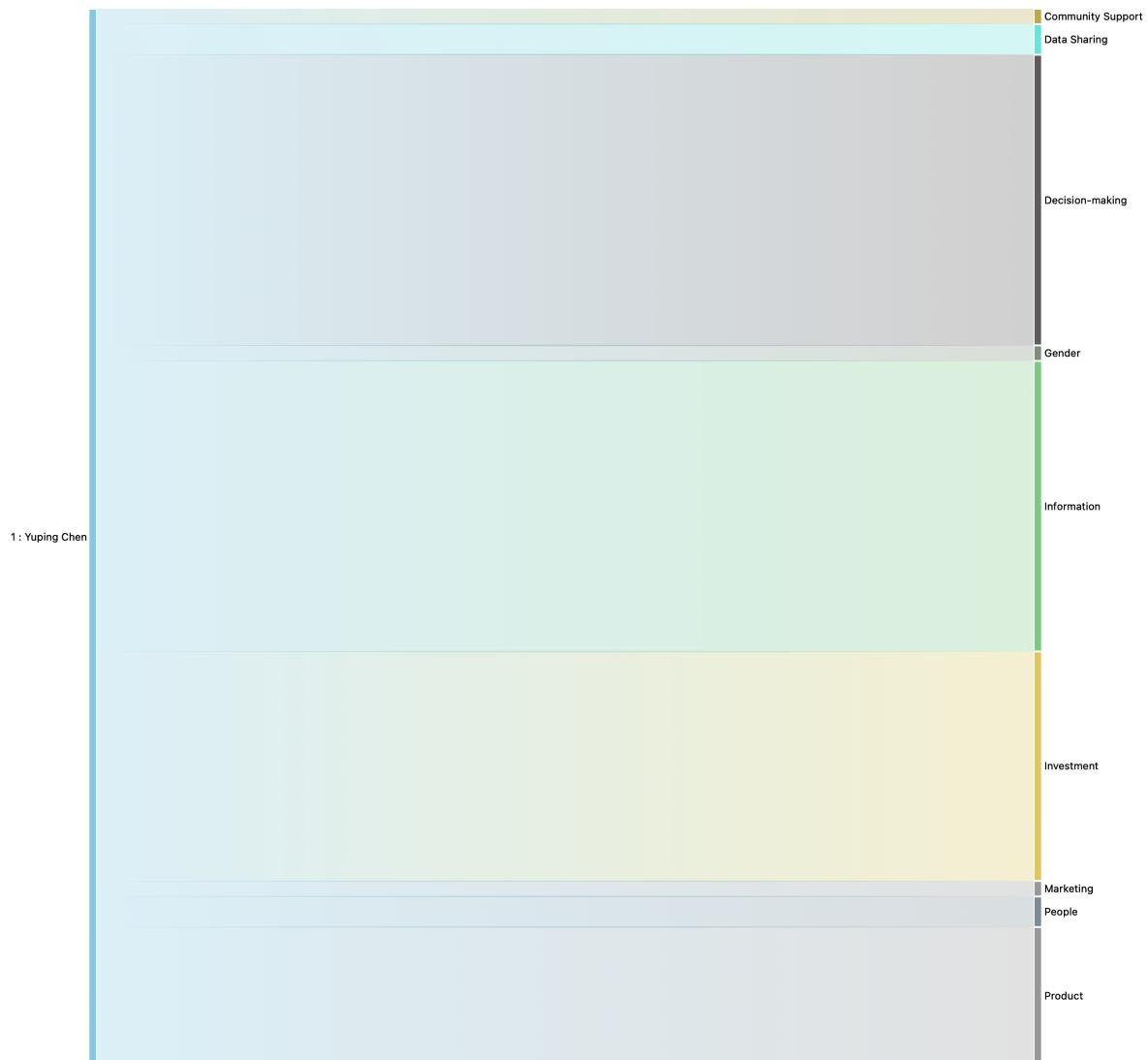


Figure 138: Yuping Chen

#### 12.17.6 First Wave Expert Feedback Summary

Common topics between all the first wave conversations become visible in the overall Sankey diagram.

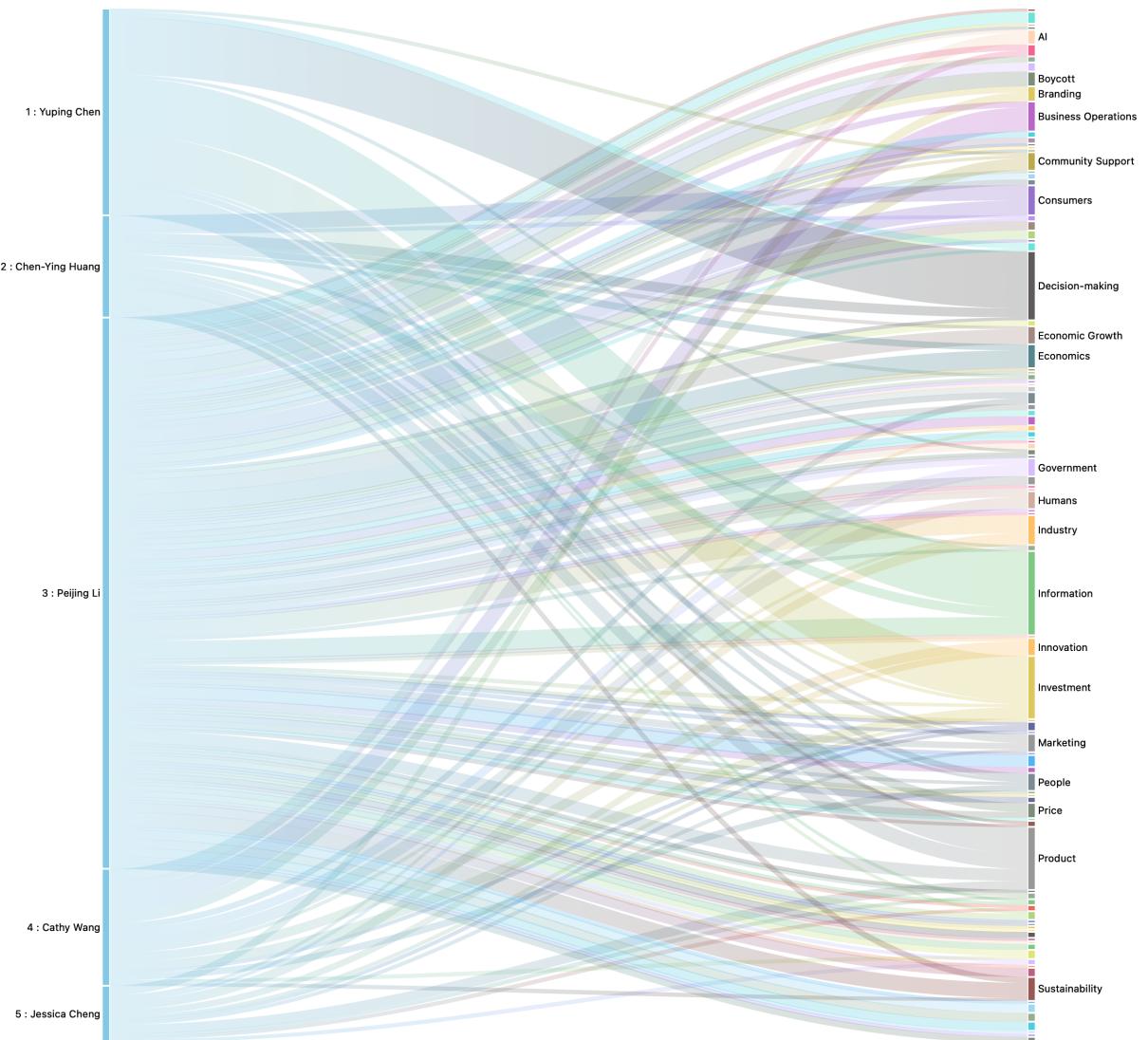


Figure 139: Common Topics Between All Experts in the First Phase

Key actionable takeaways from the first wave include:

- Provide alternatives
- Simplify text
- Use images
- Put a “New Feature” ad on the front page
- Change 繼續討論 to something more actionable (I tried changing to “see alternatives”)

## **12.18 Second Wave of Experts (2025)**

### **12.18.1 Interview 1: Technology Expert - Audrey Tang**

Date: 2025-02-28 Expert: Audrey Tang is a technology expert and former digital minister of Taiwan. Country: Taiwan. Topics: Sustainability, digitalization.

“The 17 and the 70-year-olds are the natural allies... because they care more about the long term. They don’t care about the next quarter.” - Audrey Tang

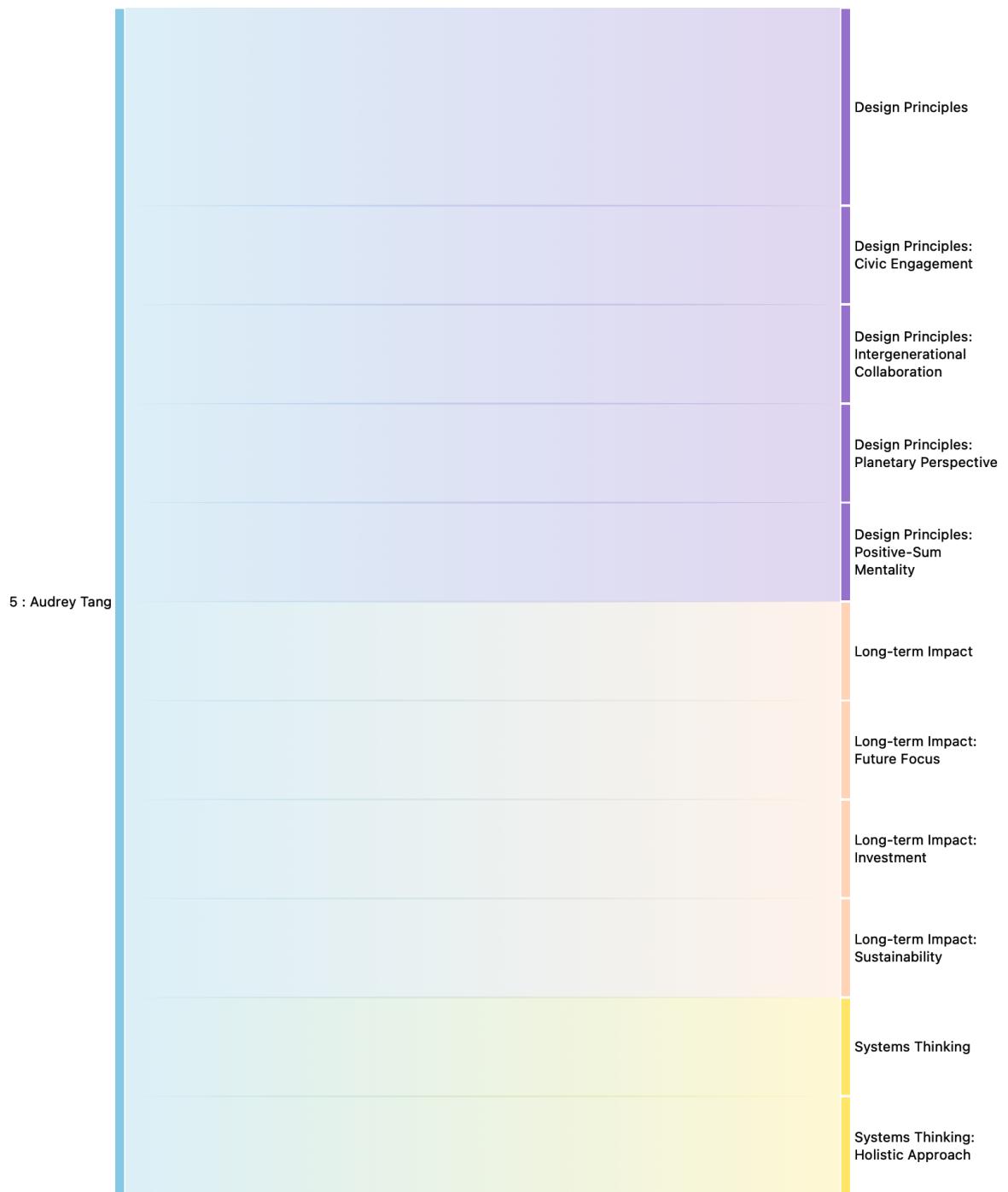


Figure 140: Audrey Tang

### 12.18.2 Interview 2: Sustainability Expert - Carlos Serra

Date: 2025-06-30 Expert: Carlos Serra is a sustainability expert and zero waste activist. Country: Mozambique. Topics: Sustainability, corporate responsibility.

"I believe certification is, obviously, a powerful means of providing positive visibility, motivating, encouraging, and even creating an attraction for eco-friendly, sustainable businesses." - Carlos Serra

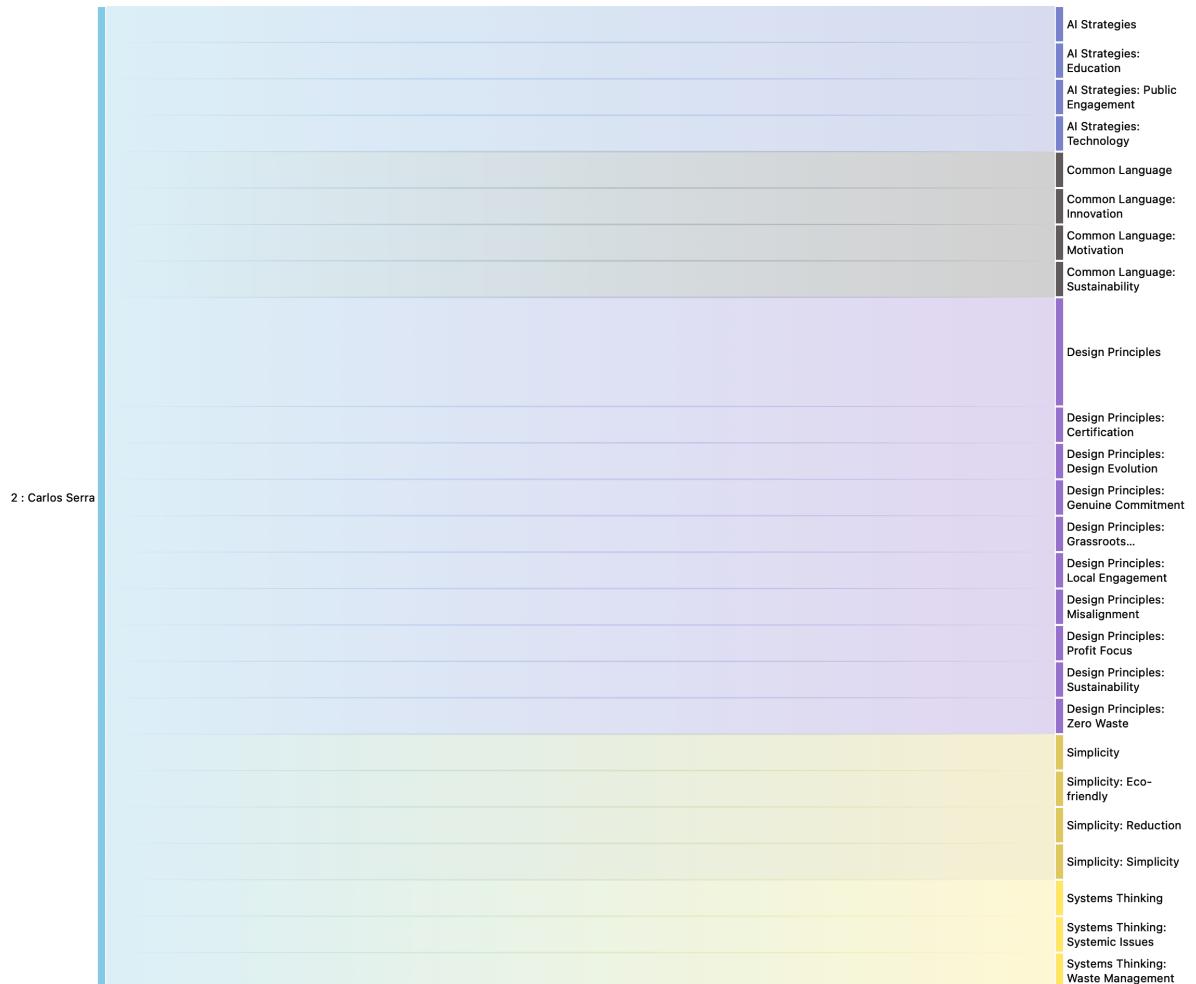


Figure 141: Carlos Serra

### 12.19 Overall Expert Feedback Summary

In the overall Sankey diagram every coded quote from the 7 expert interviewees (left column) flows into the 7 overarching themes on the right; each ribbon represents 1 excerpt, with its color matching the theme it was assigned to, and the cumulative ribbon width reveals how often that theme appeared. Purple "Design Principles" and yellow "Systems Thinking" are thickest (they dominated the discussions), while slimmer blue "AI Strategies" and peach "Simplicity" flows indicate they were discussed less; the even spread of ribbons across interviewees confirms that all participants contributed to nearly every theme, underscoring a balanced coverage and validating the qualitative coding.

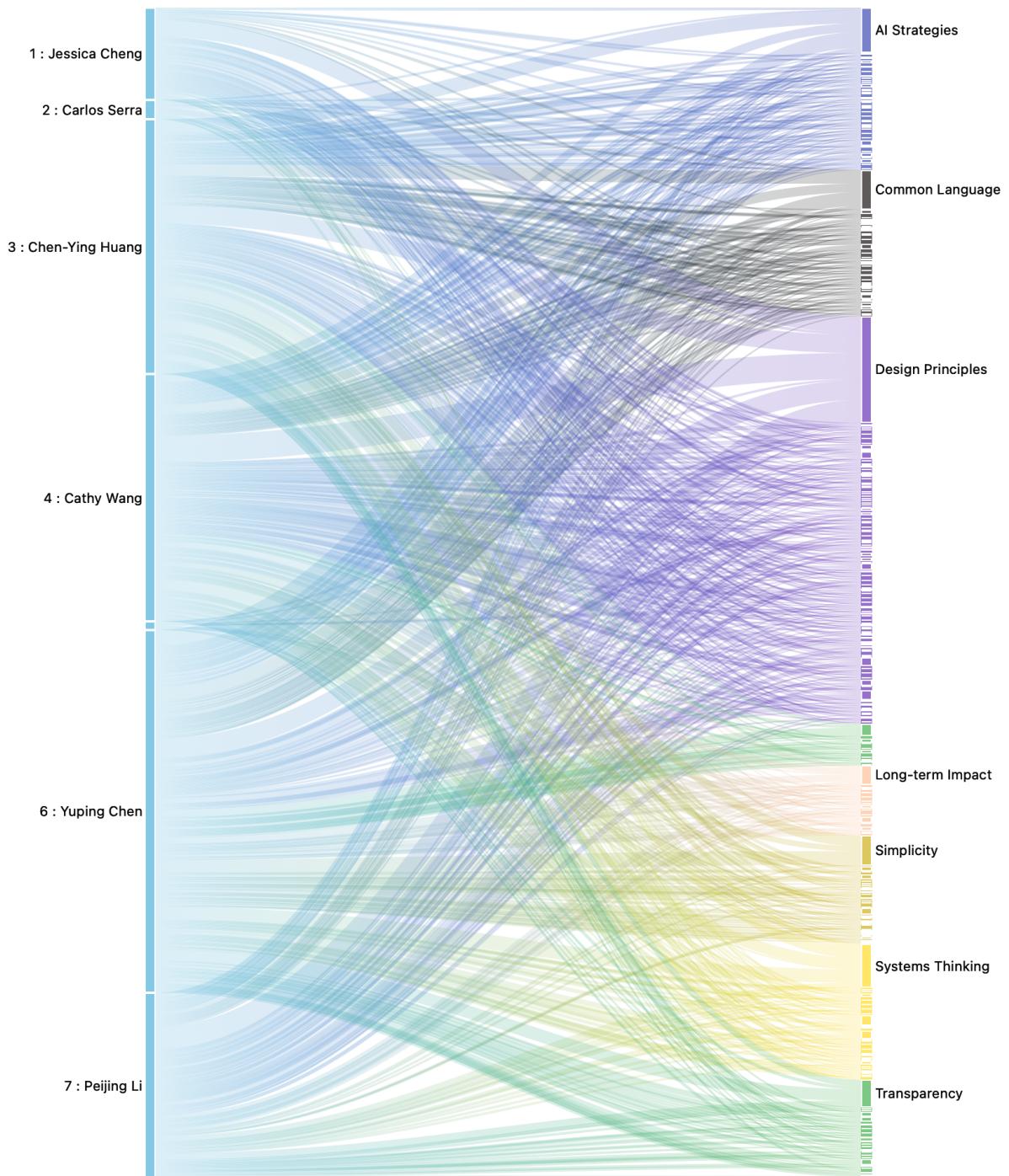


Figure 142: Common Topics Between All Experts in the First and Second Phase

The following summaries were generated by Atlas.ti for each of the 8 thematic keywords, combining insights from all the interviews, then heavily edited for brevity and formatted into tables.

### 12.19.1 Developing Thematic Codes

Category	Code	Frequency
AI Strategies	→ Technology	8
	→ User Engagement	6
	→ User Interaction	6
	→ Data Collection	5
	→ AI Tools	4
Common Language	→ Engagement	7
	→ Transparency	7
	→ Accessibility	6
	→ User Engagement	5
	→ User Experience	5
Design Principles	→ User Engagement	13
	→ Sustainability	12
	→ Collaboration	10
	→ Integration	10
	→ Transparency	9
Feedback Loops	→ Continuous Improvement	6
	→ Refinement	5
	→ User Feedback	3
	→ User Experience	2
	→ User Testing	2
Long-term Impact	→ Sustainability	9
	→ Sustained Engagement	6
	→ Long-term Impact	5
	→ Consumer Behavior	2
	→ Continuous Improvement	2
Simplicity	→ Simplicity	10
	→ Accessibility	7
	→ Clarity	7
	→ Straightforwardness	4
	→ User Engagement	4
Systems Thinking	→ Interconnectedness	31
	→ Holistic Approach	15
	→ Integration	12
	→ Consumer Behavior	5
	→ Systemic Approach	5
Transparency	→ Transparency	8
	→ Clarity	7
	→ Clear Communication	7
	→ Visibility	4

Category	Code	Frequency
	→ Product Origin	3

### 12.19.2 (1) AI Strategies

This line of discussion focuses on digital AI tool design and preferred functionality to enhance consumer awareness of product origins and sustainable consumption and investments.

Topic	Key Points
<b>User Engagement Challenges</b>	Difficulties in attracting user attention to features in apps like Momo; suggestions include curiosity-driven prompts, quizzes, and intuitive design
<b>Sustainability Focus</b>	Shared need for transparent product info, especially on environmental impact; desire for clear labeling on sustainability and investment value
<b>Improving User Experience</b>	Tactics to boost click-through rates, such as eye-catching visuals and smart contextual prompts to encourage feature exploration
<b>Technical Constraints</b>	Discussion of platform limits (e.g., Chrome) on tracking; proposes tracking once users enter a more controlled environment
<b>Educational Perspectives</b>	Need to educate users on sustainable investing; propose accessible metrics and user flows that guide them from casual to informed consumers
<b>Cultural Insights</b>	Taiwan-specific views on sustainability; food safety concerns seen as a gateway to broader sustainable practice awareness
<b>Future of AI in Design</b>	AI can simplify design and personalize interfaces; discussion includes ethical use of AI and its role in user engagement
<b>Collaborative Approach</b>	Importance of collaboration among designers, developers, and businesses to overcome user resistance and data challenges

In this line of discussion on AI strategies, experts provide ideas to build a framework for developing a sustainable consumer application while addressing user engagement, technological limitations, and the educational aspects of sustainability.

### 12.19.3 (2) Common Language

Challenges in user engagement and data collection, particularly how to move users from initial engagement to deeper interactions with the app.

Topic	Key Points
<b>User Engagement</b>	Users show initial interest but rarely go deeper; main issue is the analysis button being overlooked.
<b>App Features and UX</b>	Proposed adding a personality quiz and refining button design/colors to boost curiosity and clicks.
<b>Data Analysis and Personas</b>	3 user personas guide feature customization, aligning content with differing sustainability interests.
<b>Testing and Iteration</b>	Emphasis on refining testing, possibly using a control version to compare user behavior and preferences.
<b>Sustainability Metrics</b>	Aim to show clear, simple info about product origins and sustainability to sustain user interest.
<b>Technological Integration</b>	Suggestions include using tech to track and visualize sustainability data, enhancing transparency and usability.

This line of discussion seeks practical solutions to enhance the app's functionality and ensure it resonates with its users more effectively; the discourse focuses on a complex interplay between user experience design, data utilization, and the overarching goal of promoting more sustainable consumer habits through increased awareness and engagement.

#### 12.19.4 (3) Design Principles

This line of discussion centers around environmental sustainability, the influence of AI and technology in business, and the interface of design thinking with social and economic changes.

Topic	Key Points
<b>Emotional Connections in Digital Content</b>	AI can mimic emotional presence, creating bonds (e.g., with digital personas), especially for older users.
<b>ESG Reporting and Corporate Responsibility</b>	ESG affects investment decisions; there's a need for clearer, more honest sustainability communication.
<b>Design Thinking and User Engagement</b>	UX must reflect user emotions; feedback and intuitive interfaces are key to engaging digital products.
<b>Personalization in Consumer Platforms</b>	Users expect tailored content; platforms like Momo and Shopee benefit from adaptive recommendations.
<b>Impact of Grassroots Movements</b>	Youth-led efforts (e.g., against plastic straws) can influence corporate behavior and policy shifts.
<b>Access to Information and Accountability</b>	ESG data must be more transparent and consumer-friendly to foster trust and real accountability.
<b>The Role of Design in Social Change</b>	Design drives social impact when aligned with emotional storytelling and community needs.

Topic	Key Points
<b>Holistic and Systemic Perspectives</b>	Solving big issues (e.g., climate change) requires integrated, cross-sectoral thinking.
<b>Practical Applications of Research in Design</b>	Design theory should lead to action; involve users and students in real-life design practice.
<b>Future Directions in Sustainability</b>	Emphasis on youth-led activism, intergenerational collaboration, real-time transparency tools, personalized user journeys, and regulatory pressure (e.g., EU ESG mandates) as drivers of future sustainability innovation. Experts highlight the need for planetary thinking, upstream design changes, and grassroots movements enabled by accessible digital technology.

### 12.19.5 (4) Feedback Loops

This line of discussion focuses on the challenges in user tracking, specifically on the Momo platform. Initial testing has shown that many can't find critical buttons, highlighting design flaws that need to be addressed. Yuping Chen provides insights on user engagement and suggests ways to improve the visibility of new features. They discuss user funnels, the difficulty of capturing attention from users, and the importance of clear communication about new features.

The conversation explores the concept of persona-driven design and generative UI, noting that understanding user preferences (like product origins) can help in tailoring the app's offerings. The need for simplicity and engagement in user interfaces to keep users interested.

Feedback is exchanged on testing methods, where Yuping provides suggestions for effective user surveys and experimental designs to gauge user satisfaction, especially regarding product origins. The discussion emphasizes the need for user-friendly features and clear communication to enhance user interaction and retention within the app. They conclude that making the app's intentions explicit and engaging users interactively is crucial to success.

Topic	Key Points
<b>Continuous Improvement</b>	Improving visibility of key features on Momo; clearer prompts and in-app guidance can boost engagement.
<b>Refinement</b>	Early tests showed users overlooked important buttons; need for redesigning layout and color to capture attention more effectively.
<b>User Feedback</b>	Yuping shares tips on using surveys to collect actionable input; user responses help guide feature prioritization and messaging clarity.
<b>User Experience</b>	Simplicity and visual cues are essential; persona-driven design helps match product info (like origin) to user preferences.
<b>User Testing</b>	They emphasize A/B testing and user observation; tracking interaction data can help improve app flow and retention strategies.

## 12.19.6 (5) Long-term Impact

This line of discussion revolves around the development of an app focused on transparency in product origins and investments, exploring various user personas and their interests, emphasizing the importance of product origin in attracting users, particularly college students, sharing insights about user testing, highlighting challenges in engagement and visibility of app features.

Yuping Chen suggests strategies for improving user interaction, such as making buttons more noticeable and providing explicit information about new features, reflecting on changing consumer behavior regarding sustainability and the importance of communicating the ethical dimensions of products. Cathy Wang adds to the discussion by highlighting the emotional aspects of consumer behavior and the regulatory environment impacting businesses, especially in relation to sustainability. Exploration of concepts like “sunrise” and “sunset” industries, touches on the implications of economic growth versus sustainable practices.

Topic	Key Points
<b>User Personas &amp; Engagement</b>	Outline of personas focused on product origin, especially for college students; highlights issues in feature visibility and drop-off.
<b>Interface Design &amp; Feedback</b>	Yuping suggests clearer buttons and upfront prompts to guide users; the use of surveys to link feedback with app interactions.
<b>Sustainability &amp; Business Impact</b>	Cathy emphasizes emotional drivers in consumer behavior and how sustainability is reshaping business, especially under new regulations.

Overall, the conversation navigates the intersection of technology, consumer behavior, and sustainability, emphasizing the need for innovative approaches to engage users effectively while addressing their concerns about product origins and environmental impact.

## 12.19.7 (6) Simplicity

This line of conversation discusses the origins for the research, stemming from a desire to create a product that allows users to easily access information about the sustainability of products they purchase, inspired by the science fiction show Star Trek, indicating a wish for a scanner-like tool that could provide instant information on product quality.

Topic	Key Points
<b>Sustainability Tools</b>	The concept originated from a desire for a tool that instantly reveals the sustainability and origins of products, inspired by sci-fi ideas.
<b>Sustained Engagement</b>	Maintaining user interest requires visual design, gamified features, and clear prompts that simplify sustainability insights.
<b>Long-term Impact</b>	The goal is to transform casual purchases into informed, value-aligned decisions that support long-term sustainable habits.

Topic	Key Points
<b>Consumer Behavior</b>	Users often avoid detailed reports and prefer quick, intuitive visuals; simplifying data presentation is key to influencing decisions.
<b>Continuous Improvement</b>	Iterative feedback from testing helps refine design and communication; using familiar product types makes sustainability info more relatable.

The experts brainstorm ways to enhance the user interface and make it more intuitive, such as using *familiar product categories* for testing purposes.

Chen-Ying Huang highlights the role of AI in analyzing products and providing insights, emphasizing that users often prefer quick, easy-to-understand visual representations over detailed reports and the importance of gathering user feedback to refine the product, particularly regarding the clarity and relevance of information about product origins and sustainability.

The dialogue also touches on the need to adapt existing technology to improve user experience, especially focusing on the limitations of platforms like the Apple app ecosystem compared to more flexible ones like Google Chrome, exploring various strategies to encourage users to engage with the application, such as gamifying the experience or providing attractive prompts.

Throughout the conversation, there is a focus on how to make the initiative relevant to the general public, addressing their concerns about sustainability and helping them make informed purchasing decisions. The discussion implies a significant challenge ahead in creating a compelling, user-friendly tool that can bridge the gap between consumer behavior and sustainable practices.

### 12.19.8 (7) Systems thinking

This lengthy discussion primarily revolves around sustainability, consumer behavior, and technological solutions aimed at improving transparency in the marketplace, when it comes to products and their environmental impact.

Topic	Key Points
<b>Economic Impact and Externalities</b>	Peijing Li highlights the importance of considering external costs in economics, using the example of cigarette smoking, where the price does not reflect the full societal harm caused.
<b>Sustainability and Consumer Awareness:</b>	There is a focus on how consumers perceive products, particularly regarding sustainability. Many college student survey participants express a lack of trust in “green” claims, suggesting that they want more transparency in product origins and environmental impacts. Consumer skepticism toward green claims signals demand for clearer, verifiable data on product origins and environmental impact.

Topic	Key Points
<b>Tech-Driven Transparency</b>	Technology (such as apps, AI, blockchains, etc) can be used to enhance consumer understanding of products. There's a vision for real-time data on product origins, manufacturing practices, and company sustainability scores.
<b>Behavioral Insights</b>	How consumers interact with sustainability-related information reveal that many are overwhelmed and confused. Thus, there's a need for simplified, engaging communication about sustainable practices.
<b>Behavioral Economics</b>	The idea of "sunrise" (growing industries) and "sunset" (declining industries) companies is raised, emphasizing that consumers might change their habits out of risk avoidance rather than a genuine commitment to sustainability.
<b>Marketing Strategies</b>	Recommends using curiosity-based prompts, interactive features, and clear messaging to drive sustainable user engagement.
<b>Research, Testing &amp; Experimentation</b>	Advocates for A/B testing of sustainability labels and features, linking product origin data to user satisfaction.
<b>Community Collaboration</b>	Community-based actions and local engagement can strengthen sustainable habits and promote systems-level change.

Altogether, the conversation emphasizes the intersection of technology, consumer behavior, and economic theories in shaping a more sustainable market environment, while identifying the ongoing challenges in achieving greater transparency and consumer engagement in sustainability efforts.

### 12.19.9 (8) Transparency

Finally, the discussion on transparency centers around the concept of improving consumer awareness of sustainability and ethical practices in products through the "*Green Filter*" app.

Topic	Key Points
<b>Consumer Awareness</b>	The app aims to reveal hidden layers behind products, empowering users through simple, trustworthy insights into ethical practices. Users who understand product origins and company ethics are more empowered to make informed, sustainable choices.
<b>Feature Design and User Interaction</b>	Simplify the user journey while boosting user engagement with playful interactions. Test UIs to make sustainability information more intuitive and accessible.
<b>Investment Education</b>	Connects purchases with green investing, teaching users how spending links to broader financial and environmental outcomes.
<b>Data and Trust</b>	Recognizes challenges in ESG data reliability; seeks transparent reporting standards users can trust.

Topic	Key Points
<b>Research and Testing</b>	Uses user testing and analytics to refine features, identify pain points, and improve click-through.
<b>Label Skepticism</b>	Questions the credibility of existing sustainability labels; calls for clearer, more accountable rating systems.

The conversation revolves around creating an informative AI-based tool that empowers consumers to make more sustainable choices while addressing the realistic challenges in obtaining and presenting such information effectively.

## **12.20 Interview Template**

This is the basic interview script, which was used with small modifications at each interview.

On Momo:

- What is a brand that you like'd or would like to buy - search - please pick a product (or search again)
- After reaching Momo product page: what do you notice on this page?
- What kind of information is important for you on this page?
- Do you notice anything else?
- (If the user doesn't notice the green filter, direct their attention to it and ask: what do you think this does?)
- Would you click on it - if the user says yes, continue - if the user says no, make note and continue
- As the extension generates a response: what do you think about this content?
- Is there any information that you consider important?
- Anything else you see that you think looks special
- Do you see anywhere you can click?
- Would you click on it? - if yes, continue - if no, make note, and continue.
- Explain: due to the limitation of the prototype, the test will continue on a separate page where you can ask questions.
- Is there anything you would like to ask the helper?
- Notice if the user picks from sample questions
- Remind the user they can come up with their own question
- As the AI is generating content ask: do you see any information in this content
- Did you know this before or is there any info you didn't know before? Make a note.
- Front page: explain the helper takes into account your personal info and goals.
- Ask: what kind of information do you think important to share with the helper?

## **12.21 2nd Wave of Testing (Fall 2024 - Spring 2025) - Prototype**

Interviews and testing survey were conducted anonymously in hopes to have more honest responses from the responders.

- 32 anonymous Gen-Z participants in face-to-face interviews at 7 universities
- Over 100 anonymous self-testing participants at over 20 universities
- Testing is anonymous

Below you can see some of the images testers uploaded from their own devices (there were too many to be displayed here fully).

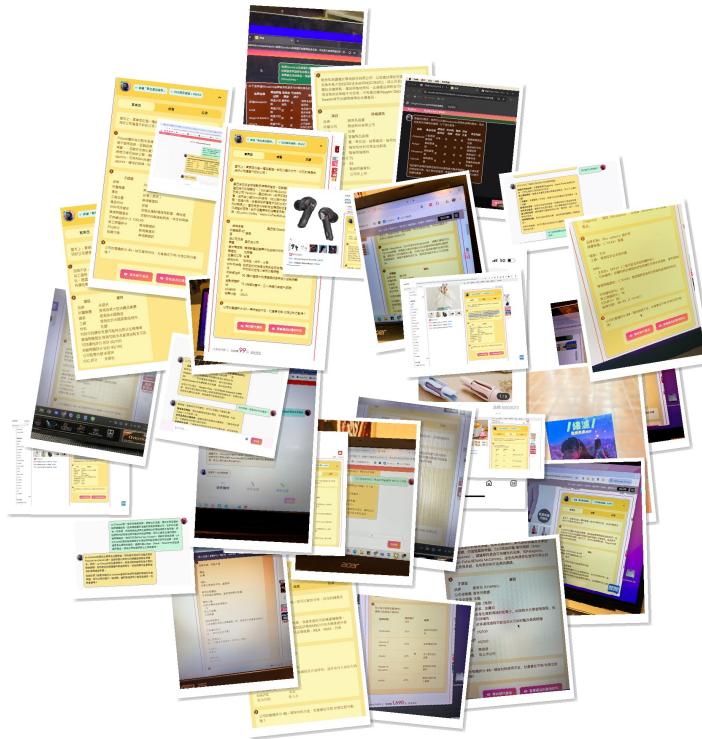


Figure 143: User-uploaded screenshots of the Green Filter prototype

#### 12.21.1 Testing Summary

In-person interviews highlighted that participants generally appreciated the transparency provided by the Green Filter app regarding sustainability of products. Interviewees mentioned that the visibility of “*Material Sustainability*” and the historical and environmental impact of products influenced their perception and purchasing intentions, sometimes causing them to reconsider previously unquestioned consumption habits. Participants were particularly intrigued by the comprehensive information on carbon emissions, labor issues, and potential health risks from certain ingredients, emphasizing that such details were rarely accessible in typical shopping experiences. Additionally, participants valued AI-generated comparative data that offered alternative sustainable brands and products, which helped them better understand environmental impacts and make more informed choices.

However, usability issues surfaced regarding terminology and interface clarity. Some users misunderstood the labeling related to financial savings and carbon emission reductions, indicating the importance of precise and intuitive wording in Chinese.

Rank	Frequently-named cue	Typical reasoning (representative quotes)
1	<b>Price / discounts / payment options</b>	“Usually I just look at the price.” “It’s acceptable if it isn’t too expensive.”
2	<b>Photos (product &amp; user images)</b>	“Pictures attract me to click in.” “I rarely read long text, but I zoom every photo.”
3	<b>Reviews &amp; star ratings</b>	“Reviews are vital, I need to see real buyer photos.” “I’ll open another page to compare reviews on different sites.”
4	<b>Key specs – size, colour, warranty, return policy</b>	Often mentioned right after price and photos.
5	<b>Brand familiarity / past experience</b>	Several interviewees picked a product simply because “I’ve used this brand before.”

Cue delivered by prototype	Typical reaction
ESG / “environmental score” bar	Recognised in abstract but <b>low literate</b> : “ESG... I actually don’t know.”
Short textual flags (e.g., “30 % lower carbon”)	<i>Noticeable</i> ; participants could paraphrase back (“because greenhouse effect”), but still uncertain what to do next.
Brand-level controversies (labour, packaging)	Triggers <i>surprise</i> (“I didn’t know Maybelline has environmental issues.”) and sometimes re-evaluation.
Concrete comparisons (alternate brands with better score)	<b>Most actionable</b> : many said they’d “consider” or “maybe switch” if the suggested alt met basic price/quality needs.

Pain point	Quick UX fix
Slow network / long load times in several sessions	Lightweight placeholder images → lazy-load high-res later
Hidden or jargon-heavy sustainability text	Collapsible “Learn more” sections + tooltip definitions
Unclear second / third navigation tabs	Add microcopy (“Environmental impact”, “Invest in this brand”)
Desire to compare alternatives easily	Inline comparison table or swipe carousel with price + core spec

#	Opportunity	Quick win you can prototype
A	Surface eco info <i>inside</i> the price/variant area (not in a far-right panel).	Add a tiny coloured icon next to the price; hover or tap expands a one-sentence impact statement.

#	Opportunity	Quick win you can prototype
<b>B</b>	Swap <i>numeric ESG</i> with <i>plain language + graphic</i>	Try a horizontal traffic-light bar: Red / Yellow / Green with 1-line “Why”.
<b>C</b>	Offer one-click sustainable <b>alternatives</b>	Your “Find alternatives” button worked; make it persistent under the Add-to-Cart button.
<b>D</b>	Match discounts with eco nudges	“5 % off and 30 % lower carbon” blends top-ranked price salience with sustainability.
<b>E</b>	Keep jargon shallow	Replace “PTC heating element” with “quick-heat ceramic (safer & lasts longer)”; users flagged spec lines only when phrased plainly.

Zi- ran ID	“Most-important” element(s)	Reason(s) the participant gave
<b>ARXH1P</b>	<b>Price</b> 2) Product description 3) Reviews (pictures also mentioned)	Wanted to know cost up-front; description “introduces the product”; reviews help judge quality before buying.
<b>1S2SE1</b>	<b>Reviews</b> 2) Return/Exchange info 3) Discounts	Trusts peer feedback; wants a clear path to return items that “aren’t good”; likes to save money via promotions.
<b>2W7HQ</b>	<b>Photos</b> 2) Price 3) Ease of site navigation / categories	Images attract clicks; price must be “acceptable, not too expensive”; prefers pages that make it easy to find items.
<b>4XGN14</b>	<b>Product image</b> 2) Clearly shown price 3) Buyer-posted photos in reviews	Needs to <i>see</i> the item and its cost; relies on real-life pictures for authenticity.
<b>BPDSA1</b>	<b>Shade/Color selector</b> 2) Price & discounts 3) Reviews	Lip cosmetics choice hinges on the right shade; checks deals; uses reviews for finer details.
<b>V7W81A</b>	<b>Photos</b> 2) Price 3) Size availability	Visual appeal first, then affordability; must confirm the size will fit.
<b>6E5N5</b>	<b>Price / loyalty-coin offers</b> 2) Promo details (accumulate & earn) 3) Product description	Interested in total out-of-pocket cost and momo-coin perks; still reads basics about the bag.
<b>6N9Z0</b>	<b>Usage &amp; safety instructions</b> 2) Detailed specs & brand intro 3) Manufacturing country	An electrical item: wants to know how to use it safely, what it’s made of, and where it’s made.
<b>17LSR</b>	<b>Price</b> 2) Pictures 3) Reviews	Re-ordered her answer to stress price first, visuals second, testimony third.
<b>ANGZQ</b>	<b>Pictures</b> 2) Price 3) Reviews	Looks for visual appeal, good price, then social proof.

---

Zi- ran ID	“Most-important” element(s)	Reason(s) the participant gave
<b>C5LGN</b>	Picture 2) Price 3) Product name (quick ID)	Needs an image and cost immediately; name confirms model/version.
<b>1E9NE</b>	<b>Clear text next to images</b> 2) Product content & price 3) Purchase/installment options	Wants concise specs alongside pictures; price clarity; evaluates payment plans or bank promos.
<b>9J97Q</b>	<b>Price</b> 2) Style/Color 3) Reviews & size chart	Cost leads; must like the look; checks fit and peer feedback.
<b>62WEN</b>	<b>Pictures</b> 2) Text description 3) Comments	Visual first, then skim details, finally read what others think.
<b>AP-</b>	1) <b>How-to &amp; safety info</b> 2) Brand <b>NOO</b> intro & specs 3) Country of origin	Similar to 6N9ZO: cares about safe use, material quality, and safety perception tied to origin.
<b>CBYNQ</b>	<b>Price / discounts &amp; coins</b> 2) Product description 3) Compliance / warning notices	Price & perks matter; still reads description; safety/compliance warnings can become deal-breakers.

---

## 12.21.2 Known Issues

- The Green Filter (Ziran) Chrome Extension is unable to record activity due to browser security restrictions for plugins.
- Meanwhile, the web-only version at “ai.ziran.tw” (without direct access to user’s screen), can record user activity.

## 12.21.3 Notable Quotes from In-Person Testing

“But I didn’t think that maybe the facial mask could contain some unknown plant extracts and chemical preservatives.”, anonymous student at Tainan Chang Jung Christian University (CJCU)

“Since I was young, they often said... if something is made locally, the carbon footprint won’t be as high.”, anonymous student at National Pingtung University of Science and Technology (NPUST)

“It gives me more choices.”, anonymous student at Tainan Southern Taiwan University of Science and Technology (STUST)

“I hadn’t thought that the final use and disposal... would also affect carbon emissions.”, anonymous student at Tainan University of Technology (STUST)

“What I see now is that it has listed the carbon footprint... it listed it very detailedly.”, anonymous student at Tainan National Cheng Kung University (NCKU)

“I don’t care, I just look at the price, see what else there is, and then buy it directly.”, anonymous student at Chiayi National Chung Cheng University (CCU)

“You can understand the product better. Before buying, you’ll know its info in more detail and what happens after you buy it...”, anonymous student at Tainan National Cheng Kung University (NCKU)

#### 12.21.4 Notable Quotes from Self-Testing (Survey)

Apart from the in-person testing, there were also over 100 college students who tested the Green Filter app on their own and reported their ideas in a survey. Here’ are some excerpts.

Field # (abridged)	Stand-out quote (translated into English)
1 “Which eco-info would you like your AI buddy to show?”	“Before I buy anything I want to check the product’s transport distance (is it local food?), how green the company’s manufacturing is, how well its workers are treated, my own monthly environmental score, and ways I can push the brands I support to become even greener—all while chatting with the AI.”
2 Optional comments	“I’ve heard of <i>carbon accounts</i> . People are economically rational: if going green brings no monetary return, motivation stays weak. Embedding a carbon-account system into the economy would give consumers a real incentive to choose green products and would strengthen sustainable investment.”
3 “Why did you click that feature?”	“I expected alternative products to pop out on the same page, not jump to a new one. And the map drew a huge red line from Taiwan to Europe to show transport distance—even though I was buying a Taiwanese brand—so I got confused.”
4 “Other options you want”	“Please curate sustainable habits I can <i>actually</i> adopt—like zero-waste shops near my neighborhood. Google Maps keeps showing me stores that are already closed.”
5 Most useful Green Filter feature	“(1) Everything is in one interface, no need for extra tabs. 2) Even if the data isn’t 100 % accurate, it pushes me to dig deeper. 3) The real-time chat includes pictures and extra links.”
6 Least useful feature	“In general the functions are handy, but the Q&A → Green Shopping → Question 7 is least helpful because I live in Taoyuan and stay in northern Taiwan. Adding north-area info would be better.”
7 Biggest worry	“The world feels increasingly out of control—wars, social division, info chaos, mental-health issues. Environmental degradation is part of it: over-production and consumption that trade resources for capital.”

Field # (abridged)	Stand-out quote (translated into English)
8 Preferred AI interaction style	“Ask me things I don’t know, or help correct my English writing.”
9 How students can influence companies	“Young people are the main fast-consumption group. When they start caring and acting on environmental issues, company profits feel it, forcing firms to rethink manufacturing or confront labor rights.”
10 Reason for boycotting a company	“Food-safety scandals, and after they were convicted the firm showed no remorse—using loopholes and splitting its brands so consumers wouldn’t realize it’s the same management.”
11 Trusted brand	“Fresh Milk Village ( <i>Xian-Niu-Fang</i> ) — <a href="https://www.bettermilk.com.tw/">https://www.bettermilk.com.tw/</a> ”
12 Biggest influence on eco attitude	“Documentaries on ecological collapse—melting ice, desertification, grassland retreat, forest fires—make me reflect on humanity’s impact.”

#### 12.21.5 Example Interview: 25 December 2024

Location: Taichung, National Chung Hsing University (NCHU) Anonymous Tester Code: [3G1RL]

Speaker	Content
Interviewer	This app is part of my thesis about sustainability. First, may I record our conversation?
Participant	Uh, yes.
Interviewer	Have you used Momo before?
Participant	Yes.
Interviewer	Which platform do you use most, Momo or Shopee?
Participant	I use Shopee more often.
Interviewer	What kind of things do you usually buy online?
Participant	On Momo I once bought a set of speakers.
Interviewer	Anything you want to shop for right now?
Participant	Maybe some movies... but let me browse shoes instead.
Interviewer	Sure, pick any item.
Participant	(Searches) Found a pair of Timberland boat shoes.
Interviewer	Why that model?
Participant	I have eyed this pair for a long time and it looks good when others wear it.
Interviewer	Let us open my prototype overlay. What do you notice first?
Participant	The company score says forty five, which feels low, so maybe it is not very eco friendly.

Speaker	Content
<b>Interviewer</b>	The green tab shows “Reduce carbon emission thirty eight percent”. What does that mean to you?
<b>Participant</b>	It lists brands with lower carbon footprints so I could choose them instead. I have tried Timberland before; the others are new to me.
<b>Interviewer</b>	The purple tab suggests investment options. Thoughts?
<b>Participant</b>	It looks like I could invest in companies similar to Timberland, check stock prices and trends. I have never bought stocks though.
<b>Interviewer</b>	If Apple scored badly on the environment, would you switch brands?
<b>Participant</b>	I would research alternatives. Environmental impact matters to me.
<b>Interviewer</b>	Try the “Ask AI” button.
<b>Participant</b>	(Types) “How much carbon does this product emit?” The answer breaks down production, packaging, transport, even end of life disposal. I never considered water and electricity used during use.
<b>Interviewer</b>	Which part of the overlay feels most useful?
<b>Participant</b>	The detailed material and ESG section, environmental and labor issues, plus the alternative brands list.
<b>Interviewer</b>	Any information missing before you decide?
<b>Participant</b>	Safety data and warranty, especially for products used near the face; also clearer brand logos and Chinese names.
<b>Interviewer</b>	At the top there is a code. Please read it aloud.
<b>Participant</b>	Three G one R L.
<b>Interviewer</b>	Could you take a photo of the most important screen and write that code on the card?
<b>Participant</b>	(Takes photo and writes code) Done.
<b>Interviewer</b>	Last question, will the sustainability data change your purchase?
<b>Participant</b>	I might still buy these shoes if I really love them, but I will think twice and compare with greener options first.
<b>Interviewer</b>	Great. Thanks for your help today.
<b>Participant</b>	No problem.

## 12.22 1st Wave of Testing (Spring 2024) - Prototype

Semi-structured interviews were conducted in Chinese. The interviewer (me) took notes of the interviews. Some gaps in the data exist due to the limited Chinese language skills of the interviewer (me).

### 12.22.1 1st Wave Interview Samples

Sun, 14. April 2024, 22h at D24

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED]

- Searches for *Lancome* brand.
- Chooses LANCOME 蘭蔻 小黑瓶 100ml (買一送一/超未來肌因賦活露國際航空版) Link to Momo page.
- Notices 買一送一 (buy one, get one free).
- Doesn't notice the analysis button at first.
- Would only click on this button if the product is really expensive.
- Would not click on "continue chat button"
- Asked "why is it so expensive in taiwan".
- Considers the report result useful.

Note: There's dropoff on every step of the user journey. Note 2: Add carbon indicators, other labels to the analysis, add report code, calculate report code from URL? Save as KV. Note 3: Make use of the Chinese term: 有意識的消費主義

RQ: To what extend can shopping become an entry point for saving and investing. RQ: Can shopping serve as an entry point for sustainable saving and investing?

### May 8

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [CZUTA].

On Momo: \* Investment help is useless.. \* Needs a simpler introduction \* Wants to see real cows [in the product source view] \* Very curious about companies \* Wants to see the company profit and margin percentage. Why is margin so high if pollution is bad? \* Wants to see the real environmental impact of the company.

### May 6

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED]

On Momo: \* Is concerned that seeing factory photos is useful only if they are trustworthy photos. Who will provide them?

### May 5

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED].

On Momo: \* Does not find the Green Filter AI at all. \* User: it looks like an ad

### May 3

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED].

User first does an online Search: - Uses Google to look for "fashion brand eco friendly" - Thinks "goodonyou.eco" looks like a brand website.

On Momo: - first looked for NET clothes but Momo doesn't sell it - Looked for Sony camera lens

## May 1

Notes: *Professor Feedback*: 1st of May Prof. suggestion - make connection between biodiversity and production and consumption clearer - what is the incentive for companies to share their data?

my own idea: like the switch of going from traditional banking with ATM machines on the street (or even the physical bank office) to online banking with mobile payments.

Hypothesis: ESG accessibility can push companies to increase production standards.

What if you can see ESG in near-realtime such as the stock market price?

I can imagine ESG derivative product like siemens gamesa

AI can help integrate esg derivatives into daily life to drive esg adoption

“effective altruism (EA)”

“Blockchain technology can improve price transparency in product distribution by allowing consumers to know the exact pricing from raw materials to distributors to suppliers.”

## Tuesday 30. April 14:05-14:45

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [7CYQ6]

On Momo: - Looks for Levis pants - Looks for recommendations on the sidebar - Looks at the photos - Looks at the price and options - Didn't notice the helper as it looks like an ad - When helped... - Ignores 社區支持: 購物 69% 儲蓄 80% 投資 65% as doesn't know what these mean

On ai.ziran: - Shares personal info: 四年後想考研究所，還不想工作，所以不會存到錢，希望可以考到台北的學校，每個月有兩萬生活費。

On DJmoney: Link to DJmoney page - Still didn't notice the helper - Doesn't understand investing (Understands it's Taiwanese stocks) so the helper is useful for explaining new concepts

## Monday 29. April 10:10-10.25

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED]

On Momo: \* Wants to buy New Balance sneakers

On DJmoney: \* Wants compare EFTs

Monday 29. april 14:50-15:10

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED]

On Momo: \* Wants to buy an Apple iPhone (older model). \* Bad internet (very slow) \* App was slow \* App crashed

Note: Green Filter analysis on DJmoney seems more trustworthy than the other 2 ETF sites  
Note 2: Button placement is important (too low on sites other than djmoney)

Sunday 28. april 16:00

User Profile: NCKU student, Gen-Z. Anonymous Tester Code: [REDACTED]

On Momo: \* Wants to buy ice cream

## 12.23 Early Feature Ideas

The following early feature ideas occurred to me during the literature review process. They are naive and meant to allow thinking in terms of *what-if* a particular user experience was possible. These prototypes were not tested with users directly and rather formed a basis for directing the questions asked in a potential user survey.

### 12.23.1 Susan (Sustainability Conversation)

*What if I could have a chat like this at the supermarket? Imagine what questions I would ask before buying a product. AI: “Kris, do you still remember Coca-Cola’s packaging is a large contributor to ocean plastic? You even went to a beach cleanup!” Me: “That’s so sad but it’s tasty!” AI. “Remember your values. Would you like to start saving for investing in insect farms in Indonesia instead? Predicted return 4% per year, according to analysts A and B.” If I’m not so sure, I could continue the conversation. Me: “Tell me more” AI: “A recent UN study says, the planet needs to grow 70% more food in the next 40 years. Experts from 8 investment companies predict growth for this category of assets.” Me: “Thanks for reminding me who I am” ... Moments later. AI: “This shampoo is made by Unilever, which is implicated in deforestation in Indonesia according to reporting by World Forest Watch. Would you consider buying another brand instead? They have a higher ESG rating.”*

Example Suggestions of the AI companion:

- *“Don’t buy a car; use a car sharing service instead to save XYZ CO<sub>2</sub>eq. Services available near you: Bolt, Uber, Line Taxi”*
- *“Use a refillable shampoo bottle to save XYZ plastic pollution”*
- *“Call your local politician to nudge them to improve bicycle paths and reduce cars in your neighborhood. Over the past 2 years, your city has experienced an increase of cars from 290 cars per capita to 350 cars per capita.”*

Speculative scenario of an interaction between a human user and a robo-advisor through the interface of chat messages in the context of retail shopping for daily products.



Figure 144: Early prototype of my Sustainable Finance AI Companion (Nov. 2020)

### 12.23.2 Sunday Market

*What if I could go to the Sunday market with other people who care about sustainability? First prototype (based on literature review) called HappyGreen's for going to the organic Sunday Market with friends. Choose industries of focus? Fashion, Food, etc?*

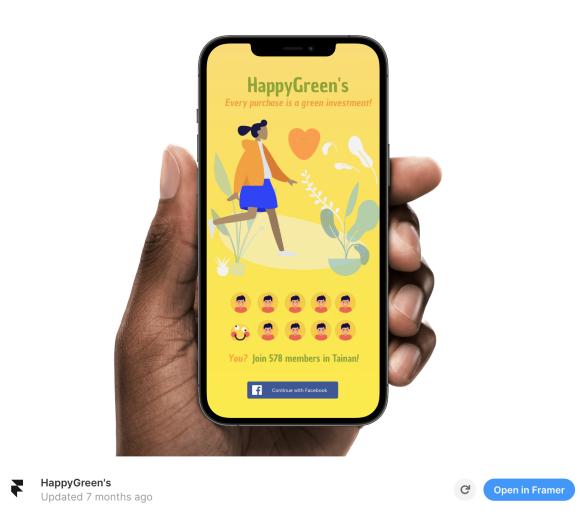


Figure 145: Feature idea: community app for shopping with eco-minded friends (Nov. 2020)

### 12.23.3 True Cost

*What if I you could see the actual cost of each product including externalities?*

Product	Price	True Cost
Coca Cola (0.5L)	3€	18€
Wella Shampoo	5€	30€

Figure 146: Feature idea: True Cost (Nov. 2020)

### 12.23.4 How Far?

*What if the exact distance traveled by a product to reach me was clearly displayed during shopping? Seeing precise transportation distances and associated emissions could immediately clarify the environmental impact of buying local versus imported goods. Such transparency might encourage consumers to prioritize local and sustainable sourcing.*

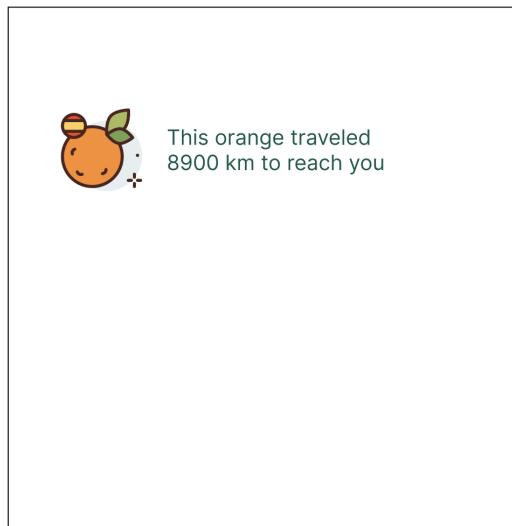


Figure 147: Feature idea: How far? (Nov. 2020)

## 12.24 Country Profiles

*What if I knew my country's top pollution sources? I could instantly access detailed insights into my country's primary sources of pollution? Having clear, accessible data on national environmental challenges might empower consumers to support policies, businesses, and lifestyle changes that address critical sustainability issues.*



Figure 148: Feature idea: Country Profile (Nov. 2020)

### 12.24.1 Know Your Company (KYC)

*What if* I could KYC the companies I interact with? This is a common practice for banks, they need to KYC “Know Your Client”. As a consumer, could I approach companies in a similar way to banks - using “Know Your Company” (KYC) for daily interactions with businesses? Possibly detailed transparency about corporate sustainability, ethics, and practices would enable consumers to engage only with companies whose values align closely with my own. Similary, *What if* I could “Speak Truth to Power”, affecting companies with truth? Consolidate user feedback for companies.

### 12.24.2 CO<sub>2</sub>eq Flex

*What if* I could show off how much CO<sub>2</sub>eq I have retired? What if I could showcase my contributions to reducing carbon emissions, similar to how fitness achievements are shared? A visual display or “badge” reflecting my environmental impact could encourage others, creating a ripple effect of positive behavior and raising community awareness about personal sustainability efforts.

### 12.24.3 Sustainability Watch

*What if* I could see all my sustainability data on a wearable device in the right context? My wearable device could provide instant, contextually relevant sustainability data throughout my day? Imagine checking my watch during shopping or commuting and instantly seeing personalized, actionable insights that help me make more eco-friendly decisions seamlessly integrated into my daily routine.



Figure 149: Feature idea: Sustainability Watch (Nov. 2020)

### 12.24.4 Narrative Layouts

*What if* I spent 5 minutes every day with a guide who could help me make more eco-friendly choices? How should the layout storyline be structured? Well it's like Strava (that running app)

for sustainability... or if you have heard of Welltory. I believe sustainable choices that would improve my life.. be it what I consume, save, invest, etc.. so I'm trying to design an app around this idea. I'm basically building the UX of AI.. focused on sustainability. How should the layout storyline be structured? Well it's like Strava (that running app) for sustainability... or if you have heard of Welltory. I believe if I spent 5 minutes every day with a guide who could help me make more eco-friendly choices that would improve my life.. be it what I consume, save, invest, etc.. so I'm trying to design an app around this idea.



Figure 150: Feature idea: Narrative Layouts (Nov. 2020)

#### 12.24.5 Shopping Divest

*What if* I you could build a community based on what I buy? Or join existing communities based explicitly on sustainable consumption habits? By sharing my purchasing choices and sustainability experiences with others, perhaps we could collectively amplify the positive impact of our eco-conscious decisions.

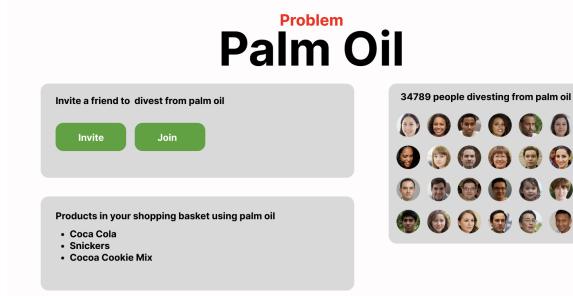


Figure 151: Feature idea: Narrative (Nov. 2020)

#### 12.25 Mapping Feature Ideas to Theory of Planned Behavior

Table 124: Categorizing early feature ideas by purpose and rationale.

Type of Feature	Specific Features	Purpose	Rationale
<b>Transparency &amp; Impact Intel</b>	<b>True Cost, How Far?, Country Profiles, KYC</b>	Surface hard-to-see facts so choices feel data-backed	Make sense of complex sustainability data, so the user can quickly grasp hidden externalities, supply-chain distance, CO2 footprints, or a company's ESG record.
<b>Personal Coach &amp; Nudge Engine</b>	<b>Susan Chatbot, Sustainability Watch, Narrative Layouts</b>	Give real-time, context-aware advice that steers decisions	These features work like a pocket mentor: chat UI, wearable devices, or daily storylines that nudge the user toward greener action.
<b>Social &amp; Collective Flex</b>	<b>Sunday Market, Shopping Divest, CO ☒ Flex</b>	Use friends, status, or crowd power to boost motivation	These ideas thrive on group shopping, community leaderboards, or brag-worthy carbon "badges," focusing on social proof and friendly competition.

While these feature ideas were developed independently, before I knew the Theory of Planned Behavior existed, the following is an attempt to organize the features according to TPB constructs.

Table 125: Early feature ideas mapped to Theory of Planned Behavior.

Type of Feature	TPB Construct	Meaning	Rationale
<b>Transparency &amp; Impact Intel</b>	<b>Attitude towards the behavior</b>	<i>"Do I think acting sustainably is good and worth it?"</i>	By exposing hidden costs, supply-chain distance, and ESG scores, these features shape positive (or negative) evaluations of a purchase.
<b>Personal Coach &amp; Nudge Engine</b>	<b>Perceived behavioral control</b>	<i>"Can I actually pull this off?"</i>	Real-time tips from Susan or a smartwatch lower friction, boosting a user's sense that greener behaviour is doable.
<b>Social &amp; Collective Flex</b>	<b>Subjective norms</b>	<i>"Do the people around me expect this?"</i>	Sunday-Market meet-ups, carbon badges, and community feeds make sustainable choices visible and socially reinforced.

## 12.26 Prototype Development

The interactive prototype of Green Filter is publicly available at the Google Chrome extensions store and separately at the AI companion's website.

- Google Chrome Extension Store: <https://chromewebstore.google.com/detail/%E7%B6%A0%E6%BF%E2%80%9Cgreen-filter%EF%BC%9F/jmpnmeefjlcbpmoklhhljcigffdmmjeg> -
- Green Filter “Ziran AI” Website: <https://ai.ziran.tw/>

### 12.26.1 Prototype Architecture

- Google Chrome browser extension
- API micro-service
- Ziran AI
- AI back-end
- Ratings API
- Redis testing AI results
- Redis Page cache / from page / separate scraping service
- Documentation: Green Filter thesis website / GitHub
- AI API GPT / Claude
- Stock ratings API
- Community ratings API

70 Questions

- Use of *Report ID* to do anonymous testing
- Page tracking to track the usage -
- 7 app questions
- 63 personality questions

Other Tools Used:

- QR generator in Canva
- Postman for API testing

### 12.26.2 Google Chrome Extension App Installs

While Google is the most popular browser with over 3.45 billion users (*Google Chrome Statistics for 2024, 2023*), extensions are a relatively less known feature of the browser. Most popular extensions are Grammarly, for Taiwanese students End Note is familiar. However, it's only available for computers (extensions don't run on phones and tablets).

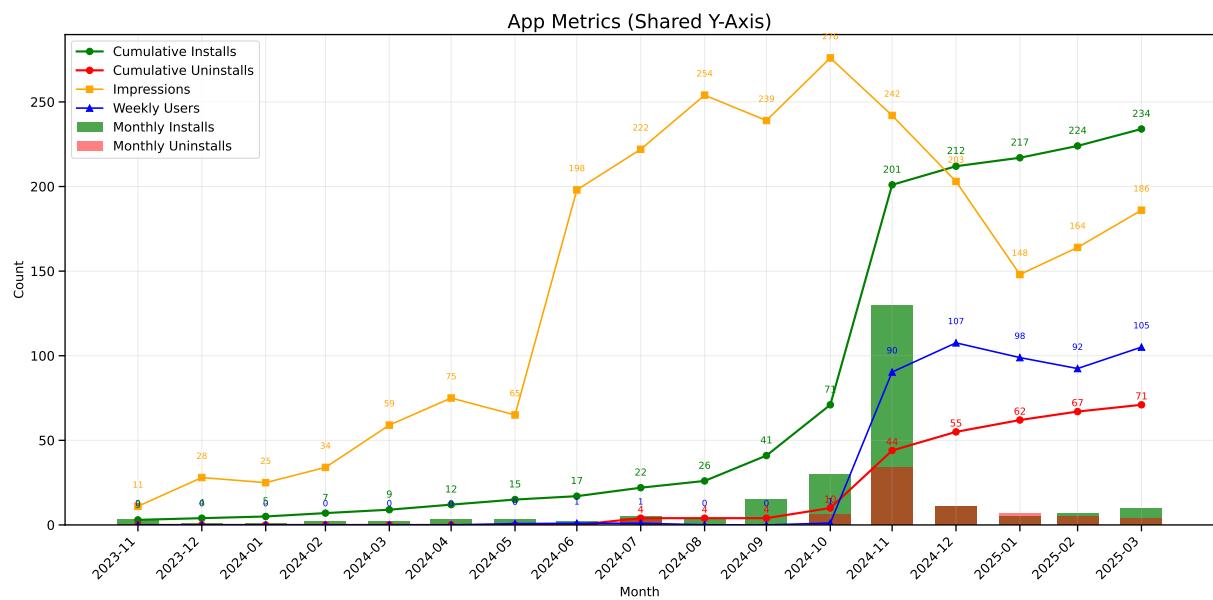


Figure 152: Green Filter Google Chrome Extension Installs

## 12.27 Prototype Design and Features

### 12.27.1 Momo AI Extension

The screenshot displays the Momo AI Extension prototype. On the left, there's a sidebar with a pink header "資生堂開架★全館77折up" and various categories like "開架熱銷彩妝★5折UP", "歐美保養★抗老保濕2折up", and "更多". Below these are sections for "保養超值組", "精華液", "乳霜", "面膜", "化妝水", "防晒", "底妝", "眼妝", "唇膏", "眉彩", "頰彩", and "★熱銷大牌★" which lists brands such as AMIINO安美諾, Biore 蜜妮, Bio-essence 碧歌斯, DHC, greenvines 綠藤生機, innisfree, Jealousness 嫉洛妮絲, MIRAE 未來美, and Neutrogena 露得清. The main area shows a product from MIRAE (未來美) with a large "官方" button. The top right has a search bar and navigation links. The right side features a detailed analysis panel with tabs for "買東西", "儲蓄", and "投資". It includes a summary message: "基本上，買東西也是一種投資喔～我可以幫你分析，你花的錢是支持好公司還是不好的公司！". Below this are three numbered sections: ① provides information about MIRAE (未來美), mentioning it's a Taiwan-based brand using 8-minute AE face mask packaging. ② details the brand's ESG metrics, including its sustainability rating of 45, and lists its brand, ownership group, country, factory, materials, and environmental issues. ③ offers options to "尋找替代產品" (Find alternative products) or "查看產品的產地狀況" (View product origin status).

Figure 153: Momo



## Review

✓ 綠濾「數位產品護照」 ✓ ESG報告編號：CC4G6 ^

買東西 儲蓄 投資

基本上，買東西也是一種投資喔～我可以幫你分析，你花的錢是支持好公司還是不好的公司！

1 MIRAE（未來美）是一M款IRAE來自未來台美隸灣的屬於台灣M保IR養品牌，以8分鐘AE面集膜聞名團，以，採用面膜開架聞名包裝。。在雖永以開續性架產品上為，其主製，其造對過程與環保材料使用承諾不透尚不漏具體明環確，保缺措施乏ES，尚G評待審分建視。議其。母提供非公司和環保使用的認證成分。若含可有大量塑考料慮或L化USH、學The Body物 Shop質、，會K對環境ie造成影hl響's。在更國環際評保級選擇。中，資料不足以具體評價其ESG表現。CEO資訊和台灣當地的生產情況也不明確。對環保有要求的消費者需謹慎考量。  
建議考量以下三個較具永續特性的品牌：  
The Body Shop（英國，主張環保與社會責任）  
Lush（英國，強調裸包裝與環保）  
Dr. Bronner's（美國，推動公平貿易與生態保護）

2

子標題	資訊
品牌	未來美 MIRAE
所屬集團	金百利克拉克 Kimberly-Clark
國家	臺灣
工廠	臺灣
材料	不織布、化學成分
材料可持續性	不織布難以分解，化學成分可能有害環境
環境問題	使用一次性材料，難降解產品處理難題
可持續性評分	45
勞工問題評分	70
ESG等級	N/A
股票代號	KMB

3 公司的整體評分 45～環保措施不足，社會責任不明 你想立即行動嗎？

● 尋找替代產品 ● 查看產品的產地狀況

Figure 154: Review



Save

The screenshot shows a mobile application interface with a yellow header bar. In the top left corner is a circular profile picture of a person with dark hair. To the right of the profile picture are two green checkmarks: one next to the text '綠濾『數位產品護照』' and another next to 'ESG報告編號：CC4G6'. In the top right corner is a small upward-pointing arrow icon.

Below the header, there are three tabs: '買東西' (Buy), '儲蓄' (Savings), and '投資' (Investment). The '儲蓄' tab is highlighted with a yellow background.

A large yellow callout box contains text in Chinese: '通過購買更多環保產品，你可以拯救自然～如果你購買來自可持續發展的公司的產品，你的環境影響將降低多少？'

Below the callout, a numbered step indicator '④' is followed by the text: '至少減少碳排放量30%！選擇可持續品牌可減少環境足跡'.

A table lists five brands along with their carbon reduction potential and environmental benefits:

品牌名稱	減排潛力 (%)	解釋
O'right	35%	使用天然成分減少化學物質
Purearth	40%	採用有機材料環保包裝
Herbivore Botanicals	32%	無動物實驗天然成分
Tata Harper	38%	全成分可追溯無毒害
Antonym Cosmetics	33%	使用可再生資源包裝

Figure 373: Save

## Invest



Figure 156: Invest



## 12.27.2 AI Companion

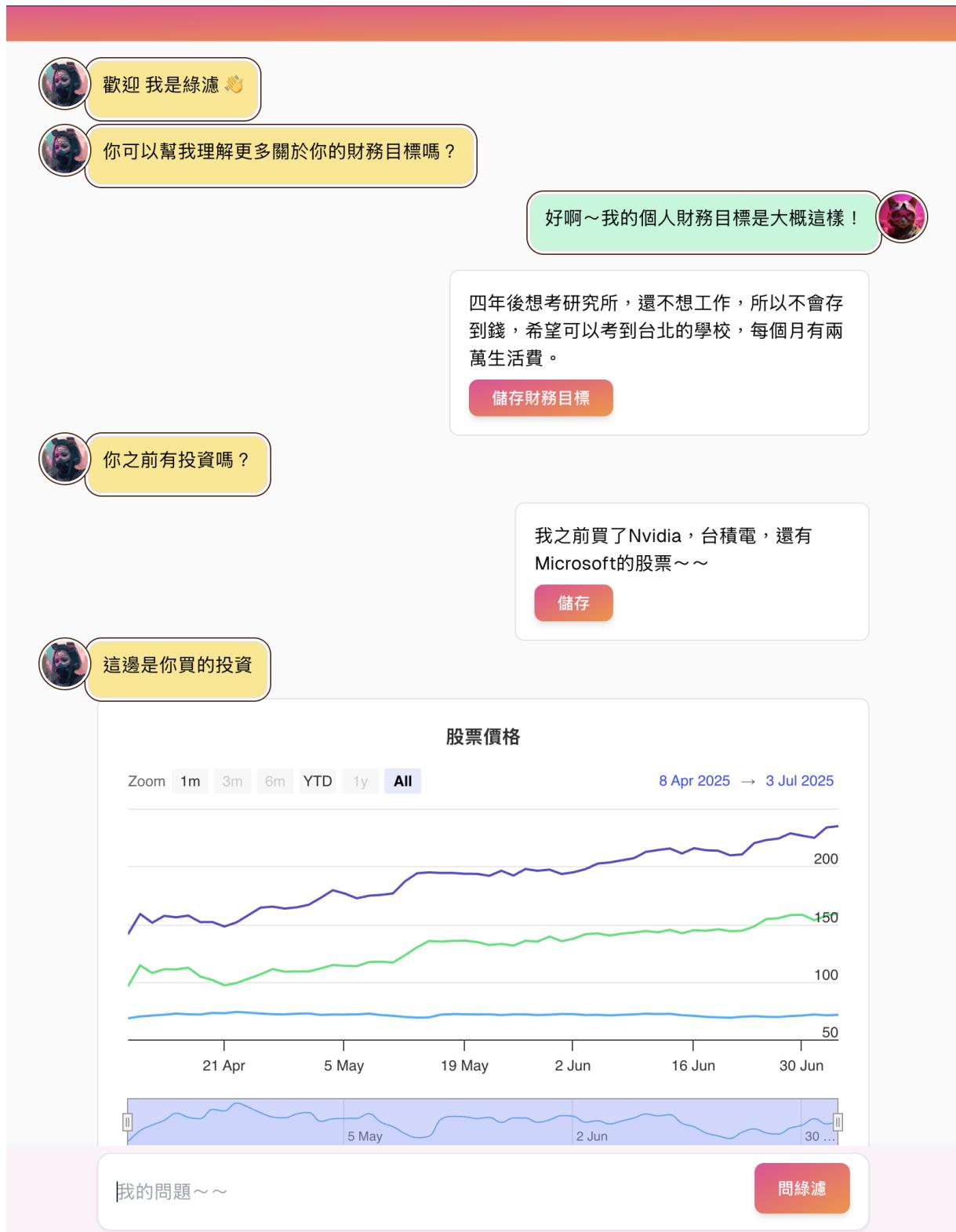


Figure 157: Home

## Factory

綠濾助手 ~ 我花錢去支持了啥物呢 ? ~ 登入

工業生產和工廠如何影響台灣各地的空氣污染 ?

要

這邊有一些工廠範例圖片 創用CC授權的圖片，拍攝於尼加拉瓜的一家台灣公司擁有的紡織廠。這些照片是在台灣總統正式訪問期間拍攝的。原始圖片可以在下載：下載連結。



這裡附近有一些紡織廠 這些都是工廠範例地圖

我的問題~~

問綠濾

Figure 158: Factory

## Map

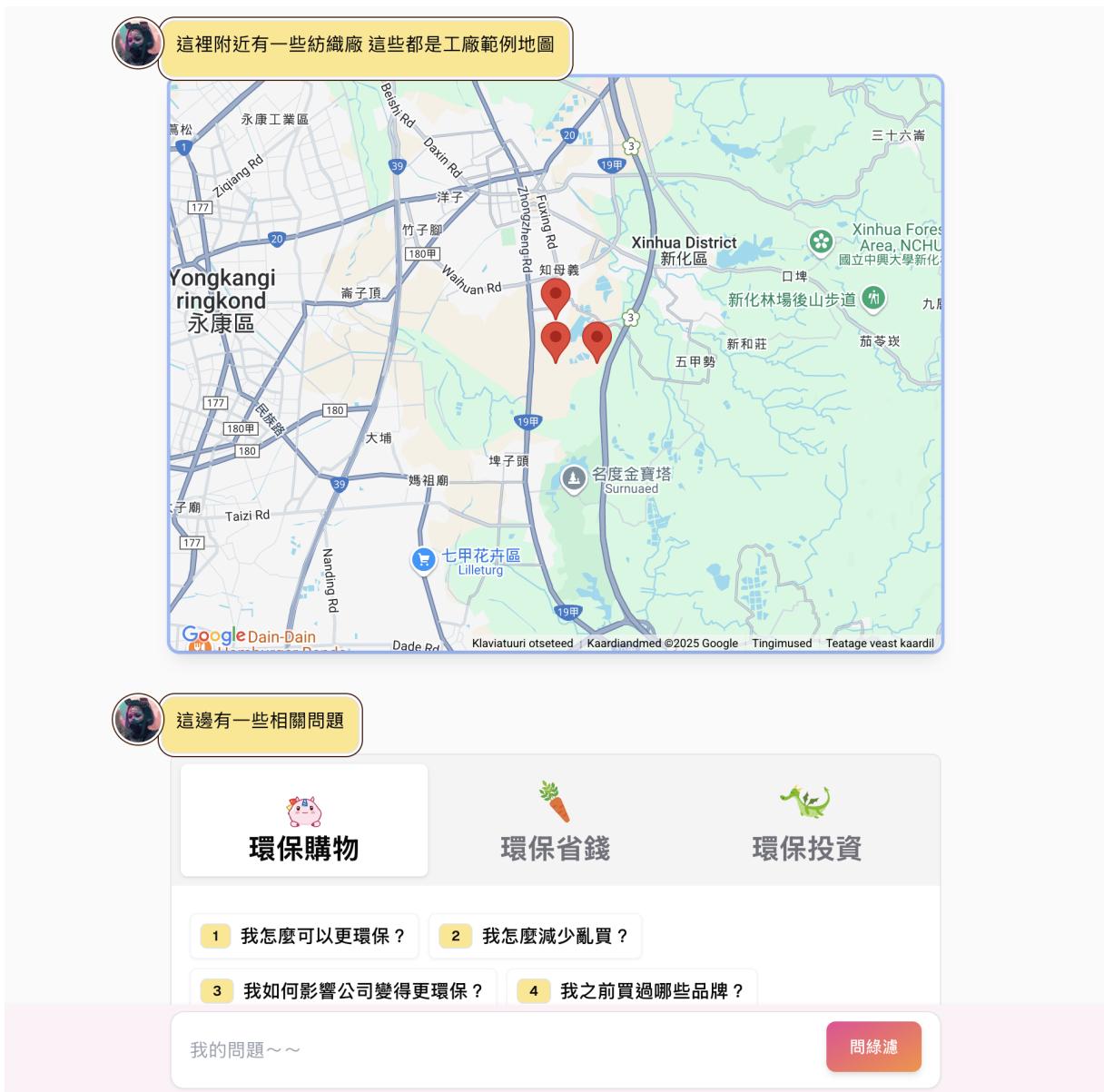


Figure 159: Map

## FAQ

The AI companion lists a number of basic questions to prompt the user to start a conversation. Feasibly, these could be personalized as the AI better understand the user and their experience thus far.



Figure 160: FAQ Shop

Everything starts with shopping; this is the first use-case for money.



Figure 161: FAQ Save

Once the user begins saving money, they'll have a source of funds to direct to investing.



Figure 162: FAQ Invest

Investing is the last, and most complicated step. This is where user probably needs the most help.

## Chat

資料來源：[www.momoshop.com.tw](http://www.momoshop.com.tw)

MIRAE（未來美）是一M款IRAE來自未來台美隸灣的屬於台灣M保IR養品牌，以8分鐘AE面集膜聞名團，以，採用面膜開架聞名包裝。。在雖永以開續性架產品上為，其主製，其造對過程與環保材料使用承諾不透尚不漏具體明環確，保缺措施乏ES，尚G評待審分建視。議其。母提供非公司和環保使用的認證成分。若含可有大量塑考料盧或L化USH、學The Body物 Shop質、，會K對環境ie造成影hl響's。在更國環際評保級選擇。中，資料不足以具體評價其 ESG 表現。CEO 資訊和台灣當地的生產情況也不明確。對環保有要求的消費者需謹慎考量。

建議考量以下三個較具永續特性的品牌：

The Body Shop (英國，主張環保與社會責任)  
Lush (英國，強調裸包裝與環保)  
Dr. Bronner's (美國，推動公平貿易與生態保護)

未來美 (MIRAE) 是一個來自台灣的保養品牌，雖然以快速見效的面膜聞名，但在永續性和環保方面的資訊相對不足。這可能意味著在生產過程中使用的材料和方法對環境的影響不明確，特別是如果涉及大量塑料或化學物質，可能會對環境造成負面影響。

這些產品的生產地在台灣，但具體的生產過程和環保措施尚不清楚。對於重視環保的消費者來說，選擇時需要謹慎考量。

如果你想了解更多關於這些產品的來源和生產地的資訊，我可以為你展示一張地圖。你想看看嗎？

Figure 163: Chat Ask

資料來源：[www.momoshop.com.tw](http://www.momoshop.com.tw)

MIRAE（未來美）是一M款IRAE來自未來台美隸灣的屬於台灣M保IR養品牌，以8分鐘AE面集膜聞名團，以，採用面膜開架聞名包裝。。在雖永以開績性架產品上為，其主製，其造對過程與環保材料使用承諾不透尚不漏具體明環確，保缺措施乏ES，尚G評待審分建視。議其。母提供非公司和環保使用的認證成分。若含可有大量塑考料慮或L化USH、學The Body物 Shop質、，會K對環境le造成影hl響's。在更國環際評保級選擇。中，資料不足以具體評價其 ESG 表現。CEO 資訊和台灣當地的生產情況也不明確。對環保有要求的消費者需謹慎考量。

建議考量以下三個較具永續特性的品牌：

The Body Shop（英國，主張環保與社會責任）

Lush（英國，強調裸包裝與環保）

Dr. Bronner's（美國，推動公平貿易與生態保護）



根據你提供的資訊，MIRAE（未來美）在環保和永續性方面的資訊不夠明確。以下是一些更具永續特性的品牌和產品選擇，供你參考：

品牌名稱	主要特點	永續性特點
The Body Shop	英國品牌，主張環保與社會責任	使用可再生材料，支持社會公益
Lush	英國品牌，強調裸包裝與環保	裸包裝，減少塑料使用
Dr. Bronner's	美國品牌，推動公平貿易與生態保護	使用有機成分，支持公平貿易

這些品牌在環保和社會責任方面都有較好的表現，可能更符合你對永續產品的需求。希望這些資訊對你有幫助！如果你有其他問題或需要更多建議，隨時告訴我喔！

Figure 164: Chat Compare

## 13 DISCUSSION

The success of interaction design depends on human psychological underpinnings. In the following tables I've used the *Theory of Planned Behavior* to categorize each feature according to what psychological state they aim to affect. To have any chance to impact human behavior towards sustainability, the nudges should be delivered in-context, and at the right time, using effective language. This section will focus on key findings that could be relevant for designing the right context - i.e. inside particular *Features* of the experience.

### 13.1 Design Implications

The following findings from *Literature Review*, *User Survey*, and *Prototype Testing*, have been categorized by chapter and list some of the key implications which can lead to *Feature Ideas*.

#### 13.1.1 College

College students need tools for action. General theory about Taiwanese society suggests that it's low-context and people need groups to do activities. But my survey about my sustainability app shows that people don't pick the features for joining groups. Joining groups was one of the least interesting choices in the survey.

TPB	Design Factors	Potential Explanation for Group-Related Features
Attitude	Survey Framing Effect	Survey respondents may feel the way I framed the survey question for "joining groups" made it sound like an extra commitment they didn't want to make.
Perceived Control	Group Fatigue	Survey respondents may already have too many group obligations to attend to (school, work, family, etc). Joining another new group may feel like a burden, not a benefit.
Perceived Control	Fear of Awkwardness	Survey respondents may feel joining strangers in online group is risky, uncomfortable or unnecessary.
Attitude	Desire for Personal Achievement; Changing Cultural Trends	Survey respondents may be more motivated by <i>individual achievement</i> to personally feel they are making a difference instead of waiting for the group. Possibly they are more individualistic than my expectations in their behavior (particularly in a digital context) and the traditional "group society" stereotype is weakening.
Subjective Norms	Are "Group" and "Sustainability" Concepts Related?	Survey respondents may not clearly understand the benefit for sustainability from their joining a group.

Environment shapes action.. how to create an environment where college students can influence companies.

Table 127: Design implications arising from the college chapter.

TPB	Human Interface	Findings and Roles	Design Implications
Subjective Norms	Community	Taiwanese students are highly influenced by the actions of their peers. People exist in relation to other people.	The app should show what other people are doing. In terms of a specific Feature, this could become “Group Purchases”, “Find Your Composting Community”, “Create a Group Chatroom”.
Perceived Control	Investing	Psychology of ‘fundraising clubs’ vs individual investing differs greatly.	Provide a community for pooling money with like-minded investors.

### 13.1.2 Sustainability

Design implications arising from the sustainability chapter.

Table 128: Design implications arising from the sustainability chapter.

TPB	Human Interface	Findings and Roles	Design Implications
Attitude	Shopping / Transparency	Realtime ESG is a building block to enable consumers and investors make more accurate, real-world purchase decisions.	Build technologies and practices that enable <i>real-time ESG</i> : up-to-date transparent information about how our products are produced.
Perceived Control	Shopping / Actionability	Start with the most polluted regions as priority?	Simplify action towards a “triple turn”: environmental, social, governance.

TPB	Human Interface	Findings and Roles	Design Implications
Perceived Control	Shopping / Pollution	People living in polluted areas are so used to it.	What app to wake them up? “You live in a highly polluted area. Here’s the TOP 10 companies causing pollution. Here’s what you can do.”
Perceived Control	Saving / Health Tracking	Blood testing and biomarkers allow people to track their health.	I’m introducing the concept of ‘eco-markers’ to follow the sustainability of human activities.
Attitude	Circular Economy	AI can help us make sense of the vast amounts of sustainability data generated daily.	Sustainability is part of product quality. If a product is hurting the environment, it’s a low quality product.
Perceived Control	EPR	There is a lot of new legislation (especially in Europe) encouraging sustainable design.	EPR and CDP data should be part of Green Filter.
Perceived Control	Eco-Design	As a consumer, eco-designed products are hard to find.	Provide clear labeling to find eco-designed products.
Subjective Norms	Governance	Politics matter and lack of transparency is intentional.	Make it easy to support policies that call for transparency.

### 13.1.3 Design

This chapter has the following design implications.

Several superapps already contain features for payments (shopping), savings, and investing. Yet none thus far integrate Digital Product Passports to understand the products’ journey, including the origin and manufacturing conditions, materials, components, CO<sub>2</sub>e footprint and environmental impact, post-consumer repair, recycling, and end-of-life disposal guidelines.

Table 129: Design implications arising from the design chapter.

TPB	Human Interface	Findings and Role	Design Implications
Perceived Control	User Interface	AI now enables generative UIs, which can dynamically change the layout and content as needed and fitting to the data.	It's a balance: while there's potential, users also need some type of stability (think: text input stays in the same place but different types of interfaces appear within a clearly defined space).
Attitude	Health	Many respondents express concerns about health.	Show health-related alerts in addition to sustainability. For example, Aspartame has not been banned or reduced after 2 years of findings; provide warnings for possible cancer-causing ingredients in the AI assistant.
Subjective Norms	Greenwashing	Personal CO <sub>2</sub> eq tracking is ineffective and the focus should be on systematic change towards circular design and zero waste practices.	Provide tools to influence companies instead of only personal lifestyle changes.
Perceived Control	Goal-setting	Users feel bored if there's no updated information.	As a student, I can set an <i>Intention</i> for myself, such as cutting plastic waste or building a climate positive investment portfolio.
Perceived Control	Accountability	Consumers lack tools to affect change.	Help consumers to demand more by integrating tooling into the shopping experience. Perhaps this could be called "embedded sustainability", inspired by the "embedded finance" trend documented in literature.

### 13.1.4 AI

This chapter looked at AI in general since its early history and then focused on AI assistants in particular.

Table 130: Design implications arising from the AI chapter.

TPB	Human Interface	Findings and Roles	Design Implications
Perceived Control	Ambient Computing	AI companions could combine sensor data from human bodies with the ability to reason about human speech, to provide increasingly relevant, in-context assistance.	Because of the conversational nature of LLMs, they are very useful for affective computing. OpenAI is developing such a device.
Perceived Control	Voice Assistants	There are many distinct ways how an algorithm can communicate with a human.	From a simple search box such as Google's to chatbots, voices, avatars, videos, to full physical manifestation, there are interfaces to make it easier for the human to communicate with a machine.
Attitude	Sustainability	While I'm supportive of the idea of using AI assistants to highlight more sustainable choices, I'm critical of the tendency of the above examples to shift full environmental responsibility to the consumer.	Sustainability is a complex interaction, where the producers' conduct can be measured and businesses can bear responsibility for their processes, even if there's market demand for polluting products.

TPB	Human Interface	Findings and Roles	Design Implications
Attitude	Sustainability	Personal sustainability projects haven't so far achieved widespread adoption, making the endeavor to influence human behaviors towards sustainability with just an app – like it's commonplace for health and sports activity trackers such as Strava – seem unlikely.	Personal notifications and chat messages are not enough unless they provide the right motivation. Could visualizing a connection to a larger system, showing the impact of the eco-friendly actions taken by the user, provide a meaningful motivation to the user, and a strong signal to the businesses?
Attitude	Cuteness	Cuter apps have higher retention. Literature suggests adding an avatar to the AI design may be worthwhile.	Design the app to be cute and ask the user for their favorite animal.
Subjective Norms	Anthropomorphism	People lose trust in AI if it lies.	AIs should disclose they are AIs. Understanding algorithm transparency helps humans to regard the AI as a machine rather than a human.

### 13.1.5 Finance

Design implications results from the literature review on finance.

TPB	Human Interface	Finding and Role	Design Implications
Perceived Control	Legislation	As a consumer, legislation does not always protect me from being complicit in pollution, even if unintended.	As a consumer, I can get notified by the app about highlights of poor legislation refuted by science.

TPB	Human Interface	Finding and Role	Design Implications
Attitude	Greenwashing	As a consumer, sustainability is fragmented and greenwashing is widespread: how can I feel trust, honesty, and transparency?	As a consumer, I can make use of Green Filter, a sustainable shopping, saving, and investing companion.
Attitude	Greenwashing	As a consumer, while reading the EU Commission's proposals shared in the news, I might think the politicians have everything under control, I can relax and continue the same lifestyles as before, the reality is emissions keep rising, while they should be falling.	As a consumer, I need proper tools to understand what's sustainable. I want to know it's possible to curb greenwashing.
Attitude	Education	As an interaction design student who cares about the environment, I ask myself how can interaction design contribute to increase sustainability?	I make the assumption that investing is inherently “good” for one’s life, in the same way, that doing sports is good, or eating healthy is good. It’s one of the human activities that is required for an improved quality of life as we age. To start investing sooner, rather than later, because of compound interest. Nonetheless, investment also includes higher risk than sports or food.

TPB	Human Interface	Finding and Role	Design Implications
Attitude	Education	As a designer for a financial product, I need to communicate the risk of investing effectively while educating the users.	?
Perceived Control	Metrics	As an investor, I want to know where my money is going.	As an investor, I can visualize what happens with the money.
Perceived Control	Metrics	ESG can't be trusted. ESG-reporting alone is not a sufficient metric to prove sustainability of a company.	ESG needs to be accompanied by other metrics.
Subjective Norms	Governance	As a consumer or investor, I can't trust the people running the company.	Show company board membership in the app product view.

## 13.2 Research Limitations

First, this work is focused on integrating sustainability into user experience design and does attempt to make a contribution to economics, finance, or any related technical field - in the context of this work, these fields are sources of inspiration for design.

Second, finance is a highly regulated industry and the proposed user experience designs may be limited by legal requirements. This study does not take such limitations into account, rather focusing only on the user experience.

Third, up to date ESG data is expensive and thus couldn't directly be used in this research. ESG needs data to give us an accurate understanding of the realities inside companies and the user experience design does not address the underlying data quality problem further than by providing a link to the data source.

Fourth, I don't have access to users' financial data, which would be useful for design research.

### **13.3 Future Research**

Some ideas for fruitful research directions:

- Perceptions of pollution levels among Taiwanese college students.
- Does the specialized interface for AI offer any advantages of a general-purpose UIs such as ChatGPT, Claude, Gemini, Mistral, and others?
- While many people are working on AI models, there's a lack of people working on Human-AI interaction in the context of sustainability.

If you do decide to pursue any of these questions or were otherwise inspired by my thesis, please do reach out. As I have interest in these areas of research, I would happy to help in any way I can. Thank you.

## 14 CONCLUSION

A survey of over 900 students from over 48 universities across Taiwan (21 of which I personally visited to hand out flyers for my survey and get a sense of the students' daily context), confirms that Gen Z college students do care about environmental damage, yet they are held back by scattered information and a lack of practical tools. As an interaction design student, I began my research by trying to understand my potential users' mental model. If my design system meets that model, change becomes possible.

According to the *Theory of Planned Behavior*, **attitudes**, **subjective norms**, and **perceived behavioral control**, drive intentions and behavior. My findings align with these constructs and inform how Green Filter supports them. My prototype "*Green Filter*" app introduced here is an AI companion that translates raw environmental and financial data into plain language, revealing facts like the ESG record and CO<sub>2</sub> eq emission of a product, the materials used, the factory where it came from, etc. It aims to nudge users toward greener shopping, treating purchases as a type of investing – i.e., "Shopping-as-Investing". In-person prototype testing with 32 students across 7 campuses uncovered everyday hurdles still matter: slow Wi-Fi, aging laptops, and dying batteries, all became challenges, stopping the users from achieving their goals. Yet, these problems are a reminder to design a lighter, mobile, more resilient version of the app, thereby increasing **perceived control**.

Nonetheless, the prototype helped students imagine how everyday spending could become a form of financial activism, shifting budgets toward green products, and pressuring companies to share honest ESG numbers. Giving young adults a convenient digital ally equips them to fold sustainability into daily life, empowers them to advocate for stronger legislation (**subjective norms**), and pushes both markets and policymakers toward greater transparency, accountability, and a healthier Earth. A comprehensive literature review in the interconnected economic behavior and ecological sustainability underscores the critical role that financial decisions play in impacting the planet's health. Literature shows that for high ESG performance, Governance, Board Diversity, Board Experts on Climate, and Fintech Adoption (Digitalization) matter. These are the main predictors of high ESG performance and should be highlighted to the users who wish to buy sustainable products.

### 14.1 RQ1: What Design Considerations Should Be Addressed When Designing an AI Companion for College Students Integrating Sustainability and Finance?

The goal of this question was to give the widest understanding, mapping out the design space: transparency, sustainability, accessibility, data ethics, integration with campus tools, cultural tone, etc. The deliverable is a set of "design commandments" that every future sprint has to respect.

*Data From Literature Review, User Survey, Expert Interviews, and User Testing the Prototype.*

Design Principle	Design Implications	Actionable Design Advice	TPB
<i>Design for Visibility &amp; Simplicity</i>	<p>Testers often overlooked the AI analysis feature, thinking it was part of the website, not a 3rd party service.</p> <p>The interface must make key actions obvious. Use prominent announcements to announce new features (e.g., a pop-up tour highlighting what's new). Minimize extra clicks: as one expert (Huang) noted, "people are lazy... if it's easier to get the information that I don't have to click a button, I will pay attention".</p> <p>In short, design a streamlined UI with clear one-step interactions and in-context prompts, thereby strengthening positive <b>attitudes</b>.</p>	<p>Make key actions obvious, use pop-up tours, cut extra clicks; boosts positive feelings toward using the tool.</p>	Attitude
<i>Design for Intuitive Visuals &amp; Feedback</i>	<p>Replace dense text with clear graphics and simple ratings. Huang observed that users tune out long reports but immediately grasp an icon or "eco score" (e.g., a polar bear or 0–100 scale).</p> <p>Similarly, testers noticed numeric eco-scores more than textual features. Thus, represent sustainability metrics as concise visuals or scores, with brief tooltips explaining meaning to bolster <b>attitudes</b>.</p>	<p>Replace dense text with icons and scores; quick comprehension lifts perceived value.</p>	Attitude
<i>Design for Engaging Tone &amp; Fun Elements</i>	<p>Use approachable language and interactive cues. Experts advised avoiding jargon: e.g., change button text from "Continue discussion" to a playful prompt to spark curiosity and intrigue user interest.</p> <p>Gamification (e.g., progress bars, "unlocking" sustainable tips) may sustain engagement, given users' limited patience for lengthy explanations.</p>	<p>Gamified language and progress bars spark curiosity and enjoyment.</p>	Attitude

Design Principle	Design Implications	Actionable Design Advice	TPB
<i>Design for Trust and Transparency</i>	<p>Students expressed moderate trust in AI (survey results show many neutral-to-skeptical responses). To build credibility, the companion must cite verifiable data (certifications, carbon labels, etc.) rather than vague claims. For example, testers distrusted offsetting alone (“I still feel like I’m not really doing it right” when just buying carbon credits), so the app should provide concrete evidence of impact. Avoid taking ESG scores at face value – include context (e.g., B Corp or supply-chain data) to align with <b>perceived behavioral control</b> over accurate information.</p>	Cite verifiable data and give context, so students feel info is credible and actionable.	Perceived Behavioral Control
<i>Design Mobile-First</i>	<p>For technical reasons the prototype testing was done using laptop computers (Apple does not allow adding 3rd party overlays on iOS apps the same way Google allows with Chrome Browser Extensions).</p> <p>However, given 96% of students use smartphones (majority iOS), mobile-first is a must, even given all the technical limitations. The design should favor a mobile app or browser extension that integrates with their existing shopping/payment tools.</p> <p>Survey clustering suggests leveraging daily habits (shopping/savings apps) as entry points. Ensure compatibility (notably, iOS imposes browser restrictions) and consider platform-specific design (e.g., integrating with Momo app interface as envisioned). Shopee was consistently mentioned by testers and could serve for the next round of testing instead of Momo.</p>	Meet students on their primary device and integrate with familiar apps, reducing friction.	Perceived Behavioral Control

## **14.2 RQ2: How can AI Companions Support College Students with Sustainability Knowledge in the Context of Financial Decisions?**

The goal of this question was to zoom into *how* the green filter app moves the needle on sustainability when money is on the line: when does the AI surface eco-facts, what modes (chat, visual score) stick, what UI patterns are effective?

***Data From Literature Review, User Survey, Expert Interviews, and User Testing the Prototype.***

Feature	Design Implications	Actionable Design Advice	TPB
Contextualized Information at Point-of-Decision	Embed sustainability data into shopping and investment flows. In prototype testing, participants valued seeing hidden product info (ingredients, manufacturing “history”) that they normally don’t encounter. For example, revealing that a facial mask contained problematic chemicals led a student to switch to an aloe-based alternative. This suggests the AI should surface concise ecological/health facts (e.g. “contains X chemical linked to...”) whenever users view a product. Similarly, in the investment context the AI showed company ESG scores and stock info. Users reacted positively: one noted, “Buying things is also an investment... I can help you analyze if the money spent is good or bad”. Thus, frame purchases as “investments” in sustainable companies to link finance and ecology.	Surface hidden ingredients, ESG scores, frame purchases as “investments”.	Attitude and Perceived Behavioral Control

Feature	Design Implications	Actionable Design Advice	TPB
Sustainable Alternatives and Comparisons	<p>Provide actionable recommendations. Testers frequently clicked a “Find Alternatives” feature, and Cathy Wang confirms that students want alerts on “the most dangerous products” to avoid. Accordingly, the companion should automatically flag high-impact products in the user’s list and suggest greener options or categories. In finance mode, it should compare companies’ performance (e.g. “Company X is high-ESG, Company Y is not”) so students can weigh investment choices. Survey data underscores this: roughly one-third of respondents want pre-investment checks of company eco-credentials (31% for certifications, 26% for consumer reviews) and comparisons (26%) of environmental performance. The AI can fulfill these by summarizing third-party eco-reports or consumer sentiments on companies.</p>	Auto-flag high-impact items and show greener options or stock comparisons.	Perceived Behavioral Control
Personal Sustainability Dashboard	<p>Many students expressed interest in tracking their own impact (25% wanted a monthly “eco-score” of spending). Building on this, the app can maintain a simple personal report (e.g. “Your spending this month saved X kg CO<sub>2</sub>” or “you’re now 20% greener”). This aligns with providing “carbon score” feedback that testers noticed. The dashboard should be succinct, using visuals (progress bars, infographics) rather than verbose text, so students quickly grasp progress (Huang’s scale idea).</p>	Monthly eco-score and progress visuals reinforce learning and self-efficacy.	Attitude and Perceived Behavioral Control

Feature	Design Implications	Actionable Design Advice	TPB
Educational Nudges & Explanations	<p>Use the AI chat (or chat-like prompts) to elaborate on sustainability concepts as needed. Although few testers clicked the “Chat with AI” button during prototyping, it can serve as a fallback for curious users. For example, when a student sees a product’s green score, they could ask “Why?” and the AI could briefly explain (“This brand was rated low because it uses high-carbon packaging”, sort of like in the earliest prototype). Encouraging exploration without overwhelming users aligns with Audrey Tang’s insight that youth are eager to engage but need clear, relatable contexts (e.g. connecting a bubble-tea straw ban to personal habits). Overall, the AI should act as an informed guide: contextualizing data, answering “what-if” questions, and helping students internalize how their financial choices affect sustainability.</p>	<p>Chat prompts explain the “why” behind scores, linking knowledge to choices.</p>	Attitude

### 14.3 RQ3: What AI Companion Features do College Students Prioritize as the Highest Importance?

The goal of this question was to directly understand the users’ voice: a list of features that the users would crave.

*Data From User Survey, Expert Interviews, and User Testing the Prototype.*

Feature	Design Implications	Why Students Want It?	TPB
<b>(1) Eco-Impact Product Filters</b>	<p>The highest-priority feature is product-level sustainability comparison. In the survey, 63% of students wanted to “see which products are most polluting so I can avoid them,” far above other categories. This aligns with testing observations: Wang notes “the main feature...was to avoid the most...dangerous products” via an alert on the shopping list. Accordingly, the companion should prominently offer “sustainability filters” (e.g. sort products by carbon footprint or toxin content) and alternative suggestions, just as users clicked the “Find Alternatives” button in our prototype.</p>	Lets them avoid polluting products quickly, aligning with personal values.	Perceived Behavioral Control
<b>(2) Supply Chain Transparency</b>	<p>Other top features relate to sourcing. About 41% of respondents want to check product origin (e.g. local vs. imported) and 40% want to know how eco-friendly the production process is. Designing a simple icon or tag for “local” or “certified eco-friendly factory” (as Chen-Ying Huang recommends using recognizable symbols) would meet these needs. Similarly, one-third favored an “organic” product search. The prototype’s green-colored “Analysis” tab (showing carbon emissions by product type) was also used by testers, indicating interest in seeing how choices impact emissions cumulatively.</p>	Origin tags and factory eco-labels give socially accepted proof of ethics.	Subjective Norm and Perceived Behavioral Control

Feature	Design Implications	Why Students Want It?	TPB
<b>(3) Personal Eco-Score and History</b>	A quarter of students (25%) expressed interest in a monthly report of their own eco-score. In testing, participants took screenshots of the carbon-reduction analysis, suggesting value in recording progress. We should include a lightweight “eco-dashboard” feature: an overview of past decisions, scores, and tips. Crucially, it must be eye-catching and concise (e.g. a single visual per month) so students will actually review it.	Visible progress boosts motivation and perceived capability.	Attitude and Perceived Behavioral Control
<b>(4) Sustainable Investing</b>	Roughly 26–32% of respondents wanted to see company eco-scores, certifications, or performance comparisons before investing. Testers saw company ESG ratings and stock info (they asked “what is this company’s stock code?”) and even got recommendations for similar sustainable companies. Thus, the feature set should include an investment tab with clear “sustainability ratings” for companies alongside stock data, and suggestions of alternative stocks aligned with the student’s values.	Company eco-scores inform responsible investment, meeting peer expectations.	Subjective Norm and Perceived Behavioral Control
<b>(5) Lower-Priority Features</b>	Given the high usage of social media in Taiwan, I was surprised community-related and social features ranked low in the survey. Only around 12% of the respondents wanted social networking with eco-peers, and indeed testers rarely engaged even with the AI’s chat option to ask more questions. These findings suggest focusing development effort on concrete decision aids (filtering, scoring, recommendations) rather than social networking or open-ended chat.	Ranked low, so less impact on key TPB levers for now.	(n/a)

## 14.4 Final Takeaway

By building the Green Filter prototype, combining Digital Product Passports (DPPs) with data-driven interaction design, large-language models, and AI agents that translate complex data into plain language, tracking data across the entire product lifecycle (source materials → purchase → recycling), injecting transparency into otherwise opaque supply chains, I have demonstrated the potential of software to close the *attitude-behavior gap*, making it obvious which products are truly circular and which are just greenwashing.

In my research, I have integrated quantitative survey trends with qualitative insights from testing and interviews. For instance, strong survey interest in product comparisons (63%) is consistent with testers clicking the “*Find Alternatives*” feature and the experts (Huang, Wang) emphasizing clear eco-indicators. By aligning the AI companion’s design closely with the above patterns: favoring concise visual info, high discoverability of features, and actionable eco-insights, I can better meet student needs, providing sustainable financial decision support exactly at the right context and the right time.

By mapping my findings onto the *Theory of Planned Behavior*, I have ensured that the Green Filter app strengthens **attitudes**, leverages **subjective norms**, and enhances **perceived behavioral control**, paving the way for sustainable financial actions among Gen Z students. With the right tools at hand, college students can demand for increased ESG accessibility (a higher baseline for sustainability). For college students, influencing business governance is the main point of leverage; in essence, Governance → Social → Environment.

## 15 REFERENCES

- « Fast fashion » : « L'ère de l'impunité des grands groupes semble révolue ». (2023).
- 2022 年空、水☒裁罰金榜首 中油、工業局連莊. (2023).
- Aaron O'Neill. (2023). *Global GDP 1985-2028*.
- Abigail Cain. (2017). *The Life and Death of Microsoft Clippy, the Paper Clip the World Loved to Hate*.
- Abnett, K. & Abnett, K. (2024). United States asks EU to delay deforestation law, letter shows. *Reuters*.
- About Ethical Consumer | Ethical Consumer*. (2018).
- Abu El Kheir-Mataria, W. & Chun, S. (2025). Climate change and women's cancer in the MENA region: Assessing temperature-related health impacts. *Frontiers in Public Health*, 13, 1529706. <https://doi.org/10.3389/fpubh.2025.1529706>
- Acemoglu, D. (2024). *The Simple Macroeconomics of AI*.
- Acuti, D., Lemarié, L. & Viglia, G. (2023). How to enhance the sustainable disposal of harmful products. *Technological Forecasting and Social Change*, 186, 122151. <https://doi.org/10.1016/j.techfore.2022.122151>
- Ada, E., Kazancoglu, Y., Gozacan-Chase, N. & Altin, O. (2023). Challenges for Circular Food Packaging: Circular Resources Utilization. *Applied Food Research*, 100310. <https://doi.org/10.1016/j.afres.2023.100310>
- Adam Corner. (2012). Why we need to move forward on carbon labelling. *The Guardian*.
- Adamkiewicz, J., Kochańska, E., Adamkiewicz, I. & Łukasik, R. M. (2022). Greenwashing and sustainable fashion industry. *Current Opinion in Green and Sustainable Chemistry*, 38, 100710. <https://doi.org/10.1016/j.cogsc.2022.100710>
- AFP. (2023). *S. Korea President Vows 'Complete Overhaul' Of Approach To Extreme Weather | Barron's*.
- Agnew, H. (2022). RIP ESG? *Financial Times*.
- AI for Good. (2023). *Listening to Nature: Harnessing AI and Acoustics for Biodiversity Conservation*.
- AI Frontiers. (2018). *Ilya Sutskever at AI Frontiers 2018: Recent Advances in Deep Learning and AI from OpenAI*.
- Aidin Ardjomandi. (2025). The role of narrative and storytelling in designing for long-term emotional engagement in product design. *International Journal of Science and Research Archive*, 15(1), 1647–1655. <https://doi.org/10.30574/ijsra.2025.15.1.1233>
- Aikman, D. (2022). *ESG DAO is out of stealth: We're on a mission to re-think ESG ratings and accelerate ReFi*.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Al Jazeera. (2023). *Death toll from S Korea rains hits 39; Yoon orders all-out effort*.
- Alammar, J. (2018). *The Illustrated Transformer*.
- Alana Semuels. (2024). *World's Most Sustainable Companies of 2024*.
- Alba, D. (2017). Etsy Needs to Preserve Its Values to Preserve Its Value. *WIRED*.
- Alethea AI. (2021). *Alethea AI - AI Personality Creative Writing Class*.

- Alex Reice. (2021). *The most eco-conscious generation? Gen Z's fashion fixation suggests otherwise.*
- Alex Tamkin & Deep Ganguli. (2021). *How Large Language Models Will Transform Science, Society, and AI.*
- Allport, G. W. (1979). *The nature of prejudice* (Unabridged, 25th anniversary ed). Addison-Wesley Pub. Co.
- Almond, R.E.A., Grooten, M., Juffe Bignoli, D. & Petersen & T. (Eds). (2022). *Living Planet Report 2022 – Building a Naturepositive Society*. WWF (World Wide Fund for Nature).
- AltFi. (2017). *ETFmatic app downloaded 100,000 times.*
- AltFi. (2021). *Belgium's Aion Bank has acquired London robo-advisor ETFmatic.*
- Altman, S. (2024). *The Intelligence Age.*
- Alvarez, B. (2021). *Generate Chatbot training data with QBox — powered by Microsoft Turing NLG.*
- Alzoubi, Y. I. & Mishra, A. (2023). Green blockchain – A move towards sustainability. *Journal of Cleaner Production*, 430, 139541. <https://doi.org/10.1016/j.jclepro.2023.139541>
- Amenc, N., Goltz, F. & Naly, A. (2023). *Green Dilution: How ESG Scores Conflict with Climate Investing*. Scientific Beta.
- American Press Institute. (2022). *Knowing the news: How Gen Z and Millennials get information on essential topics.*
- Amershi, S., Weld, D., Vorvoreanu, M., Journey, A., Nushi, B., Collisson, P., Suh, J., Iqbal, S., Bennett, P., Inkpen, K., Teevan, J., Kikin-Gil, R. & Horvitz, E. (2019, May). Guidelines for human-AI interaction. *CHI 2019*.
- Amin, S., Jamasb, T., Llorca, M., Marsiliani, L. & Renström, T. I. (2022). Decarbonisation policies and energy price reforms in Bangladesh. *Energy Policy*, 170, 113224. <https://doi.org/10.1016/j.enpol.2022.113224>
- AMINA Bank AG. (2023). *SEBA Bank rebrands to AMINA Bank and continues to write its success story.*
- Amoroso, R. O., Pitcher, C. R., Rijnsdorp, A. D., McConaughey, R. A., Parma, A. M., Suuronen, P., Eigaard, O. R., Bastardie, F., Hintzen, N. T., Althaus, F., Baird, S. J., Black, J., Buhl-Mortensen, L., Campbell, A. B., Catarino, R., Collie, J., Cowan, J. H., Durholtz, D., Engstrom, N., ... Jennings, S. (2018). Bottom trawl fishing footprints on the world's continental shelves. *Proceedings of the National Academy of Sciences*, 115(43). <https://doi.org/10.1073/pnas.1802379115>
- Anand Chandrasekhar & Andreas Gefe. (2021). *Why Switzerland matters for the tropical forests.*
- Anderljung, M., Barnhart, J., Korinek, A., Leung, J., O'Keefe, C., Whittlestone, J., Avin, S., Brundage, M., Bullock, J., Cass-Beggs, D., Chang, B., Collins, T., Fist, T., Hadfield, G., Hayes, A., Ho, L., Hooker, S., Horvitz, E., Kolt, N., ... Wolf, K. (2023). *Frontier AI Regulation: Managing Emerging Risks to Public Safety*. <https://doi.org/10.48550/ARXIV.2307.03718>
- Anderson, T. R., Hawkins, E. & Jones, P. D. (2016). CO<sub>2</sub>, the greenhouse effect and global warming: From the pioneering work of Arrhenius and Callendar to today's Earth System Models. *Endeavour*, 40(3), 178–187. <https://doi.org/10.1016/j.endeavour.2016.07.002>
- Andraszewicz, S., Kaszás, D., Zeisberger, S. & Hölscher, C. (2023). The influence of upward

- social comparison on retail trading behaviour. *Scientific Reports*, 13(1), 22713. <https://doi.org/10.1038/s41598-023-49648-3>
- André, F. J. & Valenciano-Salazar, J. A. (2022). Voluntary carbon neutral programs. Adoption and firms' strategies. *Journal of Cleaner Production*, 135191. <https://doi.org/10.1016/j.jclepro.2022.135191>
- Andrés Engler. (2022). *Berkshire Hathaway Invests \$1B in Brazilian Digital Bank Nubank, Reduces Mastercard, Visa Positions*.
- Anguiano, D. (2023). Hawaii wildfires: How did the deadly Maui fire start and what caused it? *The Guardian*.
- Anielski, M. (2001). *Measuring the Sustainability of Nations: The Genuine Progress Indicator System of Sustainable Well Being Accounts*.
- Anna J. Park. (2023). *Naver Pay to expand as comprehensive financial platform beyond simple payment service - The Korea Times*.
- Anna Watson. (2022). *Carbon dioxide removal solutions*.
- Anna Watson. (2023). *Carbon credit retirements explained | Climate Action*.
- Anthony Leiserowitz, Jennifer Carman, Nicole Buttermore, Liz Neyens, Seth Rosenthal, Jennifer Marlon, J.W. Schneider & Kelsey Mulcahy. (2022). *International Public Opinion on Climate Change 2022*. Yale Program on Climate Change Communication.
- Anthropic. (2023). *Anthropic's Responsible Scaling Policy*.
- Anthropic. (2024a). *Claude's Character*.
- Anthropic. (2024b). *What should an AI's personality be?*
- Anthropocene Fixed Income Institute (AFII). (2022). *AFII Aramco replacement*.
- Anti-ESG Crusade in US Sweeps 15 States With More Laws in Works. (2023).
- Anton Korinek. (2023). *Scenario Planning for an AGI Future*.
- Antonides, G. & Welvaarts, M. (2020). Effects of Default Option and Lateral Presentation on Consumer Choice of the Sustainable Option in an Online Choice Task. *Sustainability*, 12(13), 5484. <https://doi.org/10.3390/su12135484>
- Apple. (2022a). *Empowering people to live a healthier day*.
- Apple. (2022b). *How Apple is empowering people with their health information*.
- Apple. (2022c). *What's new in HealthKit*.
- Appleton, M. (2023). *Language Model Sketchbook, or Why I Hate Chatbots*.
- Araújo, I. F. D., Jackson, R. W., Ferreira Neto, A. B. & Perobelli, F. S. (2020). European union membership and CO<sub>2</sub> emissions: A structural decomposition analysis. *Structural Change and Economic Dynamics*, 55, 190–203. <https://doi.org/10.1016/j.strueco.2020.06.006>
- Arctic doomsday seed vault gets more than 14,000 new samples. (2025). *Reuters*.
- Armstrong, K. & Staff, A. P. S. (2021). Cultivating Cultures of Sustainability. *APS Observer*, 34.
- Armstrong McKay, D. I., Staal, A., Abrams, J. F., Winkelmann, R., Sakschewski, B., Loriani, S., Fetzer, I., Cornell, S. E., Rockström, J. & Lenton, T. M. (2022b). Exceeding 1.5°C global warming could trigger multiple climate tipping points. *Science*, 377(6611), eabn7950. <https://doi.org/10.1126/science.abn7950>
- Armstrong McKay, D. I., Staal, A., Abrams, J. F., Winkelmann, R., Sakschewski, B., Loriani, S., Fetzer, I., Cornell, S. E., Rockström, J. & Lenton, T. M. (2022a). Exceeding 1.5°C global

- warming could trigger multiple climate tipping points. *Science*, 377(6611), eabn7950. <https://doi.org/10.1126/science.abn7950>
- Arranz, C. F. A., Sena, V. & Kwong, C. (2022). Institutional pressures as drivers of circular economy in firms: A machine learning approach. *Journal of Cleaner Production*, 355, 131738. <https://doi.org/10.1016/j.jclepro.2022.131738>
- As You Sow. (2024a). *Fossil Free Funds*.
- As You Sow. (2024b). *Home - Invest Your Values*.
- Aschenbrenner, L. (2024). *SITUATIONAL AWARENESS: The Decade Ahead*.
- Asdal, Å. & Guarino, L. (2018). The Svalbard Global Seed Vault: 10 Years—1 Million Samples. *Biopreservation and Biobanking*, 16(5), 391–392. <https://doi.org/10.1089/bio.2018.0025>
- Ashraf, M. & Heavey, C. (2023). A Prototype of Supply Chain Traceability using Solana as blockchain and IoT. *Procedia Computer Science*, 217, 948–959. <https://doi.org/10.1016/j.procs.2022.12.292>
- Asia Cement Corporation. (2023). *亞洲水泥股份有限公司 2023 年永續摘要報告*.
- Asioli, D., Fuentes-Pila, J., Alarcón, S., Han, J., Liu, J., Hocquette, J.-F. & Nayga, R. M. (2022). Consumers' valuation of cultured beef Burger: A Multi-Country investigation using choice experiments. *Food Policy*, 112, 102376. <https://doi.org/10.1016/j.foodpol.2022.102376>
- Atal, M. R., Riach, K., Smith, C. & McMaster, R. (2024). Adam Smith: His continuing relevance for contemporary management thought. *European Management Journal*, 42(1), 4–10. <https://doi.org/10.1016/j.emj.2024.01.005>
- Attanasio, O. P. (2015). Frank Ramsey's a Mathematical Theory of Saving. *The Economic Journal*, 125(583), 269–294. <https://doi.org/10.1111/eco.12229>
- Aubrey Streit Krug & Yin Lu. (2023). *Pathways to a Perennial Food Future*.
- Austin Ryder. (2020). *How to Become an Investor Instead of a Consumer*.
- Australian Government. (2024). *Product stewardship in Australia*.
- Australian Government Department of Finance. (2025). *Sustainable procurement*.
- AWS. (2022). *SageMaker Studio Lab*.
- Ayers, J. W., Poliak, A., Dredze, M., Leas, E. C., Zhu, Z., Kelley, J. B., Faix, D. J., Goodman, A. M., Longhurst, C. A., Hogarth, M. & Smith, D. M. (2023). Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum. *JAMA Internal Medicine*, 183(6), 589. <https://doi.org/10.1001/jamainternmed.2023.1838>
- B Corp. (2025). *Find a B Corp*.
- Babich, N. (2019). *Interaction Design vs UX: What's the Difference?*
- Bai, Y., Kadavath, S., Kundu, S., Askell, A., Kernion, J., Jones, A., Chen, A., Goldie, A., Mirhosseini, A., McKinnon, C., Chen, C., Olsson, C., Olah, C., Hernandez, D., Drain, D., Ganguli, D., Li, D., Tran-Johnson, E., Perez, E., ... Kaplan, J. (2022). *Constitutional AI: Harmlessness from AI Feedback*. <https://doi.org/10.48550/ARXIV.2212.08073>
- Bailey, J. (2023). *AI in Education*.
- Bailey, J. L. & Eggereide, S. S. (2020). Mapping actors and arguments in the Norwegian aquaculture debate. *Marine Policy*, 115, 103898. <https://doi.org/10.1016/j.marpol.2020.103898>
- Bajarin, T. (2022). *PC Sales Are Off 12% In 2022 - When Can We Expect Them To Grow Again?*
- Baldi, F. & Pandimiglio, A. (2022). The role of ESG scoring and greenwashing risk in explaining

- the yields of green bonds: A conceptual framework and an econometric analysis. *Global Finance Journal*, 52, 100711. <https://doi.org/10.1016/j.gfj.2022.100711>
- Baltic Sea Action Group. (2023). *EIT Food Regenerative Agriculture Revolution project Q&A panel*.
- Banham, R. (1999). *The architecture of the well-tempered environment* (2. ed., repr). University of Chicago Press [u.a].
- Bankinghub. (2019). *Robo advisor – new standards in asset management*.
- BankMyCell. (2022). *How Many People Have Smartphones Worldwide*.
- Baptista, E., Zhu, J., Potkin, F. & Zhu, J. (2025). DeepSeek rushes to launch new AI model as China goes all in. *Reuters*.
- Barbara Friedberg. (2021). *MI Finance vs Betterment Robo Advisor Comparison-by Investment Expert*.
- Bardhan, A. (2022). *Men Are Creating AI Girlfriends and Then Verbally Abusing Them*.
- Barendregt, L. & Vaage, N. S. (2021). Speculative design as thought experiment. *She Ji: The Journal of Design, Economics, and Innovation*, 7(3), 374–402. <https://doi.org/10.1016/j.sheji.2021.06.001>
- Baron, M. (2023). *Lessons on building a viral consumer app: The story of Saturn*.
- Baroness Jones of Moulsecoomb & Caroline Lucas. (2023). *Clean Air (Human Rights) Bill [House of Lords]*.
- Barrett, B. (2019). McDonald's Acquires Machine-Learning Startup Dynamic Yield for \$300 Million. *Wired*.
- Bassani, F., Rodrigues, C. & Freire, F. (2024). Life cycle assessment of pharmaceutical packaging addressing end-of-life alternatives. *Waste Management*, 175, 1–11. <https://doi.org/10.1016/j.wasman.2023.12.022>
- Bassani, F., Rodrigues, C., Marques, P. & Freire, F. (2022). Ecodesign approach for pharmaceutical packaging based on Life Cycle Assessment. *Science of The Total Environment*, 816, 151565. <https://doi.org/10.1016/j.scitotenv.2021.151565>
- Bassett, C. (2019). The computational therapeutic: Exploring Weizenbaum's ELIZA as a history of the present. *AI & SOCIETY*, 34(4), 803–812. <https://doi.org/10.1007/s00146-018-0825-9>
- Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C. M. & Crowther, T. W. (2019). The global tree restoration potential. *Science*, 365(6448), 76–79. <https://doi.org/10.1126/science.aax0848>
- Battistoni, P., Di Gregorio, M., Romano, M., Sebillo, M. & Vitiello, G. (2023). Can AI-Oriented Requirements Enhance Human-Centered Design of Intelligent Interactive Systems? Results from a Workshop with Young HCI Designers. *Multimodal Technologies and Interaction*, 7(3), 24. <https://doi.org/10.3390/mti7030024>
- Baytaş, M. A. (2020). *3 Kinds of Design Research: Research for / into / through Design*.
- Bedtimestory.ai. (2023). *AI Powered Story Creator | Bedtimestory.ai*.
- Beer, M. (2024). *Wind and Solar Overtake Fossil Fuels in “Historic Shift” for EU*.
- Belonenko, T. V., Sandalyuk, N. V. & Gnevyshev, V. G. (2023). Interaction of Rossby waves with the Gulf Stream and Kuroshio using altimetry in a framework of a vortex layer model. *Advances in Space Research*, 71(5), 2384–2393. <https://doi.org/10.1016/j.asr.2022.10.042>
- Ben Martin. (2017). *World's largest wealth fund ditches coal*.

- Benjamin Cassidy. (2022). The Twisted Life of Clippy. *Seattle Met*.
- Bennati, S. & Pournaras, E. (2018). Privacy-enhancing aggregation of Internet of Things data via sensors grouping. *Sustainable Cities and Society*, 39, 387–400. <https://doi.org/10.1016/j.scs.2018.02.013>
- Benyus, J. M. (2009). *Biomimicry: Innovation inspired by nature* (Nachdr.). Perennial.
- Berger, K., Baumgartner, R. J., Weinzerl, M., Bachler, J., Preston, K. & Schögl, J.-P. (2023). Data requirements and availabilities for a digital battery passport – A value chain actor perspective. *Cleaner Production Letters*, 4, 100032. <https://doi.org/10.1016/j.clpl.2023.100032>
- Berger, K., Baumgartner, R. J., Weinzerl, M., Bachler, J. & Schögl, J.-P. (2023). Factors of digital product passport adoption to enable circular information flows along the battery value chain. *Procedia CIRP*, 116, 528–533. <https://doi.org/10.1016/j.procir.2023.02.089>
- Berger, K., Rusch, M., Pohlmann, A., Popowicz, M., Geiger, B. C., Gursch, H., Schögl, J.-P. & Baumgartner, R. J. (2023). Confidentiality-preserving data exchange to enable sustainable product management via digital product passports - a conceptualization. *Procedia CIRP*, 116, 354–359. <https://doi.org/10.1016/j.procir.2023.02.060>
- Berglund, T., Gericke, N., Boeve-de Pauw, J., Olsson, D. & Chang, T.-C. (2020). A cross-cultural comparative study of sustainability consciousness between students in Taiwan and Sweden. *Environment, Development and Sustainability*, 22(7), 6287–6313. <https://doi.org/10.1007/s10668-019-00478-2>
- Better Cotton. (2023). *Better Cotton Annual Report*.
- BeZero. (2022a). *Focus on Ratings*.
- BeZero. (2022b). *Scaling Carbon Markets*.
- BGMEA | Home. (n.d.).
- Bhatia, A., Chandani, A. & Chhateja, J. (2020). Robo advisory and its potential in addressing the behavioral biases of investors — A qualitative study in Indian context. *Journal of Behavioral and Experimental Finance*, 25, 100281. <https://doi.org/10.1016/j.jbef.2020.100281>
- Bill Gates. (1982). *Bill Gates on the Next 40 Years in Technology*.
- Bindman, P., Mendonca, E. & Mendonca, P. B. and E. (2024). *ESG funds funnel millions to meat company linked to deforestation*.
- Bingler, J. A., Kraus, M. & Leippold, M. (2021). Cheap Talk and Cherry-Picking: What ClimateBert has to say on Corporate Climate Risk Disclosures. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3796152>
- Biyo, H. (2025). *Global ESG Funds Suffer Outflows in Q1 2025 Amid Intensifying ESG Backlash*.
- BlackRock. (2022). *ESG investing in hedge funds*.
- Bleys, B. & Whitby, A. (2015). Barriers and opportunities for alternative measures of economic welfare. *Ecological Economics*, 117, 162–172. <https://doi.org/10.1016/j.ecolecon.2015.06.021>
- Blockchain Companies Team Up To Track ESG Data*. (2021).
- BlockChannel. (2017). *What Is A “DAO”? How Do They Benefit Consumers?*
- Blockworks. (2023a). *Bitcoin Price (BTC), Market Cap, Price Today & Chart History*.
- Blockworks. (2023b). *Ethereum Price (ETH), Market Cap, Price Today & Chart History*.
- Bolognesi, E., Dreassi, A., Migliavacca, M. & Paltrinieri, A. (2024). Mapping sustainable in-

- vesting: Exploring ambiguities and consistencies among sustainable indices. *Journal of Environmental Management*, 367, 122081. <https://doi.org/10.1016/j.jenvman.2024.122081>
- Bolt. (2025). *Seville is modernising public transport with help from Bolt*.
- Bommasani, R., Hudson, D. A., Adeli, E., Altman, R., Arora, S., von Arx, S., Bernstein, M. S., Bohg, J., Bosselut, A., Brunskill, E., Brynjolfsson, E., Buch, S., Card, D., Castellon, R., Chatterji, N., Chen, A., Creel, K., Davis, J. Q., Demszky, D., ... Liang, P. (2021). *On the Opportunities and Risks of Foundation Models*. <https://doi.org/10.48550/ARXIV.2108.07258>
- Bonasia, C. (2024). *Wind and solar energy surge past fossil fuels for first time in Europe*.
- Bonet-Jover, A., Sepúlveda-Torres, R., Saquete, E. & Martínez-Barco, P. (2023). A semi-automatic annotation methodology that combines Summarization and Human-In-The-Loop to create disinformation detection resources. *Knowledge-Based Systems*, 275, 110723. <https://doi.org/10.1016/j.knosys.2023.110723>
- Booth, M. S. (2022). *Burning up the carbon sink: How the EU's forest biomass policy undermines climate mitigation, and how it can be reformed*. Partnership for Policy Integrity.
- Borges, M. de A., Filho, G. L. de S., da Silva, C. I., Barros, A. M. P., Britto, R. V. B. J., Junior, N. M. de C. & de Souza, D. F. L. (2022). *Standing Forest Coin (SFC)*. <https://doi.org/10.48550/ARXIV.2203.12600>
- Boronowsky, R. D., Zhang, A. W., Stecher, C., Presley, K., Mathur, M. B., Cleveland, D. A., Garnett, E., Wharton, C., Brown, D., Meier, A., Wang, M., Braverman, I. & Jay, J. A. (2022). Plant-based default nudges effectively increase the sustainability of catered meals on college campuses: Three randomized controlled trials. *Frontiers in Sustainable Food Systems*, 6, 1001157. <https://doi.org/10.3389/fsufs.2022.1001157>
- Borreli, S., Ramasamy, R., Wong, R. & Spiby, H. (2023). Care and support during maternity for mothers affected by modern slavery: A scoping review. *International Journal of Nursing Studies Advances*, 5, 100139. <https://doi.org/10.1016/j.ijnsa.2023.100139>
- Borthwick, M., Tomitsch, M. & Gaughwin, M. (2022). From human-centred to life-centred design: Considering environmental and ethical concerns in the design of interactive products. *Journal of Responsible Technology*, 10, 100032. <https://doi.org/10.1016/j.jrt.2022.100032>
- Bouscasse, H., Gabet, S., Kerneis, G., Provent, A., Rieux, C., Ben Salem, N., Dupont, H., Troude, F., Mathy, S. & Slama, R. (2022). Designing local air pollution policies focusing on mobility and heating to avoid a targeted number of pollution-related deaths: Forward and backward approaches combining air pollution modeling, health impact assessment and cost-benefit analysis. *Environment International*, 159, 107030. <https://doi.org/10.1016/j.envint.2021.107030>
- Bousfield, C. G., Massam, M. R., Peres, C. A. & Edwards, D. P. (2022). Carbon payments can cost-effectively improve logging sustainability in the Amazon. *Journal of Environmental Management*, 314, 115094. <https://doi.org/10.1016/j.jenvman.2022.115094>
- Bowler, D. E., Bjorkman, A. D., Dornelas, M., Myers-Smith, I. H., Navarro, L. M., Niamir, A., Supp, S. R., Waldock, C., Winter, M., Vellend, M., Blowes, S. A., Böhning-Gaese, K., Bruelheide, H., Elahi, R., Antão, L. H., Hines, J., Isbell, F., Jones, H. P., Magurran, A. E., ... Bates, A. E. (2020). Mapping human pressures on biodiversity across the planet uncovers anthropogenic threat complexes. *People and Nature*, 2(2), 380–394. <https://doi.org/10.1002/>

pan3.10071

- Bowman, S. R. (2023). *Eight Things to Know about Large Language Models*. <https://doi.org/10.48550/ARXIV.2304.00612>
- Boycotts List | Ethical Consumer*. (2018).
- Boyd, D. S., Jackson, B., Wardlaw, J., Foody, G. M., Marsh, S. & Bales, K. (2018). Slavery from Space: Demonstrating the role for satellite remote sensing to inform evidence-based action related to UN SDG number 8. *ISPRS Journal of Photogrammetry and Remote Sensing*, 142, 380–388. <https://doi.org/10.1016/j.isprsjprs.2018.02.012>
- Bradley, C. G. & Corsini, L. (2023). A literature review and analytical framework of the sustainability of reusable packaging. *Sustainable Production and Consumption*, 37, 126–141. <https://doi.org/10.1016/j.spc.2023.02.009>
- Bradshaw, C. J. A., Ehrlich, P. R., Beattie, A., Ceballos, G., Crist, E., Diamond, J., Dirzo, R., Ehrlich, A. H., Harte, J., Harte, M. E., Pyke, G., Raven, P. H., Ripple, W. J., Saltré, F., Turnbull, C., Wackernagel, M. & Blumstein, D. T. (2021). Underestimating the Challenges of Avoiding a Ghastly Future. *Frontiers in Conservation Science*, 1, 615419. <https://doi.org/10.3389/fcosc.2020.615419>
- Brady Dale. (2021). *Chainlink's Founder Says DeFi and Oracles Can Help Fight Climate Change*.
- Branka Vuleta. (2023). *Generation Z Statistics*.
- Break Free From Plastic. (2024). *2023 Global Brand Audit: The Coca-Cola Company is once again the top global plastic polluter* | Break Free From Plastic.
- Brent A. Anders. (Fall 2022 - Winter 2023). Why ChatGPT is such a big deal for education. *C2C Digital Magazine*, Vol. 1(18).
- Brian Kateman. (2020). *Carbon Labels Are Finally Coming To The Food And Beverage Industry*.
- Broderick, R. (2023). *People are using AI for therapy, whether the tech is ready for it or not*.
- Brohan, P., Allan, R., Freeman, E., Wheeler, D., Wilkinson, C. & Williamson, F. (2012). Constraining the temperature history of the past millennium using early instrumental observations. *Climate of the Past*, 8(5), 1551–1563. <https://doi.org/10.5194/cp-8-1551-2012>
- Brown, A. (2021). *How Financial Chatbots Can Benefit Your Business*.
- Brown, R. (2025). *Colombia's First Unicorn Keeps Delivering*.
- Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Neelakantan, A., Shyam, P., Sastry, G., Askell, A., Agarwal, S., Herbert-Voss, A., Krueger, G., Henighan, T., Child, R., Ramesh, A., Ziegler, D. M., Wu, J., Winter, C., ... Amodei, D. (2020). *Language models are few-shot learners*. <https://arxiv.org/abs/2005.14165>
- Browne, R. (2023). *Britain to host world's first AI safety summit at home of World War II code-breakers*.
- BrusselsDonut. (2022). *Home (EN) - BrusselsDonut*.
- Bubeck, S., Chandrasekaran, V., Eldan, R., Gehrke, J., Horvitz, E., Kamar, E., Lee, P., Lee, Y. T., Li, Y., Lundberg, S., Nori, H., Palangi, H., Ribeiro, M. T. & Zhang, Y. (2023). *Sparks of Artificial General Intelligence: Early experiments with GPT-4*. <https://doi.org/10.48550/ARXIV.2303.12712>
- Bui, T.-D., Tseng, J.-W., Tseng, M.-L., Wu, K.-J. & Lim, M. K. (2023). Municipal solid waste management technological barriers: A hierarchical structure approach in Taiwan. *Resources*,

- Conservation and Recycling*, 190, 106842. <https://doi.org/10.1016/j.resconrec.2022.106842>
- Builders for Climate Action. (2021). *Making Real Zero Carbon Buildings with Carbon Storing Materials (What is Embodied Carbon?)*.
- Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung. (2023). *Lieferkettengesetz*.
- Bunq. (2020). *Bunq*.
- Buoy Health: Check Symptoms & Find the Right Care*. (n.d.).
- Cabitz, F., Campagner, A., Malgieri, G., Natali, C., Schneeberger, D., Stoeger, K. & Holzinger, A. (2023). Quod erat demonstrandum? - Towards a typology of the concept of explanation for the design of explainable AI. *Expert Systems with Applications*, 213, 118888. <https://doi.org/10.1016/j.eswa.2022.118888>
- Cafaro, P., Hansson, P. & Götmark, F. (2022). Overpopulation is a major cause of biodiversity loss and smaller human populations are necessary to preserve what is left. *Biological Conservation*, 272, 109646. <https://doi.org/10.1016/j.biocon.2022.109646>
- Cahan, P. & Treutlein, B. (2023). A conversation with ChatGPT on the role of computational systems biology in stem cell research. *Stem Cell Reports*, 18(1), 1–2. <https://doi.org/10.1016/j.stemcr.2022.12.009>
- Caio Jobim. (2022). 'Bitcoin falhou e criptomoedas vão acabar', diz autor de best-seller sobre futuro do dinheiro.
- Calastone. (2020). *Millennials and investing: A detailed look at approaches and attitudes across the globe*.
- Caldarelli, G., Rossignoli, C. & Zardini, A. (2020). Overcoming the Blockchain Oracle Problem in the Traceability of Non-Fungible Products. *Sustainability*, 12(6), 2391. <https://doi.org/10.3390/su12062391>
- Calisto, F. M., Santiago, C., Nunes, N. & Nascimento, J. C. (2021). Introduction of human-centric AI assistant to aid radiologists for multimodal breast image classification. *International Journal of Human-Computer Studies*, 150, 102607. <https://doi.org/10.1016/j.ijhcs.2021.102607>
- Calisto, F. M., Santiago, C., Nunes, N. & Nascimento, J. C. (2022). BreastScreening-AI: Evaluating medical intelligent agents for human-AI interactions. *Artificial Intelligence in Medicine*, 127, 102285. <https://doi.org/10.1016/j.artmed.2022.102285>
- Calma, J. (2025). *AI could consume more power than Bitcoin by the end of 2025*.
- Campbell-Johnston, K., Calisto Friant, M., Thapa, K., Lakerveld, D. & Vermeulen, W. J. V. (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. *Journal of Cleaner Production*, 270, 122042. <https://doi.org/10.1016/j.jclepro.2020.122042>
- Cao, J., Li, W. & Hasan, I. (2023). The impact of lowering carbon emissions on corporate labour investment: A quasi-natural experiment. *Energy Economics*, 121, 106653. <https://doi.org/10.1016/j.eneco.2023.106653>
- Cao, P. & Liu, S. (2023). The Impact of Artificial Intelligence Technology Stimuli on Sustainable Consumption Behavior: Evidence from Ant Forest Users in China. *Behavioral Sciences*, 13(7), 604. <https://doi.org/10.3390/bs13070604>
- Capgemini. (2022). *A World in Balance – Why sustainability ambition is not translating to*

*action.*

- CapInstitute. (2023). *Getting Real about Artificial Intelligence - Episode 4*.
- Capponi, A., Ólafsson, S. & Zariphopoulou, T. (2019). *Personalized Robo-Advising : An Interactive Investment Process*.
- Caravan Studios. (2022). *Strengthen your worker welfare programme*.
- CarbonChain. (n.d.). *CarbonChain Summer 2024 Product Release*.
- CarbonCredits. (2023). *Live Carbon Prices Today*.
- Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., Narwani, A., Mace, G. M., Tilman, D., Wardle, D. A., Kinzig, A. P., Daily, G. C., Loreau, M., Grace, J. B., Larigauderie, A., Srivastava, D. S. & Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, 486(7401), 59–67. <https://doi.org/10.1038/nature11148>
- Careem. (2025). *Careem's 2024 wrap-up*.
- Cargo bike | FREITAG*. (n.d.).
- Carlsson, F., Kataria, M. & Lampi, E. (2022). Sustainable food: Can information from food labels make consumers switch to meat substitutes? *Ecological Economics*, 201, 107567. <https://doi.org/10.1016/j.ecolecon.2022.107567>
- Carra Wu & Chris Dixon. (2021). *Investing in Friends With Benefits (a DAO)*.
- Carrie Xiao. (2025). *China adds record 105GW solar PV in first four months of 2025*.
- Carto. (2023). *Climate resilience, the geography of NYC taxis & photorealistic 3D maps*.
- Cashion, T., Al-Abdulrazzak, D., Belhabib, D., Derrick, B., Divovich, E., Moutopoulos, D. K., Noël, S.-L., Palomares, M. L. D., Teh, L. C. L., Zeller, D. & Pauly, D. (2018). Reconstructing global marine fishing gear use: Catches and landed values by gear type and sector. *Fisheries Research*, 206, 57–64. <https://doi.org/10.1016/j.fishres.2018.04.010>
- Casper Kessels. (2022). *Guidelines for Designing an In-Car Voice Assistant*.
- Catanoso, J. (2024). *Enviva bankruptcy fallout ripples through biomass industry, U.S. And EU*.
- CatGPT. (2025). *Why AI is more important than the Internet (Interview with Google Co-Founder, Sergey Brin)*.
- Catherine Shu. (2023). *Southeast Asia farm-to-table startup Secai Marche raises Series A*.
- CBC Radio. (2021). *Extreme heat could make Athens uninhabitable, warns city's chief heat officer*.
- CBS Mornings. (2023). *Full interview: "Godfather of artificial intelligence" talks impact and potential of AI*.
- CBS Mornings. (2025). *AI pioneer Geoffrey Hinton says world is not prepared for what's coming*.
- CDP. (2022). *Missing the Mark: CDP temperature ratings - 2022 analysis*.
- Ceballos, G., Ehrlich, P. R. & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proceedings of the National Academy of Sciences*, 114(30). <https://doi.org/10.1073/pnas.1704949114>
- Ceccato, V., Parishwad, O. & Levine, N. (2023). Defecation, littering and other acts of public disturbance in pandemic times – A study of a Scandinavian city. *Cities (London, England)*, 141, 104456. <https://doi.org/10.1016/j.cities.2023.104456>
- Celino, I. & Re Calegari, G. (2020). Submitting surveys via a conversational interface: An evaluation of user acceptance and approach effectiveness. *International Journal of Human-*

- Computer Studies*, 139, 102410. <https://doi.org/10.1016/j.ijhcs.2020.102410>
- Celo and Regenerative Finance - Climate and ReFi*. (2021).
- Centobelli, P., Abbate, S., Nadeem, S. P. & Garza-Reyes, J. A. (2022). Slowing the fast fashion industry: An all-round perspective. *Current Opinion in Green and Sustainable Chemistry*, 38, 100684. <https://doi.org/10.1016/j.cogsc.2022.100684>
- Central Bank Digital Currency (CBDC) Tracker*. (2023).
- Centre, U. W. H. (1999). *Area de Conservaci&oacute;n Guanacaste*.
- CEPR. (2022). *A fair, sustainable, and prosperous Europe needs proper navigation tools*.
- Ceschin, F. & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, 47, 118–163. <https://doi.org/10.1016/j.destud.2016.09.002>
- Chainlink. (2022). *New Report: Blockchains and Oracles Are Redefining the Energy Industry. Challenges and Opportunities in Sustainable Packaging Today*. (2022).
- Chancel, L. (2022). Global carbon inequality over 1990–2019. *Nature Sustainability*, 5(11), 931–938. <https://doi.org/10.1038/s41893-022-00955-z>
- Chang, C.-C., Wegerif, R. & Hennessy, S. (2023). Exploring dialogic education used to teach historical thinking within the cultural context of East Asia: A multiple-case study in Taiwanese classrooms. *Learning, Culture and Social Interaction*, 41, 100729. <https://doi.org/10.1016/j.lcsi.2023.100729>
- Chang, C.-H., Tsai, M.-L., Huang, T.-T. & Wang, Y.-C. (2021). Authentication of fish species served in conveyor-belt sushi restaurants in Taiwan using DNA barcoding. *Food Control*, 130, 108264. <https://doi.org/10.1016/j.foodcont.2021.108264>
- Chang, H.-C. (2022). Climate strike or not? Intersectionality of age and culture encountered by young climate activists in Taiwan. *Childhood (Copenhagen, Denmark)*, 29(1), 7–23. <https://doi.org/10.1177/0907568221074869>
- Chang Hsiung-feng, Wu Che-hao & Wu Kuan-hsien. (2024). *Taiwan's air 45th most polluted in world, 3rd in East Asia - Focus Taiwan*.
- Chang, M. & Hsiao, I.-C. (2025). *Our first geothermal energy deal in Asia*.
- Chang, T., Hsu, C.-M., Chen, S.-T., Wang, M.-C. & Wu, C.-F. (2023). Revisiting economic growth and CO<sub>2</sub> emissions nexus in Taiwan using a mixed-frequency VAR model. *Economic Analysis and Policy*, 79, 319–342. <https://doi.org/10.1016/j.eap.2023.05.022>
- Chant, T. D. (2022). *Personal carbon-cutting app Joro raises \$10M Series A from Sequoia, Jay-Z's Arrive*.
- Chapman, J. (2009). Design for (Emotional) Durability. *Design Issues*, 25(4), 29–35.
- Cheba, K., Bąk, I., Szopik-Depczyńska, K. & Ioppolo, G. (2022). Directions of green transformation of the European Union countries. *Ecological Indicators*, 136, 108601. <https://doi.org/10.1016/j.ecolind.2022.108601>
- Chen, C.-L. & Tsai, C.-H. (2016). Marine environmental awareness among university students in Taiwan: A potential signal for sustainability of the oceans. *Environmental Education Research*, 22(7), 958–977. <https://doi.org/10.1080/13504622.2015.1054266>
- Chen, D. & Chou, M. (2023). Social Innovation in Taiwan: Theories and Practices. *Innovation in the Social Sciences*, 1(1), 5–43. <https://doi.org/10.1163/27730611-bja10003>
- Chen, H.-W. (2006). Gallium, indium, and arsenic pollution of groundwater from a semiconduc-

- tor manufacturing area of Taiwan. *Bulletin of Environmental Contamination and Toxicology*, 77(2), 289–296. <https://doi.org/10.1007/s00128-006-1062-3>
- Chen, Y., Duo, L., Zhao, D., Zeng, Y. & Guo, X. (2023). The response of ecosystem vulnerability to climate change and human activities in the Poyang lake city group, China. *Environmental Research*, 233, 116473. <https://doi.org/10.1016/j.envres.2023.116473>
- Chen, Chiang & Storey. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. *MIS Quarterly*, 36(4), 1165. <https://doi.org/10.2307/41703503>
- Cheng, X., Zhang, X., Yang, B. & Fu, Y. (2022). An investigation on trust in AI-enabled collaboration: Application of AI-Driven chatbot in accommodation-based sharing economy. *Electronic Commerce Research and Applications*, 54, 101164. <https://doi.org/10.1016/j.elerap.2022.101164>
- Cheng, Y. & Han, X. (2022). Assessing the economic loss due to natural disasters from outer space. *Climate Services*, 26, 100286. <https://doi.org/10.1016/j.cliser.2022.100286>
- Chiang, S. (2024). *Google invests in BlackRock-backed Taiwanese solar developer to boost energy capacity amid AI boom*.
- Chiang, W.-L., Zheng, L., Sheng, Y., Angelopoulos, A. N., Li, T., Li, D., Zhang, H., Zhu, B., Jordan, M., Gonzalez, J. E. & Stoica, I. (2024). *Chatbot arena: An open platform for evaluating LLMs by human preference*. <https://arxiv.org/abs/2403.04132>
- Chinese billionaire Jack Ma sees AI future for Ant Group, in rare appearance. (2024). *Reuters*.
- Chiu, C., Wu, L. & Liu, T. (2022). Weight problems rise among Taiwanese. *Taipei Times*.
- Chong, J., Mason, L., Pillora, S. & Giurco, D. (2009). *Product stewardship schemes in Asia: China and Taiwan, Japan, South Korea*. Institute for Sustainable Futures, University of Technology, Sydney.
- Chouai, S. & Mayer, S. (2024). *[BLOG] Is eco-design an obsolete concept ?*
- Chouinard, Y. (2005). *Let my people go surfing: The education of a reluctant businessman*. Penguin Press.
- Chourasia, S., Tyagi, A., Pandey, S. M., Walia, R. S. & Murtaza, Q. (2022). Sustainability of Industry 6.0 in Global Perspective: Benefits and Challenges. *MAPAN*, 37(2), 443–452. <https://doi.org/10.1007/s12647-022-00541-w>
- Christ, K. L. & V Helliar, C. (2021). Blockchain technology and modern slavery: Reducing deceptive recruitment in migrant worker populations. *Journal of Business Research*, 131, 112–120. <https://doi.org/10.1016/j.jbusres.2021.03.065>
- Christian Rohrer. (2022). *When to Use Which User-Experience Research Methods*.
- Christiano, P. (2021). *My research methodology*.
- Christiano, P. (2023). *My views on “doom”*.
- Christiano, P., Leike, J., Brown, T. B., Martic, M., Legg, S. & Amodei, D. (2017). *Deep reinforcement learning from human preferences*. <https://doi.org/10.48550/ARXIV.1706.03741>
- Christiansen, A., Hasse, G. & Tønder, R. (2021). *Extended Producer Responsibility in the Danish textile sector: Assessing the optimal development and implementation*.
- Christodoulou, P., Psillaki, M., Sklias, G. & Chatzichristofis, S. A. (2023). A blockchain-based framework for effective monitoring of EU Green Bonds. *Finance Research Letters*, 58, 104397. <https://doi.org/10.1016/j.frl.2023.104397>
- Circle Economy. (2021). *Keynote: Ilektra Kouloumpi at the Second Utrecht Degrowth Symposium*.

sium.

- Circle Economy. (2022). *The Circularity Gap Report 2022*.
- Circularise. (2018). *Flexible Transparency Part 1: How to Survive Change and Drive it*.
- Circularise. (2020a). *Circularise raises €1.5 million to trace plastic supply chains*.
- Circularise. (2020b). *EuPC and Circularise Plastics collaborate to further develop the digital platform to monitor the....*
- City of Malmö. (2017). *Green Bond Framework*.
- Citywealth. (2021). *ESG branding with B-Corps?*
- Claudio-Quiroga, G., Gil-Alana, L. A. & Larrarte, A. M. (2025). Persistence in China's household consumption level: Implications for the new growth model. *Journal of Economics and Finance*, 49(1), 283–298. <https://doi.org/10.1007/s12197-025-09709-x>
- Clean Clothes Campaign. (n.d.).
- Cleantech Group. (2023). *Global Cleantech 100*.
- Clifford, C. (2022). *How this popular Jeff Bezos quote drives Amazon's climate goals*.
- Climate Action 100+. (2023). *Companies*.
- Climate Analytics & NewClimate Institute. (2023). *Climate Action Tracker*.
- Climate Bonds. (2023). *Climate Bonds Interactive Data Platform*.
- Climate Bonds Initiative calls for greening of \$55trn short-term debt market. (2022).
- Climate change mitigation: Reducing emissions. (2023).
- Climate Interactive. (n.d.). *En-ROADS is an online simulator that provides policymakers, educators, businesses, the media, and the public with the ability to test and explore cross-sector climate solutions*.
- Climate Interactive. (2023). *LIVE from COP28: The En-ROADS Climate Workshop*.
- Climate Neutral. (2024). *Flickr | A Climate Label Certified Brand*.
- Climate Neutral Certified. (2023). *The Climate Neutral Standards*.
- ClimatePartner. (2020). *Labelling the carbon footprint of food and consumer goods*.
- CME Group. (2025). *E-mini S&P 500 ESG Index Futures Contract Specs*.
- CO2-neutral factories. (n.d.).
- Codrington, J., Varnum, A. A., Hildebrandt, L., Pröfrock, D., Bidhan, J., Khodamoradi, K., Höhme, A.-L., Held, M., Evans, A., Velasquez, D., Yarborough, C. C., Ghane-Motlagh, B., Agarwal, A., Achua, J., Pozzi, E., Mesquita, F., Petrella, F., Miller, D. & Ramasamy, R. (2024). Detection of microplastics in the human penis. *International Journal of Impotence Research*. <https://doi.org/10.1038/s41443-024-00930-6>
- Cohen, M. A. & Vandenberg, M. P. (2012). The potential role of carbon labeling in a green economy. *Energy Economics*, 34, S53–S63. <https://doi.org/10.1016/j.eneco.2012.08.032>
- Colombo, J. A. & Yarovaya, L. (2024). Are crypto and non-crypto investors alike? Evidence from a comprehensive survey in Brazil. *Technology in Society*, 76, 102468. <https://doi.org/10.1016/j.techsoc.2024.102468>
- Combi, C., Amico, B., Bellazzi, R., Holzinger, A., Moore, J. H., Zitnik, M. & Holmes, J. H. (2022). A manifesto on explainability for artificial intelligence in medicine. *Artificial Intelligence in Medicine*, 133, 102423. <https://doi.org/10.1016/j.artmed.2022.102423>
- Commission, E., for Energy, D.-G., for Enterprise, D.-G. & Industry. (2014). *Ecodesign your future : How ecodesign can help the environment by making products smarter*. European

- Commission. <https://doi.org/doi/10.2769/38512>
- Communications, O. (2023). *UNSD & OECD use OpenCorporates' data to help the world understand multinational enterprises.*
- Confino, J. (2015). Beyond capitalism and socialism: Could a new economic approach save the planet? *The Guardian*.
- Constandse, C. (2018). *How AI-driven website builders will change the digital landscape.*
- Contactless payments prevalent in Macau - City's de facto central bank.* (2023).
- Copet, J., Kreuk, F., Gat, I., Remez, T., Kant, D., Synnaeve, G., Adi, Y. & Défossez, A. (2023). *Simple and Controllable Music Generation.* <https://doi.org/10.48550/ARXIV.2306.05284>
- Cordeiro, T. & Weevers, I. (2016). Design is No Longer an Option - User Experience (UX) in FinTech. In S. Chishti & J. Barberis (Eds.), *The FinTech Book* (pp. 34–37). John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781119218906.ch9>
- Corporate Knights. (2024). *Global 100.* Corporate Knights.
- Costa, A. & Silva, F. (2022). Interaction Design for AI Systems: An oriented state-of-the-art. *2022 International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA)*, 1–7. <https://doi.org/10.1109/HORA55278.2022.9800084>
- Costa, C. D. (2018). *How Finnish Culture Can Teach You To Design Your Life.*
- Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P. & Van Den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387(6630), 253–260. <https://doi.org/10.1038/387253a0>
- Cowan, G. (2018). Robo Advisers Start to Take Hold in Europe. *Wall Street Journal*.
- Crabb, J. (2023). *A rant about terrible personas.*
- Crain, M. & Nadler, A. (2019). Political Manipulation and Internet Advertising Infrastructure. *Journal of Information Policy*, 9, 370–410. <https://doi.org/10.5325/jinfopol.9.2019.0370>
- Credit Suisse. (2022). *Young consumers may drive the speed of environmental change.*
- Crenna, E., Sinkko, T. & Sala, S. (2019). Biodiversity impacts due to food consumption in Europe. *Journal of Cleaner Production*, 227, 378–391. <https://doi.org/10.1016/j.jclepro.2019.04.054>
- Creutzig, F. & Kapmeier, F. (2020). Engage, don't preach: Active learning triggers climate action. *Energy Research & Social Science*, 70, 101779. <https://doi.org/10.1016/j.erss.2020.101779>
- Crippa, M., Guizzardi, D., Muntean, M., Schaaf, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J. & Vignati, E. (2020). *Fossil CO<sub>2</sub> and GHG emissions of all world countries – 2020 report.* Publications Office.
- CRM Alliance. (2020). *EIT Raw Materials Summit: Practical Plan for a Greener EU.*
- Crompton, L. (2021). The decision-point-dilemma: Yet another problem of responsibility in human-AI interaction. *Journal of Responsible Technology*, 7–8, 100013. <https://doi.org/10.1016/j.jrt.2021.100013>
- Cuppini, N., Frapperti, M. & Pirone, M. (2022). When cities meet platforms: Towards a trans-urban approach. *Digital Geography and Society*, 3, 100042. <https://doi.org/10.1016/j.diggeo.2022.100042>
- CYCU. (2023). 中原大學因應 ChatGPT 及 AI 之影響進行全校師生問卷調査.

- Czaika, E. & Selin, N. E. (2017). Model use in sustainability policy making: An experimental study. *Environmental Modelling & Software*, 98, 54–62. <https://doi.org/10.1016/j.envsoft.2017.09.001>
- da Silva, F. C. (2023). *ETFmatic Review*.
- Dai, D. (2019). 全球學生氣候運動，臺灣學生走出自己的路.
- Daily, G. C. (Ed.). (1997). *Nature's services: Societal dependence on natural ecosystems*. Island Press.
- Daily Sun. (2022). *Bangladesh regains 2nd position in RMG exports*.
- Daisy Wolf & Pande Vijay. (2023). *Where Will AI Have the Biggest Impact? Healthcare*.
- Daly, H. E. (1997). *Beyond growth: The economics of sustainable development* (Nachdr.). Beacon Press.
- Dang, V. T. (2024). *Inside Apple's AI: Understanding the Architecture and Innovations of AFM Models*.
- Daniel Värjö. (2022). *Nya satelliter avslöjar dolda utsläpp av växthusgaser*. Sveriges Radio.
- Daphne, T. (2022). *Zero-knowledge proofs explained in 3 examples*.
- Darwyne, A. (2025). *Utilities, K-pop and dividend funds resilient amid global market rout*. Datakick: The Open Product Database. (n.d.).
- David Attlee. (2022). *Buying crypto with credit cards is now indirectly banned in Taiwan*.
- David, D. B., Resheff, Y. S. & Tron, T. (2021). *Explainable AI and Adoption of Financial Algorithmic Advisors: An Experimental Study* (No. arXiv:2101.02555). arXiv. <https://arxiv.org/abs/2101.02555>
- David Hoang. (2022). *Creating interface studies*.
- David Hoang on how AI brings design and development together | Figma Blog*. (2024).
- David Johnston. (2023). *Smart Agent Protocol - Community Paper Version 0.2*.
- David Pinto. (2023). *Backlash against Nature Restoration Law shows deep divides in European Parliament*.
- David Suzuki Foundation. (2021). *Well-being economies*.
- Dávid Pásztor. (2018). *AI UX: 7 Principles of Designing Good AI Products*.
- Davidson, H. & Chi-hui, L. (2024). Empty classrooms, silent halls: Taiwan's declining birthrate forces schools to close. *The Guardian*.
- DBS. (2018). *DBS launches Singapore's first holistic digital financial advisor "Your Financial GPS"*.
- DBS Singapore. (n.d.). *DBS LiveBetter*.
- De Balie. (2018). *Kate Raworth: Creating a 21st century economy - Doughnut Economics*.
- De, D., El Jamal, M., Aydemir, E. & Khera, A. (2025). Social Media Algorithms and Teen Addiction: Neurophysiological Impact and Ethical Considerations. *Curēus*. <https://doi.org/10.7759/cureus.77145>
- de Otazu, R. L. de L. D., Akizu-Gardoki, O., de Ulibarri, B., Iturrondobeitia, M., Minguez, R. & Lizundia, E. (2022). Ecodesign coupled with Life Cycle Assessment to reduce the environmental impacts of an industrial enzymatic cleaner. *Sustainable Production and Consumption*, 29, 718–729. <https://doi.org/10.1016/j.spc.2021.11.016>
- De Queiroz-Stein, G. & Siegel, K. M. (2023). Possibilities for mainstreaming biodiversity? Two perspectives on the concept of bioeconomy. *Earth System Governance*, 17, 100181.

- https://doi.org/10.1016/j.esg.2023.100181
- Debnath, R., Bardhan, R., Shah, D. U., Mohaddes, K., Ramage, M. H., Alvarez, R. M. & Sovacool, B. K. (2022). Social media enables people-centric climate action in the hard-to-decarbonise building sector. *Scientific Reports*, 12(1), 19017. https://doi.org/10.1038/s41598-022-23624-9
- Decker Sparks, J. L., Boyd, D. S., Jackson, B., Ives, C. D. & Bales, K. (2021). Growing evidence of the interconnections between modern slavery, environmental degradation, and climate change. *One Earth (Cambridge, Mass.)*, 4(2), 181–191. https://doi.org/10.1016/j.oneear.2021.01.015
- DeepSeek-AI, Guo, D., Yang, D., Zhang, H., Song, J., Zhang, R., Xu, R., Zhu, Q., Ma, S., Wang, P., Bi, X., Zhang, X., Yu, X., Wu, Y., Wu, Z. F., Gou, Z., Shao, Z., Li, Z., Gao, Z., ... Zhang, Z. (2025). *DeepSeek-R1: Incentivizing Reasoning Capability in LLMs via Reinforcement Learning*. arXiv. https://doi.org/10.48550/ARXIV.2501.12948
- Delclòs-Alió, X., Rodríguez, D. A., Medina, C., Miranda, J. J., Avila-Palencia, I., Targa, F., Moran, M. R., Sarmiento, O. L. & Quistberg, D. A. (2022). Walking for transportation in large Latin American cities: Walking-only trips and total walking events and their sociodemographic correlates. *Transport Reviews*, 42(3), 296–317. https://doi.org/10.1080/01441647.2021.1966552
- Deliverect. (2024). *Deliverect US | What is FMCG? Understanding the Fast-Moving Consumer Goods Industry*.
- Deloitte. (2024). *Decarbonizing H2O: Financing Global Water Security with Voluntary Carbon Markets*.
- Deng, B. & Chau, M. (2021). Anthropomorphized financial robo-advisors and investment advice-taking behavior. *Proceedings of the 27th Americas Conference on Information Systems (AMCIS 2021)*.
- Design Fiction group. (2018). *Group Overview ↴ Design Fiction*.
- Design Portland. (2018). *Humans Have the Final Say — Stories*.
- dessler2. (2024). *Climate economics with Noah Kaufman*.
- Destination Earth | Shaping Europe's digital future*. (2023).
- Detail-rich sustainable packaging Product Database is an industry first*. (2010).
- Deutsche Börse Group. (2025). *ESG Index Derivatives*.
- Deutsche Welle. (2019). *Fridays for Future global climate strike*.
- Devlin, A. & Yang, A. (2022). Regional supply chains for decarbonising steel: Energy efficiency and green premium mitigation. *Energy Conversion and Management*, 254, 115268. https://doi.org/10.1016/j.enconman.2022.115268
- Dew, M. A., Penkower, L. & Bromet, E. J. (1991). Effects of Unemployment on Mental Health in the Contemporary Family. *Behavior Modification*, 15(4), 501–544. https://doi.org/10.1177/01454455910154004
- Dewy. (2024). *Building a RAG "tool" with Dewy and Vercel's Generative UI components*.
- Deyan Georgiev. (2023a). *39+ Smartphone Statistics You Should Know in 2023*.
- Deyan Georgiev. (2023b). *Gen Z Statistics - What We Know About the New Generation*.
- dGen & PositiveBlockchain. (2021). *Blockchain & the SDGs: How Decentralisation Can Make a Difference*.

- Di Pizio, A. (2023). *Sam Altman Says AI Will Make Businesses 30 Times More Productive: 2 Stocks Investors Will Want to Buy.*
- Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., Hill, R., Chan, K. M. A., Baste, I. A., Brauman, K. A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P. W., Van Oudenoven, A. P. E., Van Der Plaat, F., Schröter, M., Lavorel, S., ... Shirayama, Y. (2018). Assessing nature's contributions to people. *Science*, 359(6373), 270–272. <https://doi.org/10.1126/science.aap8826>
- Dicks, H. (2023). *The Biomimicry Revolution: Learning from Nature How to Inhabit the Earth.* Columbia University Press. <https://doi.org/10.7312/dick20880>
- Dicuonzo, G., Palmaccio, M. & Shini, M. (2024). ESG, governance variables and Fintech: An empirical analysis. *Research in International Business and Finance*, 69, 102205. <https://doi.org/10.1016/j.ribaf.2023.102205>
- Diduch, M. (2020). *Is Economic Growth the Wrong Goal?*
- Digital receipts and customer loyalty in one platform | ReceiptHero.* (n.d.).
- Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N. D., Wikramanayake, E., Hahn, N., Palminteri, S., Hedao, P., Noss, R., Hansen, M., Locke, H., Ellis, E. C., Jones, B., Barber, C. V., Hayes, R., Kormos, C., Martin, V., Crist, E., ... Saleem, M. (2017). An Ecoregion-Based Approach to Protecting Half the Terrestrial Realm. *BioScience*, 67(6), 534–545. <https://doi.org/10.1093/biosci/bix014>
- Ditlevsen, P. & Ditlevsen, S. (2023). Warning of a forthcoming collapse of the Atlantic meridional overturning circulation. *Nature Communications*, 14(1), 4254. <https://doi.org/10.1038/s41467-023-39810-w>
- Diver, K. (2025). *The Clear-Cut Truth Behind the Biomass Industry in the U.S. Southeast.*
- Doorey, D. J. (2011). The Transparent Supply Chain: From Resistance to Implementation at Nike and Levi-Strauss. *Journal of Business Ethics*, 103(4), 587–603. <https://doi.org/10.1007/s10551-011-0882-1>
- Dot Go. (2023). *Dot Go.*
- Douglas, E. (2023). *This summer is on track to be among Texas' most extreme.*
- Drupp, M. A., Baumgärtner, S., Meyer, M., Quaas, M. F. & Von Wehrden, H. (2020). Between Ostrom and Nordhaus: The research landscape of sustainability economics. *Ecological Economics*, 172, 106620. <https://doi.org/10.1016/j.ecolecon.2020.106620>
- Du Toit, L. & Kotzé, L. J. (2022). Reimagining international environmental law for the Anthropocene: An earth system law perspective. *Earth System Governance*, 11, 100132. <https://doi.org/10.1016/j.esg.2022.100132>
- dub. (2025). *Copy Trade Anyone on the App Store.*
- Dull, D. (2021). *Circular supply chain: 17 common questions, how any supply chain can take the next step.* Amazon Italia Logistica.
- Dunne, A. & Raby, F. (2013). *Speculative everything: Design, fiction, and social dreaming.* The MIT Press.
- Duriez, E., Morlier, J., Azzaro-Pantel, C. & Charlotte, M. (2022). Ecodesign with topology optimization. *Procedia CIRP*, 109, 454–459. <https://doi.org/10.1016/j.procir.2022.05.278>
- Dutta, P., Choi, T.-M., Somani, S. & Butala, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation Research*

*Part E: Logistics and Transportation Review*, 142, 102067. <https://doi.org/10.1016/j.tre.2020.102067>

- DW Euromaxx. (2018). *Ask a Designer: Dieter Rams' 10 principles of good design*.
- Dwarkesh Patel. (2024). *Mark Zuckerberg - Llama 3, \$10B Models, Caesar Augustus, & 1 GW Datacenters*.
- Dwi Tamara. (2025). Gen Z, climate justice and '#IndonesiaGelap' - Academia. *The Jakarta Post*.
- Dzebo, A., Iacobuță, G. & Beaussart, R. (2023). *The Paris Agreement and the Sustainable Development Goals: Evolving connections*. Stockholm Environment Institute. <https://doi.org/10.51414/sei2023.036>
- Earth Day. (2023). *Earth Day 2023*.
- Earth.Org. (2022). *The World's 50 Most Sustainable Companies in 2021*.
- Echeverría, L., Gimenez-Nadal, J. I. & Molina, J. A. (2022). Green mobility and well-being. *Ecological Economics*, 195, 107368. <https://doi.org/10.1016/j.ecolecon.2022.107368>
- Edenbrandt, A. K. & Lagerkvist, C.-J. (2022). Consumer perceptions and attitudes towards climate information on food. *Journal of Cleaner Production*, 370, 133441. <https://doi.org/10.1016/j.jclepro.2022.133441>
- Edwards, F. & Pettersen, I. N. (2023). Speculative design for envisioning more-than-human futures in desirable counter-cities. *Cities (London, England)*, 142, 104553. <https://doi.org/10.1016/j.cities.2023.104553>
- Eerola, T. (2022). Corporate conduct, commodity and place: Ongoing mining and mineral exploration disputes in Finland and their implications for the social license to operate. *Resources Policy*, 76, 102568. <https://doi.org/10.1016/j.resourpol.2022.102568>
- Eesti Disainikeskus I Estonian Design Centre. (2021). *Circular Design HOW TO session 6: Circularit y in Textiles*.
- Eesti Kunstiakadeemia. (2022). *EKA arendas Euroopa tippdisainikoolidega jäätkusuutliku disaini õpetamise tööriistad*.
- Eesti Vabariigi Valitsus. (2022). *Rohepöörde tegevusplaan*.
- Eisenstein, C. (2011). *Sacred economics: Money, gift, & society in the age of transition*. Evolver Editions.
- Eisenstein, C. (2018). *Climate: A new story*. North Atlantic Books.
- Ela Khodai. (2023). *Why the VCM needs more transparency*.
- Eliza Strickland. (2023). *Dr. ChatGPT Will Interface With You Now*.
- Ellen MacArthur Foundation, Material Economics. (2019). *Completing the picture: How the circular economy tackles climate change*.
- Ellsmoor, J. (2019). *New Zealand Ditches GDP For Happiness And Wellbeing*.
- EMarketer. (2021). *Almost 75% of BNPL users in the US are Gen Z or millennials*.
- Ember. (2023). *Carbon Price Tracker*.
- Ember. (2025). *Electricity Data Explorer*.
- Emele Onu & Anthony Osae-Brown. (2022). Nigeria Caps ATM Cash Withdrawals at \$45 Daily to Push Digital Payments. *Bloomberg*.
- Emily Chan. (2022a). *We Still Don't Have Enough Transparency In Fashion*.
- Emily Chan. (2022b). Will 2022 Be The Year The Fashion Industry Finally Faces Green Leg-

- islation? *British Vogue*.
- Emily Chan. (2022c). Will The Fashion Industry Finally Face Sustainability Legislation In 2022? | British Vogue. *British Vogue*.
- Empowering Digital Asset Banking*. (n.d.).
- Engkvist, J. (2024). *Why aren't there more UX sociologists out there?*
- Epoch AI. (2024). *Data on Notable AI Models*.
- Erhard, A., Boztug, Y. & Lemken, D. (2023). How do defaults and framing influence food choice? An intervention aimed at promoting plant-based choice in online menus. *Appetite*, 190, 107005. <https://doi.org/10.1016/j.appet.2023.107005>
- Eric fogg. (2020). *What is Lights Out Manufacturing? Exploring Full Automation*.
- Erik Brynjolfsson. (2022). *The Turing Trap: The Promise & Peril of Human-Like Artificial Intelligence*.
- Eriksson, M., Christensen, J. & Malefors, C. (2023). Making food waste illegal in Sweden – Potential gains from enforcing best practice in the public catering sector. *Sustainable Production and Consumption*, 35, 229–237. <https://doi.org/10.1016/j.spc.2022.11.003>
- ERR. (2023). *Estonian beekeepers maintain quality amid influx of cheap synthetic imports*.
- ERR, J. S. (2022). *Komisjon tahab vähendada kiirmoekettide toodangu jõudmist EL-i*.
- Erratum for the Report: “The global tree restoration potential” by J.-F. Bastin, Y. Finegold, C. Garcia, D. Mollicone, M. Rezende, D. Routh, C. M. Zohner, T. W. Crowther and for the Technical Response “Response to Comments on ‘The global tree restoration potential’” by J.-F. Bastin, Y. Finegold, C. Garcia, N. Gellie, A. Lowe, D. Mollicone, M. Rezende, D. Routh, M. Sacande, B. Sparrow, C. M. Zohner, T. W. Crowther. (2020). *Science*, 368(6494), eabc8905. <https://doi.org/10.1126/science.abc8905>
- ESG hedge funds | Barclays Corporate & Investment Bank*. (2021).
- ESG 浪潮反思：一間減碳表現優異、但產品有害健康的企業，符合 ESG 精神嗎？*. (2022).
- Eshe Nelson, Ana Swanson & Jeanna Smialek. (2023). Heat, War and Trade Protections Raise Uncertainty for Food Prices. *The New York Times*.
- Espinosa, F. & Bazairi, H. (2023). Impacts, evolution, and changes of pressure on marine ecosystems in recent times. Toward new emerging and unforeseen impacts within a changing world. In *Coastal Habitat Conservation* (pp. 1–16). Elsevier. <https://doi.org/10.1016/B978-0-323-85613-3.00004-9>
- Estonian Responsible Business Index*. (n.d.).
- ETFmatic - Account funding of EURO accounts ceases*. (2023).
- Ethan Mollick [@emollick]. (2023). *I think most interesting/unnerving fast demo of the future of AI chatbots is to use the Pi iOS app, which lets you have a phone call with a Large Language Model optimized for chat It isn't the AI from "Her" yet, but you can start to see the path towards AI companions*. <https://t.co/agJU14ukBB>
- Ethical Savings: Everything You Need To Know | Bloom Money*. (2023).
- Etsy made mistakes, but its commitment to social responsibility wasn't one of them*. (2017).
- EU reaches agreement on national emission reductions*. (2022).
- EU taxonomy for sustainable activities*. (n.d.).
- Eugenia Kuyda. (2023). *Replika*.
- Euronext. (2020). *Euronext launches suite of ESG products and services to empower sustainable*

*growth.*

- European Central Bank. (2019). *Lending and payment systems in upheaval: The fintech challenge*.
- European Commission. (2019a). *A Sustainable Europe by 2030*.
- European Commission. (2019b). *EU labels for benchmarks (climate, ESG) and benchmarks' ESG disclosures - European Commission*.
- European Commission. (2019c). *The European Green Deal*.
- European Commission. (2022a). *Circular Economy Action Plan: For a cleaner and more competitive Europe*.
- European Commission. (2022b). *Ecodesign for sustainable products*.
- European Commission. (2022c). *Green Deal: New proposals to make sustainable products the norm and boost Europe's resource independence*.
- European Commission. (2023a). *EU and Republic of Korea - Green Partnership*.
- European Commission. (2023b). *Strategic foresight*.
- European Commission. (2024a). *Application of EUDR Regulation on deforestation-free products delayed until December 2025*.
- European Commission. (2024b). *Ecodesign for Sustainable Products Regulation*.
- European Commission. (2025). *Protecting ecosystems: Almost half of EU Biodiversity Strategy recommendations now in place*.
- European Commission. Joint Research Centre. (2021). *Circular economy perspectives in the EU textile sector: Final report*. Publications Office.
- European Commission. Joint Research Centre. (2022). *CO2 emissions of all world countries :JRC/IEA/PBL 2022 report*. Publications Office.
- European Council. (2022). *Fit for 55 - The EU's plan for a green transition*.
- European Environment Agency. (2022). *Textiles and the environment: The role of design in Europe's circular economy*.
- European Parliament. (2014). *Directive 2014/65/EU: Vols. OJ L (No. 32014L0065)*.
- European Parliament. (2022). *Ecodesign for sustainable products*.
- European Parliament. (2023). *Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (Text with EEA relevance)*.
- European Securities and Markets Authority. (2017). *MiFID II*.
- European Space Agency. (2023). *AI maps icebergs 10,000 times faster than humans*.
- European Union. (2024). *Regulation (EU) 2024/1689 on artificial intelligence (AI act)*.
- Eurostat. (2022). *Treatment of waste by waste category, hazardousness and waste management operations*. Eurostat. [https://doi.org/10.2908/ENV\\_WASTRT](https://doi.org/10.2908/ENV_WASTRT)
- EVM maaarhitektuuri keskus. (2019). *Climate-responsive design principles*.
- Fabrique & Q42. (n.d.). *What is "Good" Design? A quick look at Dieter Rams' Ten Principles*.
- Fabris, N. & Luburić, R. (2022). *CLIMATE CHANGE AND QUALITY OF LIFE*.
- Falconer, R. (2023). *Over 123 million under heat alerts as intensifying heat wave spreads across U.S.*
- Fanelli, A. (2024). *Bolt.New, Flow Engineering for Code Agents, and > \$8m ARR in 2 Months*

as a Claude Wrapper.

- Fanning, A. L., O'Neill, D. W., Hickel, J. & Roux, N. (2021). The social shortfall and ecological overshoot of nations. *Nature Sustainability*, 5(1), 26–36. <https://doi.org/10.1038/s41893-021-00799-z>
- Fanning, E., Eyres, G., Frew, R. & Kebede, B. (2023). Linking cocoa quality attributes to its origin using geographical indications. *Food Control*, 151, 109825. <https://doi.org/10.1016/j.foodcont.2023.109825>
- Fares, O. H., Lee, S. H. & Lee, O. H. F. and S. H. (2024). *How TikTok's "underconsumption core" trend is challenging consumerism*.
- Fashion Revolution Foundation. (2022). *FASHION TRANSPARENCY INDEX 2022*.
- FashionChecker. (2023). *FashionChecker: Wages and transparency in the garment industry*.
- Feifei Liu 刘菲菲. (n.d.). *Prompt Controls in GenAI Chatbots: 4 Main Uses and Best Practices*.
- Feine, J., Gnewuch, U., Morana, S. & Maedche, A. (2019). A Taxonomy of Social Cues for Conversational Agents. *International Journal of Human-Computer Studies*, 132, 138–161. <https://doi.org/10.1016/j.ijhcs.2019.07.009>
- FFC - Fair Factories ClearingHouse - Compliance Solutions. (n.d.).
- Fiegenbaum, H. (2024). *Complementing Carbon Credits from Forest-Related Activities with Biodiversity Insurance and Resilience Value*. arXiv. <https://doi.org/10.48550/ARXIV.2411.08452>
- Fifth National Climate Assessment*. (2023). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023>
- Figma. (2023). *AI: The Next Chapter in Design*.
- Financial Materiality Marks Next Big ESG Investing Battle*. (2023).
- Financial Times. (2022). *8 Sustainability ideas that will change the world | FT Rethink*.
- Finextra. (2024). *Ant group's smart financial manager Zhixiaobao in Alipay hits 59 million user*.
- Finkenstadt, D. J. & Handfield, R. (2021). Blurry vision: Supply chain visibility for personal protective equipment during COVID-19. *Journal of Purchasing and Supply Management*, 27(3), 100689. <https://doi.org/10.1016/j.pursup.2021.100689>
- FINMA, E. F. (2021). *Approval of first Swiss crypto fund*.
- Fioramonti, L., Coscieme, L., Costanza, R., Kubiszewski, I., Trebeck, K., Wallis, S., Roberts, D., Mortensen, L. F., Pickett, K. E., Wilkinson, R., Ragnarsdóttir, K. V., McGlade, J., Lovins, H. & De Vogli, R. (2022). Wellbeing economy: An effective paradigm to mainstream post-growth policies? *Ecological Economics*, 192, 107261. <https://doi.org/10.1016/j.ecolecon.2021.107261>
- First paper money*. (n.d.).
- First time world exceeds 1.5C warming limit over 12-month period*. (2024).
- Fischer, J., Riechers, M., Loos, J., Martin-Lopez, B. & Temperton, V. M. (2021). Making the UN Decade on Ecosystem Restoration a Social-Ecological Endeavour. *Trends in Ecology & Evolution*, 36(1), 20–28. <https://doi.org/10.1016/j.tree.2020.08.018>
- Fletcher, J. (2023). *Generative UI and the Downfall of Digital Experiences — The Swift Path to Average*.
- Flor, R. S., Aline. (2024). “*Isto não acaba aqui*,” garantem jovens portugueses sobre decisão do Tribunal Europeu.

- Focus Taiwan. (2025). iPASS launches QR code payment system for public transport services. *Focus Taiwan - CNA English News*.
- Foley, A. M., Heffron, R. J., Al Kez, D., Furszyfer Del Rio, D. D., McInerney, C. & Welfle, A. (2024). Restoring trust in ESG investing through the adoption of just transition ethics. *Renewable and Sustainable Energy Reviews*, 199, 114557. <https://doi.org/10.1016/j.rser.2024.114557>
- Food and Agriculture Organization of the United Nations. (2023). *FAOSTAT corporate statistical database: Honey production by country, 2023*.
- foodNEXT, 食力. (2024). 2024 年第二季台灣民生消費品市場年增 4% 追求享樂精緻生活、零食和保健品花費提升.
- Ford, H. V., Jones, N. H., Davies, A. J., Godley, B. J., Jambeck, J. R., Napper, I. E., Suckling, C. C., Williams, G. J., Woodall, L. C. & Koldewey, H. J. (2022). The fundamental links between climate change and marine plastic pollution. *Science of The Total Environment*, 806, 150392. <https://doi.org/10.1016/j.scitotenv.2021.150392>
- Formentini, G. & Ramanujan, D. (2023). Design for circular disassembly: Evaluating the impacts of product end-of-life status on circularity through the parent-action-child model. *Journal of Cleaner Production*, 405, 137009. <https://doi.org/10.1016/j.jclepro.2023.137009>
- Forrester. (2024). *Forrester: Global Online Retail Sales To Grow 8.9% Annually, Reaching \$6.8 Trillion In 2028*.
- Fotheringham, N. (2017). *How To Create A Greener Investment Portfolio*.
- Fox, J. (2007). The uncertain relationship between transparency and accountability. *Development in Practice*, 17(4-5), 663–671. <https://doi.org/10.1080/09614520701469955>
- Fox, M. (2023). *Retail investors will drive the stock market higher in 2023 as they start to invest their \$1.8 trillion cash pile, Fundstrat says*.
- FRA 2020 Remote Sensing Survey. (2022). FAO. <https://doi.org/10.4060/cb9970en>
- Frances Schwatzkopff. (2022a). *EU Explores Tighter Rules for ESG Funds Amid Greenwash Concerns*.
- Frances Schwatzkopff. (2022b). *Firms Aren't Reporting Financial Risks of Carbon Emissions, Study Finds - Bloomberg*.
- Fransen, T., Henderson, C., O'Connor, R., Alayza, N., Caldwell, M., Chakrabarty, S., Dixit, A., Finch, M., Kustar, A., Langer, P., Stolle, F., Walls, G. & Welle, B. (2022). The State of Nationally Determined Contributions: 2022. *World Resources Institute*. <https://doi.org/10.46830/wrirpt.22.00043>
- Franzen, A. & Bahr, S. (2024). The development of global environmental concern during the last three decades. *Current Research in Environmental Sustainability*, 8, 100260. <https://doi.org/10.1016/j.crsust.2024.100260>
- Frédéric Simon. (2020). *Commission under fire for including “carbon sinks” into EU climate goals*.
- Frédéric Simon. (2022). *Europe rapidly losing its forest carbon sink, study shows*.
- Freundt, T., Grossmann, C., Lehmann, S. & Staack, Y. (2024). *Talk is cheap: How much will consumers really pay for green products?*
- Fridays For Future. (2025). *Strike Statistics*.
- Fu, J. (2024). Is aspartame bad for you? What we know about the sweetener's health risks. *The*

*Guardian.*

- Fu, T., Gao, S., Zhao, X., Wen, J. & Yan, R. (2022). Learning towards conversational AI: A survey. *AI Open*, 3, 14–28. <https://doi.org/10.1016/j.aiopen.2022.02.001>
- Fuentes, C., Enarsson, P. & Kristoffersson, L. (2019). Unpacking package free shopping: Alternative retailing and the reinvention of the practice of shopping. *Journal of Retailing and Consumer Services*, 50, 258–265. <https://doi.org/10.1016/j.jretconser.2019.05.016>
- Fuller, R. B. (1983). *Grunch of giants* (1st ed). St. Martin's Press.
- Future of Life Institute. (2023). *Pause Giant AI Experiments: An Open Letter*.
- GABV. (2023). *Triodos Bank UK: Support for nature-based investment projects*.
- Gamage, A., Gangahagedara, R., Gamage, J., Jayasinghe, N., Kodikara, N., Suraweera, P. & Merah, O. (2023). Role of organic farming for achieving sustainability in agriculture. *Farming System*, 1(1), 100005. <https://doi.org/10.1016/j.farsys.2023.100005>
- Ganbold, O., Rose, A. M., Rose, J. M. & Rotaru, K. (2022). Increasing Reliance on Financial Advice with Avatars: The Effects of Competence and Complexity on Algorithm Aversion. *Journal of Information Systems*, 36(1), 7–17. <https://doi.org/10.2308/ISYS-2021-002>
- Ganu, J. B. and S., Dominic Okus. (2021). *Why Blockchain Can Both Promote ESG And Accelerate Climate Transition*.
- Gao, L., la Tour, T. D., Tillman, H., Goh, G., Troll, R., Radford, A., Sutskever, I., Leike, J. & Wu, J. (2024). *Scaling and evaluating sparse autoencoders*. arXiv. <https://doi.org/10.48550/ARXIV.2406.04093>
- Gao, Y., Xiong, Y., Gao, X., Jia, K., Pan, J., Bi, Y., Dai, Y., Sun, J., Wang, M. & Wang, H. (2023). *Retrieval-Augmented Generation for Large Language Models: A Survey*. <https://doi.org/10.48550/ARXIV.2312.10997>
- Garcia, D. C. (2025a). *Bolt acquires Danish ride-hailing company Viggo in first acquisition in its 12 year history*.
- Garcia, D. C. (2025b). *German search engine Ecosia unveils new climate impact experience for users, shifting away from tree planting | EU-Startups*.
- Garcia, M. A., Liu, R., Nihart, A., El Hayek, E., Castillo, E., Barrozo, E. R., Suter, M. A., Bleske, B., Scott, J., Forsythe, K., Gonzalez-Estrella, J., Aagaard, K. M. & Campen, M. J. (2024). Quantitation and identification of microplastics accumulation in human placental specimens using pyrolysis gas chromatography mass spectrometry. *Toxicological Sciences*, 199(1), 81–88. <https://doi.org/10.1093/toxsci/kfae021>
- Garner, A. J. (2023). Observed increases in North Atlantic tropical cyclone peak intensification rates. *Scientific Reports*, 13(1), 16299. <https://doi.org/10.1038/s41598-023-42669-y>
- Garner, A. J., Samanta, D., Weaver, M. M. & Horton, B. P. (2024). Changes to tropical cyclone trajectories in Southeast Asia under a warming climate. *Npj Climate and Atmospheric Science*, 7(1), 156. <https://doi.org/10.1038/s41612-024-00707-0>
- Gates, B. (2023). *AI is about to completely change how you use computers*.
- Gauci, V., Pangala, S. R., Shenkin, A., Barba, J., Bastviken, D., Figueiredo, V., Gomez, C., Enrich-Prast, A., Sayer, E., Stauffer, T., Welch, B., Elias, D., McNamara, N., Allen, M. & Malhi, Y. (2024). Global atmospheric methane uptake by upland tree woody surfaces. *Nature*, 631(8022), 796–800. <https://doi.org/10.1038/s41586-024-07592-w>
- Gaure, S. & Golombok, R. (2022). True or not true: CO<sub>2</sub> free electricity generation is possible.

- Energy*, 259, 124998. <https://doi.org/10.1016/j.energy.2022.124998>
- Ge Wang. (2019). *Humans in the Loop: The Design of Interactive AI Systems*.
- Ge, Y. & Wei, H. (Jul 20, 2020 06:42 PM). *Update: Alibaba's Ant Marches Toward Dual Listing - Caixin Global*.
- Gelles, D. & Andreoni, M. (2023). The Ocean's Dire Message. *The New York Times*.
- Gemeente Amsterdam. (2022). *The Circular Economy Monitor: An Outline | Website Onderzoek en Statistiek*.
- Gemma Woodward. (2022). *Good riddance ESG? 8 key problems that must be fixed*.
- Generative UI Design: Einstein, Galileo, and the AI Design Process*. (2023).
- Gent, E. (2023). A Cryptocurrency for the Masses or a Universal ID?: Worldcoin Aims to Scan all the World's Eyeballs. *IEEE Spectrum*, 60(1), 42–57. <https://doi.org/10.1109/MSPEC.2023.10006664>
- Geoffrey Supran. (2022). Three Shades of Green (washing). *Algorithmic Transparency Institute*.
- George Geddes. (2019). *S&P Global acquires RobecoSAM's ESG rating business*.
- GHG Protocol. (n.d.). *About Us | GHG Protocol*.
- Giacalone, M., Mattera, R. & Nissi, E. (2022). Well-being analysis of Italian provinces with spatial principal components. *Socio-Economic Planning Sciences*, 84, 101377. <https://doi.org/10.1016/j.seps.2022.101377>
- Giannakos, M. N., Sharma, K., Papavlasopoulou, S., Pappas, I. O. & Kostakos, V. (2020). Fit-bit for learning: Towards capturing the learning experience using wearable sensing. *International Journal of Human-Computer Studies*, 136, 102384. <https://doi.org/10.1016/j.ijhcs.2019.102384>
- Gigerenzer, G. (2008). Why Heuristics Work. *Perspectives on Psychological Science*, 3(1), 20–29. <https://doi.org/10.1111/j.1745-6916.2008.00058.x>
- Gigerenzer, G. & Selten, R. (Eds.). (2002). *Bounded Rationality: The Adaptive Toolbox*. The MIT Press. <https://doi.org/10.7551/mitpress/1654.001.0001>
- Ginn, J. & Sparkman, G. (2024). Can you default to vegan? Plant-based defaults to change dining practices on college campuses. *Journal of Environmental Psychology*, 93, 102226. <https://doi.org/10.1016/j.jenvp.2023.102226>
- Gitcoin Passport — Sybil Defense. Made Simple. [@gitcoinpassport]. (2023). *Why did Gitcoin choose to build @GitcoinPassport as an "aggregator" of anti-Sybil solutions?* □ *Gitcoin Passport Workstream Co-Lead @kevinrolsen explains:* <https://t.co/QYgqp85QBm>.
- Giudice, F. (2020). *WeChat: The impact of the super app on Chinese society*.
- Global Carbon Budget. (2023). *Cumulative CO<sub>2</sub> emissions*.
- Global Web Index. (2017). *98% of Gen Z Own a Smartphone*.
- Gnanasambandam, C., Harrysson, M. & Singh, R. (2022). *Sustainability, privacy, and diversity in tech product development*.
- Goh, S. K., Wong, K. N., McNown, R. & Chen, L.-J. (2023). Long-run macroeconomic consequences of Taiwan's aging labor force: An analysis of policy options. *Journal of Policy Modeling*, 45(1), 121–138. <https://doi.org/10.1016/j.jpolmod.2023.01.006>
- Gold Standard. (2024). *Sustainable Mangrove Management Methodology*.
- Gold, T. B. (1986). *State and society in the Taiwan miracle*. Sharpe.
- Gómez-Baggethun, E., De Groot, R., Lomas, P. L. & Montes, C. (2010). The his-

- tory of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecological Economics*, 69(6), 1209–1218. <https://doi.org/10.1016/j.ecolecon.2009.11.007>
- Good On You. (2023). *Good On You - Sustainable and Ethical Fashion Brand Ratings*.
- Goodfellow, I. J., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A. & Bengio, Y. (2014). *Generative Adversarial Networks*. arXiv. <https://doi.org/10.48550/ARXIV.1406.2661>
- Goodwin, K., Allen, C., Teh, S. H., Li, M., Fry, J., Lenzen, M., Farrelly, S., Leon, C., Lewis, S., Chen, G., Schandl, H. & Wiedmann, T. (2023). Targeting 1.5 degrees with the global carbon footprint of the Australian Capital Territory. *Environmental Science & Policy*, 144, 137–150. <https://doi.org/10.1016/j.envsci.2023.03.006>
- Google. (n.d.). *Our Principles – Google AI*.
- Google. (2021). *Google Sustainability | Helping every day be more sustainable with Google - American Sign Language*.
- Google. (2022). *Google Presents: AI@ '22*.
- Google. (2023). *Carbon Footprint*.
- Google. (2024). *Multimodal prompting with a 44-minute movie | Gemini 1.5 Pro Demo*.
- Google. (2025). *Google Payments Privacy Notice*.
- Google 'airbrushes' out emissions from flying, BBC reveals. (2022). *BBC News*.
- Google Chrome Statistics for 2024*. (2023).
- Google Design. (2019). *Design Is [Speculative] Futures Design Thinking - a new toolkit for preemptive design*.
- Google mostrará por defecto la ruta más 'verde' en su GPS y ordenará los vuelos según su impacto ambiental*. (2021).
- Google & The Oxford Internet Institute. (2022). *The A-Z of AI*.
- Goswami, R. (2023). *Google reportedly building A.I. That offers life advice*.
- goto. (2023). *Transformation for Progress*.
- Gottschlich, D. & Friedrich, B. (2014). The Legacy of Sylvicultura oeconomica. A Critical Reflection on the Notion of Sustainability. *Gaia: Okologische Perspektiven in Natur-, Geistes- Und Wirtschaftswissenschaften*, 23, 23–29.
- Government of Malaysia. (2025). *Data.gov.my*.
- Grab Holdings Limited. (2025). *Grab Reports Fourth Quarter and Full Year 2024 Results*.
- Graham, E. & Fulghum, N. (2024). *Wind and solar overtake EU fossil fuels in the first half of 2024*.
- Grand View Research. (2021). *Real Estate Market Size & Trends Report, 2022-2030*.
- Gratch, J. & Fast, N. J. (2022). The power to harm: AI assistants pave the way to unethical behavior. *Current Opinion in Psychology*, 47, 101382. <https://doi.org/10.1016/j.copsyc.2022.101382>
- Grauer, P. (2017). Taiwan leading the way in ESG disclosure. *Bloomberg L.P.*
- Green Central Banking*. (n.d.).
- Green Finance Institute*. (2023).
- Green Finance Platform. (2020). *Green Fintech Trends for 2020 – What's to Come?*
- Greenfield, P. & @pgreenfielduk. (2021). “I've never said we should plant a trillion trees”:

- What ecopreneur Thomas Crowther did next. *The Guardian*.
- Greenly. (2023). *Greenly Introduces Climate Rating System to Create Transparency in Companies' Decarbonization Progress*.
- Greenpeace 綠色和平. (2024). 從揭露在地汙染，走向國際談判：2024 年綠色和平減塑倡議 跨越疆界.
- Greens EFA. (2023). *Nature vote a success for people, planet & responsible politics*.
- GreensEFA. (2023). #BeyondGrowth - Changing the goal: From GDP growth to social prosperity.
- Greenwald, G. (2015). *No place to hide: Edward Snowden, the NSA, and the U.S. Surveillance state* (First Picador edition). Picador.
- Greylock. (2022). *OpenAI CEO Sam Altman | AI for the Next Era*.
- Grigsby-Toussaint, D. S., Shin, J. C., Reeves, D. M., Beattie, A., Auguste, E. & Jean-Louis, G. (2017). Sleep apps and behavioral constructs: A content analysis. *Preventive Medicine Reports*, 6, 126–129. <https://doi.org/10.1016/j.pmedr.2017.02.018>
- GS1. (n.d.). *EAN/UPC barcodes*.
- Gu, L., Peng, Y., Vigne, S. A. & Wang, Y. (2023). Hidden costs of non-green performance? The impact of air pollution awareness on loan rates for Chinese firms. *Journal of Economic Behavior & Organization*, 213, 233–250. <https://doi.org/10.1016/j.jebo.2023.07.014>
- Guath, M., Stikvoort, B. & Juslin, P. (2022). Nudging for eco-friendly online shopping – Attraction effect curbs price sensitivity. *Journal of Environmental Psychology*, 81, 101821. <https://doi.org/10.1016/j.jenvp.2022.101821>
- Guerrero, M. J., Bedoya, C. L., López, J. D., Daza, J. M. & Isaza, C. (2023). Acoustic animal identification using unsupervised learning. *Methods in Ecology and Evolution*, 14(6), 1500–1514. <https://doi.org/10.1111/2041-210X.14103>
- Guidotti, T. L. (2015). *Health and sustainability: An introduction*. Oxford University Press.
- Guo, X., Wang, L., Wang, X., Li, D., Wang, H., Xu, H., Liu, Y., Kang, R., Chen, Q., Zheng, L., Wu, S., Guo, Z. & Zhang, S. (2024). Discovery and analysis of microplastics in human bone marrow. *Journal of Hazardous Materials*, 477, 135266. <https://doi.org/10.1016/j.jhazmat.2024.135266>
- Gupta, A. H. (2020). An “Electrifying” Economist’s Guide to the Recovery. *The New York Times*.
- Gupta, B. B., Gaurav, A., Panigrahi, P. K. & Arya, V. (2023). Analysis of artificial intelligence-based technologies and approaches on sustainable entrepreneurship. *Technological Forecasting and Social Change*, 186, 122152. <https://doi.org/10.1016/j.techfore.2022.122152>
- Gupta, R. (2023). *Designing for AI: Beyond the chatbot*.
- Gurung, M., expertise:, Financial Journalism, currently:, Financial Journalist and Content Contributor at Investing.com, education:, B.Tech Jaypee University of Engineering and Technology, linkedin logo, See Full Bio. (2025). *Piotroski Score: Definition, Calculation, Importance & Limitations*.
- Gyabaah, D., Awuah, E., Antwi-Agyei, P. & Kuffour, R. A. (2023). Characterization of dumpsite waste of different ages in Ghana. *Heliyon*, 9(5), e15827. <https://doi.org/10.1016/j.heliyon.2023.e15827>
- Gyuriczki, T. & Szládek, B. (2025). *Revolut ESG investing*.

- Haeggman, M., Moberg, F. & Sandin, G. (2018). *Planetary Boundaries analysis for Houdini Sportswear—a Pilot Study: Assessment of company performance from a planetary boundaries perspective*.
- Hagger, M. S. & Hamilton, K. (2025). Progress on theory of planned behavior research: Advances in research synthesis and agenda for future research. *Journal of Behavioral Medicine*, 48(1), 43–56. <https://doi.org/10.1007/s10865-024-00545-8>
- Hagström-Ilievska, K. (Apr. 17, 2025 18:00). *Major step for geothermal energy in Asia - Baseload Capital and Google forge corporate PPA*'.
- Haje Jan Kamps. (2022). *Kuri is an app that wants to reduce your food's carbon footprint*.
- HakkaNews, 2024 台灣網路報告／AI 素養有明顯數位落差. 年齡、教育程度影響大. (2024). 2024 台灣網路報告／AI 素養有明顯數位落差 年齡、教育程度影響大. **客新聞 HakkaNews**.
- Håkon Bogen. (2016). *Is there a global database of all products with EAN 13 barcodes?*
- Haldrup, M., Samson, K. & Laurien, T. (2022). Designing for Multispecies Commons: Ecologies and Collaborations in Participatory Design. *Proceedings of the Participatory Design Conference 2022 - Volume 2*, 14–19. <https://doi.org/10.1145/3537797.3537801>
- Hall, I. (2024). *HK breaks new ground with multi-currency digital green bonds issuance*.
- Han, W. & Chen, W. Y. (2022). Embedding nature-based solutions into the social cost of carbon. *Environment International*, 167, 107431. <https://doi.org/10.1016/j.envint.2022.107431>
- Handa, K., Tamkin, A., McCain, M., Huang, S., Durmus, E., Heck, S., Mueller, J., Hong, J., Ritchie, S., Belonax, T., Troy, K. K., Amodei, D., Kaplan, J., Clark, J. & Ganguli, D. (2025). *Which Economic Tasks are Performed with AI? Evidence from Millions of Claude Conversations*. arXiv. <https://doi.org/10.48550/ARXIV.2503.04761>
- Hankewitz, S. (2021). *Estonian fintech company Fairown secures a €4.2 million seed round, attempts to reduce waste*.
- Hannah Devlin. (2022). *Cancer breakthrough is a “wake-up” call on danger of air pollution*.
- Hannah Ritchie. (2020). *Sector by sector: Where do global greenhouse gas emissions come from?*
- Hannß Carl von Carlowitz. (1713). *Sylvicultura oeconomica, oder haußwirthliche Nachricht und Naturmäßige Anweisung zur wilden Baum-Zucht*. Braun.
- Hans van Leeuwen. (2023). *Modern slavery: Grace Forrest's Walk Free launches Global Slavery Index*.
- Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., Thau, D., Stehman, S. V., Goetz, S. J., Loveland, T. R., Kommareddy, A., Egorov, A., Chini, L., Justice, C. O. & Townshend, J. R. G. (2013). High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, 342(6160), 850–853. <https://doi.org/10.1126/science.1244693>
- Hardin, G. (1968). The Tragedy of the Commons: The population problem has no technical solution; it requires a fundamental extension in morality. *Science*, 162(3859), 1243–1248. <https://doi.org/10.1126/science.162.3859.1243>
- Harding, E. P. (2019). *ESG futures catching on in Europe | FIA*.
- harrisson, thomas. (2019). *Analysis: Why the UK's CO2 emissions have fallen 38% since 1990*.
- Harvard Advanced Leadership Initiative. (2021). *Human-AI Interaction: From Artificial Intelligence to Human Intelligence Augmentation*.
- Harvey, C. (2025). *Three NASA Climate Satellites Are Dying. There's No Plan to Replace Them*.

- Hassoun, A., Jagtap, S., Trollman, H., Garcia-Garcia, G., Abdullah, N. A., Goksen, G., Bader, F., Ozogul, F., Barba, F. J., Cropotova, J., Munekata, P. E. S. & Lorenzo, J. M. (2023). Food processing 4.0: Current and future developments spurred by the fourth industrial revolution. *Food Control*, 145, 109507. <https://doi.org/10.1016/j.foodcont.2022.109507>
- Haugeland, I. K. F., Følstad, A., Taylor, C. & Bjørkli, C. A. (2022). Understanding the user experience of customer service chatbots: An experimental study of chatbot interaction design. *International Journal of Human-Computer Studies*, 161, 102788. <https://doi.org/10.1016/j.ijhcs.2022.102788>
- Hausfather, Z. & Peters, G. P. (2020). Emissions – the “business as usual” story is misleading. *Nature*, 577(7792), 618–620. <https://doi.org/10.1038/d41586-020-00177-3>
- Hawkins, E. & Jones, Phil. D. (2013). On increasing global temperatures: 75 years after Callendar: On increasing global temperatures. *Quarterly Journal of the Royal Meteorological Society*, 139(677), 1961–1963. <https://doi.org/10.1002/qj.2178>
- Health. Powered by Ada.* (n.d.).
- Heath, A. (2021). *The rise of the super app*.
- Hedberg, A. & Šipka, S. (2021). Toward a circular economy: The role of digitalization. *One Earth* (Cambridge, Mass.), 4(6), 783–785. <https://doi.org/10.1016/j.oneear.2021.05.020>
- Hedge. (2023). *Hedge - Make a hedge fund with your friends*.
- Heidel, S. & Handa, N. (2025). *MCP, reasoning, and multiple Responses API tools can work together* [Tweet].
- Helbling, T. (2012). *Externalities: Prices Do Not Capture All Costs*. IMF.
- Helen Davidson & Chi Hui Lin. (2022). *Classical trash: How Taiwan’s musical bin lorries transformed “garbage island”*.
- Hencz, A. (2022). *Neri Oxman: Material Ecology & Nature-Centric Design*.
- Hendrycks, D., Burns, C., Basart, S., Zou, A., Mazeika, M., Song, D. & Steinhardt, J. (2020). *Measuring Massive Multitask Language Understanding*. <https://doi.org/10.48550/ARXIV.2009.03300>
- Hermsen, S., Verbiest, V., Buijs, M. & Wentink, E. (2023). Perceived Use Cases, Barriers, and Requirements for a Smart Health-Tracking Toilet Seat: Qualitative Focus Group Study. *JMIR Human Factors*, 10, e44850. <https://doi.org/10.2196/44850>
- Hern, A. (2024). TechScape: What we learned from the global AI summit in South Korea. *The Guardian*.
- Hernandez-Santin, C., Amati, M., Bekessy, S. & Desha, C. (2023). Integrating biodiversity as a non-human stakeholder within urban development. *Landscape and Urban Planning*, 232, 104678. <https://doi.org/10.1016/j.landurbplan.2022.104678>
- Hester M. Peirce. (2022). *SEC.gov | Statement on Settlement with BlockFi Lending LLC*.
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., Wray, B., Mellor, C. & Van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: A global survey. *The Lancet Planetary Health*, 5(12), e863–e873. [https://doi.org/10.1016/S2542-5196\(21\)00278-3](https://doi.org/10.1016/S2542-5196(21)00278-3)
- HIITV. (2021). *Wojciech Szpankowski: Emerging Frontiers of Science of Information*.
- Hilborn, R., Amoroso, R., Collie, J., Hiddink, J. G., Kaiser, M. J., Mazor, T., McConnaughey, R. A., Parma, A. M., Pitcher, C. R., Sciberras, M. & Suuronen, P. (2023). Evaluating the sus-

- tainability and environmental impacts of trawling compared to other food production systems. *ICES Journal of Marine Science*, 80(6), 1567–1579. <https://doi.org/10.1093/icesjms/fsad115>
- Hildebrand, C. & Bergner, A. (2021). Conversational robo advisors as surrogates of trust: On-boarding experience, firm perception, and consumer financial decision making. *Journal of the Academy of Marketing Science*, 49(4), 659–676. <https://doi.org/10.1007/s11747-020-00753-z>
- Hines, K. (2023a). *OpenAI Files Trademark Application For GPT-5*.
- Hines, K. (2023b). *Perplexity Announces AI Search Updates And Code Llama Chat*.
- Hintzy, L. (2025). *LINE's Evolution into a Super App: Web3, Token Economy, and Future Growth | Meet Global*.
- Hioe, B. (2019). “*Fridays for Future*” Protest Calling for Environmental Action Held Outside Legislative Yuan.
- Hirsh, S. (2021). *Ecosia Founder Christian Kroll on How His Eco-Friendly Search Engine Fights Climate Change (Exclusive)*.
- HKTDC Research. (2022). *France Expands Producer Responsibility to Certain Textile Items; Recommends Limiting Hazardous Chemicals in School Supplies*.
- HM Treasury. (2020). *Chancellor sets out ambition for future of UK financial services*.
- Ho, S. (2019). *Asian Investors Are Increasingly Looking To Do Good But 'Impact Washing' Remains A Concern*.
- Hoang, D. (2022). *Enter Dynamic Island, a major hint at Apple’s Extended Reality (XR) strategy*.
- Hoffmann, J., Bauer, P., Sandu, I., Wedi, N., Geenen, T. & Thiemert, D. (2023). Destination Earth – A digital twin in support of climate services. *Climate Services*, 30, 100394. <https://doi.org/10.1016/j.cliser.2023.100394>
- Hoffmann, S., Lasarov, W., Reimers, H. & Trabandt, M. (2024). Carbon footprint tracking apps. Does feedback help reduce carbon emissions? *Journal of Cleaner Production*, 434, 139981. <https://doi.org/10.1016/j.jclepro.2023.139981>
- Hoikkala, H. (2019). *H&M CEO Sees “Terrible” Fallout as Consumer Shaming Spreads*.
- Holbrook, J. (2018). *Human-Centered Machine Learning*.
- Holger, D. (2019). Norway’s Sovereign-Wealth Fund Boosts Renewable Energy, Divests Fossil Fuels. *Wall Street Journal*.
- Holzinger, A., Keibliger, K., Holub, P., Zatloukal, K. & Müller, H. (2023). AI for life: Trends in artificial intelligence for biotechnology. *New Biotechnology*, 74, 16–24. <https://doi.org/10.1016/j.nbt.2023.02.001>
- Holzinger, A., Malle, B., Saranti, A. & Pfeifer, B. (2021). Towards multi-modal causability with Graph Neural Networks enabling information fusion for explainable AI. *Information Fusion*, 71, 28–37. <https://doi.org/10.1016/j.inffus.2021.01.008>
- Home - Lark Health*. (n.d.).
- Honton, J. (2022). *The Forgotten Father of Climatology*.
- Horwitz, S. (2017). *There’s a Hole in the Middle of Doughnut Economics | Steven Horwitz*.
- Houdini. (2018). *Planetary Boundaries Assessment*.
- Houdini Sportswear. (2024). *2024 Planetary Boundaries Assessment | Houdini Sportswear*.
- House of Commons. (2002). *Environmental Audit - Second Report*.
- How Gen Z and millennials spend their money. (2023). *The Economist*.

- Howard, J., McLeod, E., Thomas, S., Eastwood, E., Fox, M., Wenzel, L. & Pidgeon, E. (2017). The potential to integrate blue carbon into MPA design and management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 27, 100–115. <https://doi.org/10.1002/aqc.2809>
- Hsu, J. L., Lu, H. C.-H. & Chen, C. M.-L. (2014). The effect of family beef taboos on beef consumption on young Taiwanese adults. *Food Quality and Preference*, 34, 45–49. <https://doi.org/10.1016/j.foodqual.2013.12.008>
- Hsu, P.-C., Macagga, R. A. T., Lu, C.-Y. & Lo, D. Y.-J. (2024). Investigation of the Kuroshio-coastal current interaction and marine heatwave trends in the coral habitats of Northeastern Taiwan. *Regional Studies in Marine Science*, 71, 103431. <https://doi.org/10.1016/j.rsma.2024.103431>
- Hsu, S.-C., Hsieh, H.-L., Chen, C.-P., Tseng, C.-M., Huang, S.-C., Huang, C.-H., Huang, Y.-T., Radashevsky, V. & Lin, S.-H. (2011). Tungsten and other heavy metal contamination in aquatic environments receiving wastewater from semiconductor manufacturing. *Journal of Hazardous Materials*, 189(1-2), 193–202. <https://doi.org/10.1016/j.jhazmat.2011.02.020>
- Hu, C. J., Garcia, M. A., Nihart, A., Liu, R., Yin, L., Adolphi, N., Gallego, D. F., Kang, H., Campen, M. J. & Yu, X. (2024). Microplastic presence in dog and human testis and its potential association with sperm count and weights of testis and epididymis. *Toxicological Sciences*, 200(2), 235–240. <https://doi.org/10.1093/toxsci/kfae060>
- Huang, R., Lv, G. & Li, X. (2020). Taiwan has shifted to being a net CO<sub>2</sub> exporter since the mid-1990s. *Journal of Environmental Management*, 264, 110484. <https://doi.org/10.1016/j.jenvman.2020.110484>
- Huang, Y.-C., Zhu, W.-L., Chang, C.-K., Gavahian, M., Chen, Y. & Hsieh, C.-W. (2025). *Debunking the 'Local is Greener' Myth: Life Cycle Assessment of Local vs. Imported Ingredients in Ice Cream Production*. In Review. <https://doi.org/10.21203/rs.3.rs-6526193/v1>
- Hui, D., Zipser, D., Shi, J. & Chen, C. (2025). *Chinese consumption amid the new reality*.
- Hung, C.-C., Hsieh, H.-H., Chou, W.-C., Liu, E.-C., Chow, C. H., Chang, Y., Lee, T.-M., Santschi, P. H., Ranatunga, R. R. M. K. P., Bacosa, H. P. & Shih, Y.-Y. (2024). Assessing CO<sub>2</sub> sources and sinks in and around Taiwan: Implication for achieving regional carbon neutrality by 2050. *Marine Pollution Bulletin*, 206, 116664. <https://doi.org/10.1016/j.marpolbul.2024.116664>
- Hungerford, O. (2025). *Modelcontextprotocol/servers: Model Context Protocol Servers*.
- Hupkes, T. & Hedman, A. (2022). Shifting towards non-anthropocentrism: In dialogue with speculative design futures. *Futures*, 140, 102950. <https://doi.org/10.1016/j.futures.2022.102950>
- Hyde, L. (2006). *The gift: How the creative spirit transforms the world*. Canongate.
- Ian Bezek. (2021). *It's Time Everyone Knows What DAOs Are. They May Disrupt Exchanges and Corporations*.
- Ianole, R. & Cornescu, V. (2013). Overconsumption Society through the Looking-glass of Behavioral Economics. *Procedia Economics and Finance*, 6, 66–72. [https://doi.org/10.1016/S2212-5671\(13\)00115-9](https://doi.org/10.1016/S2212-5671(13)00115-9)
- IBISA Network – Enabling the Next Generation of Insurance for Agriculture*. (n.d.).
- I-Cheng Yeh. (2009). *Default of Credit Card Clients*. UCI Machine Learning Repository. <https://doi.org/10.24432/C55S3H>

- ICVCM. (2025). *The Voluntary Carbon Market explore*.
- IEA. (2022). *Global Energy Review: CO2 Emissions in 2021*.
- IEA. (2023a). *The world's top 1% of emitters produce over 1000 times more CO2 than the bottom 1% – Analysis*.
- IEA. (2023b). *Tracking Clean Energy Progress 2023*.
- IEA. (2024). *Electricity Mid-Year Update*.
- iGenius. (2020). *Let's talk about sustainable AI*.
- Igini, M. (2024a). *Just 2.8% of the World's Ocean Is 'Effectively' Protected: Report*.
- Igini, M. (2024b). *The Environmental Impact of Online Shopping*.
- Ilya Sutskever. (2018). *Ilya Sutskever at AI Frontiers : Progress towards the OpenAI mission*.
- IMF. (2023a). *World Economic Outlook (April 2023) - GDP, current prices*. International Monetary Fund.
- IMF. (2023b). *World Economic Outlook (April 2023) - GDP growth*. International Monetary Fund.
- imperfectidealist. (2020). *Sustainable or Greenwashing? How to Evaluate Fashion Brands*.
- Implement Consulting Group. (2022). *How the digital sector is supporting climate action - An Implement Consulting Group study commissioned by Google*.
- Iñarra, B., San Martin, D., Ramos, S., Cidad, M., Estévez, A., Fenollosa, R., Martinez, J. M., Ferdinando, A., De Smet, A. M. & Zufia, J. (2022). Ecodesign of new circular economy scheme for Brewer's side streams. *Sustainable Chemistry and Pharmacy*, 28, 100727. <https://doi.org/10.1016/j.scp.2022.100727>
- Indices, S. D. J. (Oct 03, 2016, 08:30 ET). *S&P Dow Jones Indices Acquires Trucost*.
- Indrek Kald. (2022). *Eesti IT-firma automatiseris Flowiti ja PwC toel süsiniku jalajälje kaardistamise. Sääst 90% - ITuudised*.
- Infinit Fiber. (2023). *Infinit Fiber*.
- Innocent opens £200m carbon-neutral factory in Rotterdam - Investment Monitor*. (n.d.).
- Inside Google's regenerative agriculture play | Greenbiz*. (2021).
- Instant Gratification for Collective Awareness and Sustainable Consumerism*. (2022).
- Institute, E. (2023). *Energy system struggles in face of geopolitical and environmental crises*.
- Institute for Climate and Sustainable Growth. (2022). *The Air Quality Life Index (AQLI)*. The University of Chicago.
- Institute of International and European Affairs (IIEA). (2023). *Can the World Still Exit the Climate Casino?*
- Interaction Design – How to Evaluate Interaction Costs and Improve User Experience*. (2021).
- Interactive Brokers. (2025a). *Commissions Stock Asia-Pacific*.
- Interactive Brokers. (2025b). *IMPACT Features*.
- Intercontinental Exchange. (2025). *ICE MSCI Climate & ESG Index Derivatives*.
- International carbon market*. (n.d.).
- International Labour Organization. (2024). *Profits and poverty: The economics of forced labour*.
- International Trade Centre. (2022). *StandardsMap*.
- Investing.com. (2024). *Carbon Emissions Futures Price Today*.
- Investment Clubs and Collectives | Deprecation FAQ*. (n.d.).
- Irene Zhao. (2022). *Here's why @0xIreneDao is not a fluke or as some may have it, an Asian*

*Fetish. They are missing the real deal. Something bigger underlies the concept that is behind the IreneDao. □□□ Here's the story:*

- Irwin, R., Short, I., Mohammadrezaei, M. & Dhubháin, Á. N. (2023). Increasing tree cover on Irish dairy and drystock farms: The main attitudes, influential bodies and barriers that affect agroforestry uptake. *Environmental Science & Policy*, 146, 76–89. <https://doi.org/10.1016/j.envsci.2023.03.022>
- Is blood sugar monitoring without diabetes worthwhile?* (2021).
- Isabella Ghassemi Smith. (2019). Interview: Daniel Baeriswyl, CEO of Magic Carpet | SeedLegals.
- Ishiguro, K. (2021). *Klara and the sun* (First edition). Alfred A. Knopf.
- ISO. (2019). *Human-centred design for interactive systems*.
- Isotherms.simply.earth | Average temperatures of the world in 1838.* (2023).
- IUCN. (2024). *The IUCN Red List of Threatened Species. Version 2024-1*.
- Ivanova, D., Barrett, J., Wiedenhofer, D., Macura, B., Callaghan, M. & Creutzig, F. (2020). Quantifying the potential for climate change mitigation of consumption options. *Environmental Research Letters*, 15(9), 093001. <https://doi.org/10.1088/1748-9326/ab8589>
- Ivanova, D., Stadler, K., Steen-Olsen, K., Wood, R., Vita, G., Tukker, A. & Hertwich, E. G. (2016). Environmental Impact Assessment of Household Consumption. *Journal of Industrial Ecology*, 20(3), 526–536. <https://doi.org/10.1111/jiec.12371>
- Ivy Yin. (2023). Commodities 2023: China's carbon market to slow in 2023 as energy security, economy take priority. *S&P Global Commodity Insights*.
- IxDF. (n.d.). *What is Interaction Design?*
- Jackson, T. (1996). *Material concerns: Pollution, profit, and quality of life*. SEI, Stockholm Environment Institute ; Routledge.
- Jackson, T. (2009). *Prosperity without growth: Economics for a finite planet*. Earthscan.
- Jackson, T. (2017). *Prosperity without growth: Foundations for the economy of tomorrow* (Second Edition). Routledge, Taylor & Francis Group.
- Jacques Vernier. (2021). Extended producer responsibility (EPR) in France. *Field Actions Science Reports*.
- Jacquet, J. & Pauly, D. (2022). Reimagining sustainable fisheries. *PLOS Biology*, 20(10), e3001829. <https://doi.org/10.1371/journal.pbio.3001829>
- Jahau Lewis Chen, Li-Hsing Shih, Jyh-Shing Yang & Chen, T. (2005). Eco-design Activities in Taiwan. *2005 4th International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, 535–538. <https://doi.org/10.1109/ECODIM.2005.1619289>
- James Phillipps. (2022). *Is ESG in crisis or just misunderstood?*
- Jan Leike & Ilya Sutskever. (2023). *Introducing Superalignment*.
- Jang, K., Kajale, S. N., Joy, B. C., Bono, D. C., Neltner, B. & Sarkar, D. (2025). A wearable device for continuous monitoring of circulating cells at single-cell resolution. *Npj Biosensing*, 2(1), 10. <https://doi.org/10.1038/s44328-025-00032-3>
- Jarovsky, L. (2022a). *Dark Patterns in AI: Privacy Implications*.
- Jarovsky, L. (2022b). *You Are Probably Doing Privacy UX Wrong*.
- Jarvis, M. (2025). *Wearable device tracks individual cells in the bloodstream in real time*.
- Jason Jacobs. (2019). Episode 4: Sanchali Pal, Joro.

- Jeblick, K., Schachtner, B., Dexl, J., Mittermeier, A., Stüber, A. T., Topalis, J., Weber, T., Wesp, P., Sabel, B., Ricke, J. & Ingrisch, M. (2022). *ChatGPT Makes Medicine Easy to Swallow: An Exploratory Case Study on Simplified Radiology Reports*. <https://doi.org/10.48550/ARXIV.2212.14882>
- Jeff Benson. (2022). *China Releases Digital Yuan Wallet as Bitcoin Crackdown Continues*.
- Jeni Miles. (2022). *Becoming a Sustainability-Aware App or Game*.
- Jensen, S. F., Kristensen, J. H., Adamsen, S., Christensen, A. & Waehrens, B. V. (2023). Digital product passports for a circular economy: Data needs for product life cycle decision-making. *Sustainable Production and Consumption*, 37, 242–255. <https://doi.org/10.1016/j.spc.2023.02.021>
- Jerrett, M., Jina, A. S. & Marlier, M. E. (2022). Up in smoke: California's greenhouse gas reductions could be wiped out by 2020 wildfires. *Environmental Pollution*, 310, 119888. <https://doi.org/10.1016/j.envpol.2022.119888>
- Jessop, S., Twidale, S. & Jessop, S. (2024). Google buys stake in Taiwan solar power firm owned by BlackRock. *Reuters*.
- Jia, W., Wang, W. & Zhang, Z. (2023). From simple digital twin to complex digital twin part II: Multi-scenario applications of digital twin shop floor. *Advanced Engineering Informatics*, 56, 101915. <https://doi.org/10.1016/j.aei.2023.101915>
- Jiang, Q., Zhang, Y. & Pian, W. (2022). Chatbot as an emergency exist: Mediated empathy for resilience via human-AI interaction during the COVID-19 pandemic. *Information Processing & Management*, 59(6), 103074. <https://doi.org/10.1016/j.ipm.2022.103074>
- Jiang, Y. (2023). □How have Covid and economic downturn shaped Chinese consumer spending in 2023 | Following the yuan.
- Jim Boehm, Jan Shelly Brown, Lama Sabbagh & Karim Thomas. (2021). *Better risk controls to accelerate digital transformation*.
- Jing, Z. T. C. (2025). *Meituan (03690) 2024 financial report: Annual revenue of 337.6 billion yuan, increasing investment to promote a win-win ecosystem*.
- Joe Blair. (2024). *Generative UI: The new front end of the internet? — Joe Blair*.
- John Fullerton. (2011). *John Fullerton: When Growth Bumps Into the Biosphere*.
- John Fullerton. (2022). *Regenerative Business Part 1 | John Fullerton at Planetiers World Gathering 2022*.
- John Ssenkeezi. (2022). *I've been invited to vote at @Apple's 2022 Annual Meeting as a shareholder. Yes, you read that right! You can own shares in any company listed on @NYSE from as little as \$1 with @chippercashapp*. <https://t.co/dNr8UPb7ND>.
- Johnson, S. (2025). ESG fund outflows hit record as sustainable investing backlash grows. *Financial Times*.
- Jones, A. & Steffen, W. (2019). *Our climate is like reckless banking before the crash – it's time to talk about near-Term collapse*.
- Jordan G. Teicher. (2021). *Doughnut Economics Has a Hole at Its Core*.
- Josh Lovejoy. (n.d.). *The UX of AI*.
- Joyce, C. (2024). *The rise of Generative AI-driven design patterns*.
- Justin Baker. (2018). *Red Routes — Critical Design Paths That Make or Break Your App*.
- Justine Calma. (Oct 6, 2021, 10:01 AM GMT+3). *Google launches new features to help users*

- shrink their carbon footprints - *The Verge*.
- Käärmann, K. (2018). *Why does TransferWise have fees?*
- Kaiser, M., Bernauer, M., Sunstein, C. R. & Reisch, L. A. (2020). The power of green defaults: The impact of regional variation of opt-out tariffs on green energy demand in Germany. *Eco-logical Economics*, 174, 106685. <https://doi.org/10.1016/j.ecolecon.2020.106685>
- Kaklauskas, A., Abraham, A., Kaklauskiene, L., Ubarte, I., Amaratunga, D., Lill, I., Milevicius, V. & Kaklauskaite, U. (2023). Synergy of climate change with country success and city quality of life. *Scientific Reports*, 13(1), 7872. <https://doi.org/10.1038/s41598-023-35133-4>
- Kalle, K., Arro G., Kriipsalu M., McQuibban J., Kranjc J., Žnajder Ž. & Kenk K. (2022). *Zero Waste Training Handbook* (K. Kalle, Ed.). BEZWA (Building a European Zero Waste Academy).
- Kamei, M., Wangmo, T., Leibowicz, B. D. & Nishioka, S. (2021). Urbanization, carbon neutrality, and Gross National Happiness: Sustainable development pathways for Bhutan. *Cities (London, England)*, 111, 102972. <https://doi.org/10.1016/j.cities.2020.102972>
- Kantar Worldpanel. (2024). *FMCG 消費者四項價☒趨勢驅動市場：便利、健康、美妝與寵物陪伴 - Taiwanese*.
- Kanza, S., Bird, C. L., Niranjan, M., McNeill, W. & Frey, J. G. (2021). The AI for Scientific Discovery Network+. *Patterns*, 2(1), 100162. <https://doi.org/10.1016/j.patter.2020.100162>
- Kaplan, J., McCandlish, S., Henighan, T., Brown, T. B., Chess, B., Child, R., Gray, S., Radford, A., Wu, J. & Amodei, D. (2020). *Scaling Laws for Neural Language Models*. arXiv. <https://doi.org/10.48550/ARXIV.2001.08361>
- Kara Manke. (2022). *ChatGPT architect, Berkeley alum John Schulman on his journey with AI*.
- Karatzas, S., Kapoulas, A. & Priporas, C. V. (2019). Consumers' Perceptions on Complexity and Prospects of Ethical Luxury: Qualitative Insights from Taiwan. *Australasian Marketing Journal*, 27(4), 224–232. <https://doi.org/10.1016/j.ausmj.2019.08.001>
- Karila, T. (2024). *Infinitied Fiber project update: Supply chain readiness and environmental permit process in focus - Infinitied Fiber*.
- Karpus, J., Krüger, A., Verba, J. T., Bahrami, B. & Deroy, O. (2021). Algorithm exploitation: Humans are keen to exploit benevolent AI. *iScience*, 24(6), 102679. <https://doi.org/10.1016/j.isci.2021.102679>
- Kate Brandt & Matt Brittin. (2022). *Google's climate action in Europe*.
- Kate Moran. (2016). *Designing for Young Adults (Ages 18–25)*.
- Kate Moran & Sarah Gibbons. (2024). *Generative UI and Outcome-Oriented Design*.
- Katie Gustafson. (2022). *Why tracing seafood from sea to plate is the next frontier in sustainability | Stories | WWF*.
- Katz, M. L. & Shapiro, C. (1985). Network Externalities, Competition, and Compatibility. *The American Economic Review*, 75(3), 424–440.
- Kazanins, J. (2024). *Why Cash App Pay is a big deal for Block*.
- Kecht, C., Egger, A., Kratsch, W. & Röglinger, M. (2023). Quantifying chatbots' ability to learn business processes. *Information Systems*, 102176. <https://doi.org/10.1016/j.is.2023.102176>
- Keeble, B. R. (1988). The Brundtland Report: 'Our Common Future'. *Medicine and War*, 4(1), 17–25.
- Keeling, R. F. & Keeling, C. D. (2017). *Atmospheric Monthly In Situ CO<sub>2</sub> Data - Mauna Loa*

- Observatory, Hawaii. In Scripps CO2 Program Data.* UC San Diego Library Digital Collections. <https://doi.org/10.6075/J08W3BHW>
- Kelly, S. M. (2024). *Apple's new China problem: ChatGPT is banned there | CNN Business*.
- Kemp, L., Xu, C., Depledge, J., Ebi, K. L., Gibbins, G., Kohler, T. A., Rockström, J., Scheffer, M., Schellnhuber, H. J., Steffen, W. & Lenton, T. M. (2022). Climate Endgame: Exploring catastrophic climate change scenarios. *Proceedings of the National Academy of Sciences*, 119(34), e2108146119. <https://doi.org/10.1073/pnas.2108146119>
- Kende, J. (2023). *The difference between Product Design and Growth Design*.
- Kenton, W. (2020). *MiFID II*.
- Kenton, W. (2023). *What Is a Layaway Plan? History, and Which Companies Offer Them*.
- Kenton, W. (2024). *Fast-Moving Consumer Goods (FMCG) Industry: Definition, Types, and Profitability*.
- Ketcham, C. (2023). *When Idiot Savants Do Climate Economics*.
- Keyßer, L. T. & Lenzen, M. (2021). 1.5 °C degrowth scenarios suggest the need for new mitigation pathways. *Nature Communications*, 12(1), 2676. <https://doi.org/10.1038/s41467-021-22884-9>
- Khosravi, H., Shum, S. B., Chen, G., Conati, C., Tsai, Y.-S., Kay, J., Knight, S., Martinez-Maldonado, R., Sadiq, S. & Gašević, D. (2022). Explainable Artificial Intelligence in education. *Computers and Education: Artificial Intelligence*, 3, 100074. <https://doi.org/10.1016/j.caai.2022.100074>
- Kickstart your investment journey.* (2023).
- Kiessling, T., Hinzmann, M., Mederake, L., Dittmann, S., Brennecke, D., Böhm-Beck, M., Knickmeier, K. & Thiel, M. (2023). What potential does the EU Single-Use Plastics Directive have for reducing plastic pollution at coastlines and riversides? An evaluation based on citizen science data. *Waste Management*, 164, 106–118. <https://doi.org/10.1016/j.wasman.2023.03.042>
- Kim, B. (2023). *Do You Have Lightning In a Bottle? How to Benchmark Your Social App*.
- Kim, D. E. & Lim, S. S. (2024). Economic impacts of the European Union carding system on global fish trade. *Marine Policy*, 165, 106208. <https://doi.org/10.1016/j.marpol.2024.106208>
- King, M. R. N., Timms, P. D. & Mountney, S. (2023). A proposed universal definition of a Digital Product Passport Ecosystem (DPPE): Worldviews, discrete capabilities, stakeholder requirements and concerns. *Journal of Cleaner Production*, 384, 135538. <https://doi.org/10.1016/j.jclepro.2022.135538>
- Kira Taylor. (2021). *EU plan puts spotlight on carbon sinks to tackle climate change*.
- Kirakosian, M. (Noveber 16, 2020). *LOIM launches circular bioeconomy fund inspired by Prince of Wales*.
- Kirchherr, J., Reike, D. & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Kitano, Y. (2024). *Hong Kong Harnesses Blockchain in Green Finance Push*.
- Kjaergard, B., Land, B. & Bransholm Pedersen, K. (2014). Health and sustainability. *Health Promotion International*, 29(3), 558–568. <https://doi.org/10.1093/heapro/das071>
- KlimaDAO. (2023a). *An open call for alternative carbon standards*.

- KlimaDAO*. (2023b).
- Klinglmayr, J., Bergmair, B., Klaffenböck, M. A., Hörmann, LeanderB. & Pournaras, E. (2017). Sustainable Consumerism via Context-Aware Shopping: *International Journal of Distributed Systems and Technologies*, 8(4), 54–72. <https://doi.org/10.4018/IJDST.2017100104>
- Klinglmayr, J., Bergmair, B. & Pournaras, E. (2016). Sustainable Consumerism via Self-Regulation. *2016 IEEE 1st International Workshops on Foundations and Applications of Self\* Systems (FAS\*W)*, 138–142. <https://doi.org/10.1109/FAS-W.2016.40>
- Klosterman, S., Masson-Forsythe, M., Keenan, T. F., Guzder-Williams, B. P., Staccone, A., Piffer, P. R. & Hughes, M. J. (2022, December). Mapping the global potential of reforestation projects using ground observations, remote sensing, and machine learning. *Fall Meeting 2022*.
- Knight, L., Tate, W., Carnovale, S., Di Mauro, C., Bals, L., Caniato, F., Gualandris, J., Johnsen, T., Matopoulos, A., Meehan, J., Miemczyk, J., Patrucco, A. S., Schoenherr, T., Selviaridis, K., Touboulic, A. & Wagner, S. M. (2022). Future business and the role of purchasing and supply management: Opportunities for “business-not-as-usual” PSM research. *Journal of Purchasing and Supply Management*, 28(1), 100753. <https://doi.org/10.1016/j.pursup.2022.100753>
- Kobetz, R. (2023). *Decoding the future: The evolution of intelligent interfaces*.
- Koch, N. (2022). Opinion | Arizona Is in a Race to the Bottom of Its Water Wells, With Saudi Arabia’s Help. *The New York Times*.
- Kocijan, V., Davis, E., Lukasiewicz, T., Marcus, G. & Morgenstern, L. (2022). *The Defeat of the Winograd Schema Challenge*. <https://doi.org/10.48550/ARXIV.2201.02387>
- Köhler, A., Watson, D., Trzepacz, S., Löw, C., Liu, R., Danneck, J., Konstantas, A., Donatello, S. & Faraca, G. (2021). *Circular economy perspectives in the EU textile sector: Final report*. Publications Office of the European Union.
- Kohli, T. (2019). *How designers can help deal with climate change*.
- Koike, Y. (2018). *Tokyo and Paris: Global leaders in clean air, clean cities and climate action*.
- Kolko, J. & Connors, C. (2010). *Thoughts on interaction design: A collection of reflections*. Morgan Kaufmann.
- Kommenda, N., Nevitt, C., Terazono, E., Joiner, S. & Davies, E. (2022). *Would carbon food labels change the way you shop?*
- Konrad, A. (n.d.). *A16z Crypto Leads \$14 Million Bet On Rye, New Web3 Commerce Startup From Justin Kan*.
- Kornek, U., Klenert, D., Edenhofer, O. & Fleurbaey, M. (2021). The social cost of carbon and inequality: When local redistribution shapes global carbon prices. *Journal of Environmental Economics and Management*, 107, 102450. <https://doi.org/10.1016/j.jeem.2021.102450>
- Korosec, K. (2021). *Amazon taps \$2B climate fund to invest in three more startups*.
- Korzhova, V. (2020). *Sustainable Product Management with Grover: Advancing Circular Economy*.
- Kosová, E., James, K., MacArthur, M., Vovides, A., Peters, J., Metcalfe, D., Roberts, K. & Naylor, L. A. (2023). The BioGeo Ecotile: Improving biodiversity on coastal defences using a multiscale, multispecies eco-engineering design. *Ecological Engineering*, 188, 106881. <https://doi.org/10.1016/j.ecoleng.2022.106881>

- Kovacic, Z. & Giampietro, M. (2015). Beyond “beyond GDP indicators:” The need for reflexivity in science for governance. *Ecological Complexity*, 21, 53–61. <https://doi.org/10.1016/j.ecocom.2014.11.007>
- KraneShares. (2020). *Ant Group 101*.
- Kreuk, F., Synnaeve, G., Polyak, A., Singer, U., Défossez, A., Copet, J., Parikh, D., Taigman, Y. & Adi, Y. (2022). *AudioGen: Textually Guided Audio Generation*. <https://doi.org/10.48550/ARXIV.2209.15352>
- Kristina Kostap. (2022). LEVITA SÕNA: Uus rakendus pakub kvaliteetset toitu poole odavama hinnaga. *Postimees*.
- Krügel, S., Ostermaier, A. & Uhl, M. (2023). Algorithms as partners in crime: A lesson in ethics by design. *Computers in Human Behavior*, 138, 107483. <https://doi.org/10.1016/j.chb.2022.107483>
- Kuch, A. (2022). *Building resilience: The impact of the circular economy on global trade and supply chains*.
- Kühne, K., Bartsch, N., Tate, R. D., Higson, J. & Habet, A. (2022). “Carbon Bombs” - Mapping key fossil fuel projects. *Energy Policy*, 166, 112950. <https://doi.org/10.1016/j.enpol.2022.112950>
- Kunz, N., Chesney, T., Trautrimas, A. & Gold, S. (2023). Adoption and transferability of joint interventions to fight modern slavery in food supply chains. *International Journal of Production Economics*, 258, 108809. <https://doi.org/10.1016/j.ijpe.2023.108809>
- Kuo-Hua Chen. (2019). Transforming Environmental Values for a Younger Generation in Taiwan: A Participatory Action Approach to Curriculum Design. *Journal of Futures Studies*, 23(4). [https://doi.org/10.6531/JFS.201906\\_23\(4\).0008](https://doi.org/10.6531/JFS.201906_23(4).0008)
- Kyle Wiggers. (2022). *Makersite lands \$18M to help companies manage product supply chains*.
- L, J. (2025a). *China’s Renewable Energy Boom: A Record-Breaking Shift or Still Chained to Coal?*
- L, J. (2025b). *Google Ignites Taiwan’s First Corporate Geothermal Deal for 24/7 Clean Energy*.
- Lab, O. C. F. (2021). *Taiwan Takes Actions on “Open Government” and “Open Parliament” and Launches the 1st OGP Action Plan Co-Developed with Civil Society Representatives*.
- Lagerkvist, C. J., Edenbrandt, A. K., Tibbelin, I. & Wahlstedt, Y. (2020). Preferences for sustainable and responsible equity funds - A choice experiment with Swedish private investors. *Journal of Behavioral and Experimental Finance*, 28, 100406. <https://doi.org/10.1016/j.jbef.2020.100406>
- LangChain. (2024). *Dynamic few-shot examples with LangSmith datasets*.
- Lange, J.-P. (2021). Towards circular carbo-chemicals – the metamorphosis of petrochemicals. *Energy & Environmental Science*, 14(8), 4358–4376. <https://doi.org/10.1039/D1EE00532D>
- Langton, J. (2025). ICI wants more retail access to private markets. *Investment Executive*.
- Lasnik, M. (2018). *Social anxiety and taijin kyofusho among taiwanese university students in hualien: A cross cultural comparison of social phobia symptoms* [Master’s thesis]. National Dong Hwa University.
- Latent Space. (2025). *Building Manus AI (first ever Manus Meetup)*.
- Laureen van Breen, Aileen Robinson, Abigail Munroe & Adriana Bora. (2023). *Panel: Scaling Corporate Accountability: Humans and AI together in the fight to #EndSlavery*.

- Lavers, J. L., Bond, A. L. & Rolsky, C. (2022). Far from a distraction: Plastic pollution and the planetary emergency. *Biological Conservation*, 272, 109655. <https://doi.org/10.1016/j.biocon.2022.109655>
- Laxton, D., DLaxton@imf.org, Mursula, S., SMursula@imf.org, Kumhof, M., MKumhof@imf.org, Muir, D. & DMuir@imf.org. (2010). The Global Integrated Monetary and Fiscal Model (GIMF)  $\ddot{\text{I}}_c \frac{1}{2}$  Theoretical Structure: Theoretical Structure. *IMF Working Papers*, 10(34), 1. <https://doi.org/10.5089/9781451962734.001>
- Laya, P. (2024). SoftBank-Backed App Rappi Expects to Be IPO-Ready in 12 Months. *Bloomberg*.
- Le Provost, G., Schenk, N. V., Penone, C., Thiele, J., Westphal, C., Allan, E., Ayasse, M., Blüthgen, N., Boeddinghaus, R. S., Boesing, A. L., Bolliger, R., Busch, V., Fischer, M., Gossner, M. M., Hölzel, N., Jung, K., Kandeler, E., Klaus, V. H., Kleinebecker, T., ... Manning, P. (2022). The supply of multiple ecosystem services requires biodiversity across spatial scales. *Nature Ecology & Evolution*. <https://doi.org/10.1038/s41559-022-01918-5>
- LeafScore. (2023). *LeafScore - The Leading Online Voice for Climate Friendly Living*.
- Lee, I. (2024). Food poisoning scare limited to one restaurant.
- Lee, K. (2024). Kakao Pay handed over 40 mil. Users' data to Alipay without consent: FSS - *The Korea Times*.
- Lee, Philip. (2025). *Kakao 2024 Revenue Grows 4% Despite Q4 Content Segment Decline*.
- Lee, Peter, Goldberg, C. & Kohane, I. (2023). *The AI revolution in medicine: GPT-4 and beyond* (1st ed.). Pearson.
- Lee, S. & Doevedans, K. (2011). *Aesthetics of sustainable architecture*. 010 Publishers.
- Lee, T. H., Jan, F.-H. & Liu, J.-T. (2021). Developing an indicator framework for assessing sustainable tourism: Evidence from a Taiwan ecological resort. *Ecological Indicators*, 125, 107596. <https://doi.org/10.1016/j.ecolind.2021.107596>
- Leino, K., Sen, S., Datta, A., Fredrikson, M. & Li, L. (2018). *Influence-Directed Explanations for Deep Convolutional Networks*. <https://doi.org/10.48550/ARXIV.1802.03788>
- Leite, M. L., de Loiola Costa, L. S., Cunha, V. A., Kreniski, V., de Oliveira Braga Filho, M., da Cunha, N. B. & Costa, F. F. (2021). Artificial intelligence and the future of life sciences. *Drug Discovery Today*, 26(11), 2515–2526. <https://doi.org/10.1016/j.drudis.2021.07.002>
- Leng, Q., Portes, J., Havens, S., Zaharia, M. & Carbin, M. (Mon, 08/12/2024 - 19:46). Long Context RAG Performance of LLMs.
- Lenharo, M. (2023). ChatGPT gives an extra productivity boost to weaker writers. *Nature*, d41586-023-02270-9. <https://doi.org/10.1038/d41586-023-02270-9>
- Lennart Ziburski. (2018). *The UX of AI*.
- Lenovo. (08-29-22). “Fast tech” is unsustainable: The circular economy is the smart answer.
- Lenton, T. M., Xu, C., Abrams, J. F., Ghadiali, A., Loriani, S., Sakschewski, B., Zimm, C., Ebi, K. L., Dunn, R. R., Svenning, J.-C. & Scheffer, M. (2023). Quantifying the human cost of global warming. *Nature Sustainability*. <https://doi.org/10.1038/s41893-023-01132-6>
- León, M. A. (2025). *Territorial circular ecosystems for end-of-life foam (Circular Foam)*.
- Leopold, A. (1972). *A Sand county almanac and sketches here and there*. OUP.
- Lerner, S. (2019). How Coca-Cola Undermines Plastic Recycling Efforts.
- Leswing, K. (2023). Nvidia reveals new A.I. Chip, says costs of running LLMs will 'drop signif-

*icantly'.*

- Leung, R. & Luximon, A. (2021). Green design. In *Handbook of Footwear Design and Manufacture* (pp. 459–476). Elsevier. <https://doi.org/10.1016/B978-0-12-821606-4.00018-1>
- Leverhulme Centre for Nature Recovery. (2023). *Monetary valuation of nature Pragmatic conservation of unhelpful commodification of nature*.
- Levesque, H. J., Davis, E. & Morgenstern, L. (2012). The winograd schema challenge. *Proceedings of the Thirteenth International Conference on Principles of Knowledge Representation and Reasoning*, 552–561.
- Levy, S. (2023). Uber's CEO Says He'll Always Find a Reason to Say His Company Sucks. *Wired*.
- Lew, G. & Schumacher, R. M. J. (2020). *AI and UX: Why artificial intelligence needs user experience*. Apress.
- Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., Küttler, H., Lewis, M., Yih, W., Rocktäschel, T., Riedel, S. & Kiela, D. (2020). *Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks*. <https://doi.org/10.48550/ARXIV.2005.11401>
- Lexow, M. (2021). *Designing for AI — a UX approach*.
- LHV. (2020). *Microinvestment with Growth Account*.
- LHV. (2024). “Buy now, pay later” option more popular than ever before · LHV.
- Li, J.-H. & Ko, Y.-C. (2012). Plasticizer incident and its health effects in Taiwan. *The Kaohsiung Journal of Medical Sciences*, 28(7S). <https://doi.org/10.1016/j.kjms.2012.05.005>
- Li, L., Feng, R., Xi, J., Huijbens, E. H. & Gao, Y. (2023). Distinguishing the impact of tourism development on ecosystem service trade-offs in ecological functional zone. *Journal of Environmental Management*, 342, 118183. <https://doi.org/10.1016/j.jenvman.2023.118183>
- Li, M., Li, N., Khan, M. A., Khaliq, N. & Rehman, F. U. (2022). Can retail investors induce corporate green innovation? -Evidence from Baidu Search Index. *Helijon*, 8(6), e09663. <https://doi.org/10.1016/j.heliyon.2022.e09663>
- Li, N., Yang, H., Dong, Y., Wei, B., Liang, L., Yun, X., Tian, J., Zheng, Y., Duan, S. & Zhang, L. (2024). Prevalence and implications of microplastic contaminants in general human seminal fluid: A Raman spectroscopic study. *Science of The Total Environment*, 937, 173522. <https://doi.org/10.1016/j.scitotenv.2024.173522>
- Li, Q., Zhang, K. & Wang, L. (2022). Where's the green bond premium? Evidence from China. *Finance Research Letters*, 48, 102950. <https://doi.org/10.1016/j.frl.2022.102950>
- Li, S. & Kallas, Z. (2021). Meta-analysis of consumers' willingness to pay for sustainable food products. *Appetite*, 163, 105239. <https://doi.org/10.1016/j.appet.2021.105239>
- Li, T., Vorvoreanu, M., DeBellis, D. & Amershi, S. (2022). Assessing human-AI interaction early through factorial surveys: A study on the guidelines for human-AI interaction. *ACM Transactions on Computer-Human Interaction*.
- Li, X. & Sung, Y. (2021). Anthropomorphism brings us closer: The mediating role of psychological distance in User–AI assistant interactions. *Computers in Human Behavior*, 118, 106680. <https://doi.org/10.1016/j.chb.2021.106680>
- Liang, P., Bommasani, R., Lee, T., Tsipras, D., Soylu, D., Yasunaga, M., Zhang, Y., Narayanan, D., Wu, Y., Kumar, A., Newman, B., Yuan, B., Yan, B., Zhang, C., Cosgrove, C., Manning, C. D., Ré, C., Acosta-Navas, D., Hudson, D. A., ... Koreeda, Y. (2022). *Holistic Evaluation*

- of Language Models* (No. arXiv:2211.09110). arXiv. <https://arxiv.org/abs/2211.09110>
- Liang, W., Yuksekgonul, M., Mao, Y., Wu, E. & Zou, J. (2023). *GPT detectors are biased against non-native English writers*. <https://doi.org/10.48550/ARXIV.2304.02819>
- Liao, C.-W., Liao, Y.-H., Chen, B.-S., Tseng, Y.-J. & Ho, W.-S. (2022). Elementary Teachers' Environmental Education Cognition and Attitude: A Case Study of the Second Largest City in Taiwan. *Sustainability*, 14(21), 14480. <https://doi.org/10.3390/su142114480>
- Liebreich, M. (2025). *Are Big Investors Abandoning Climate Progress? Ep195: David Blood* (No. 195).
- Life Lessons From Books. (2023). *Klara and the Sun by Kazuo Ishiguro (Book Review)*.
- Lightyear. (n.d.). *Lightyear: Investing? Own it.*
- Lightyear. (2025). *Fees and taxes.*
- Lily | mindful + active living on Instagram: "Yesterday, the Garment Worker Protection Act (SB62) was signed into law by Governor Newsom in California. Garment workers in LA make an..."*. (n.d.).
- Lim, E., Hill, W., Lee, C., Weeden, C. E., Augustine, M., Chen, K., Kuan, F. C., Marongiu, F., Evans, E., Moore, D., Ryu, M. H., Luchtenborg, M., Lavelle, K., Carlsten, C., Malanchi, I., Hackshaw, A., Litchfield, K. R., Degregori, J., Jamal-Hanjani, M. & Swanton, C. (2022). 1MO Air pollution-induced non-small cell lung cancer: Towards molecular cancer prevention. *Annals of Oncology*, 33, S1383. <https://doi.org/10.1016/j.annonc.2022.09.002>
- Lin, J., Khanna, N., Liu, X., Wang, W., Gordon, J. & Dai, F. (2022). Opportunities to tackle short-lived climate pollutants and other greenhouse gases for China. *Science of The Total Environment*, 842, 156842. <https://doi.org/10.1016/j.scitotenv.2022.156842>
- Lin, J.-Y., Zheng, Z.-W., Zheng, Q., Wu, D.-R., Gopalakrishnan, G., Ho, C.-R., Pan, J., Lin, Y.-C. & Xie, L.-L. (2022). Satellite observed new mechanism of Kuroshio intrusion into the northern South China Sea. *International Journal of Applied Earth Observation and Geoinformation*, 115, 103119. <https://doi.org/10.1016/j.jag.2022.103119>
- Linden, A. (2021). *What is the role of an AI designer?*
- Lindhqvist, T. (2000). *Extended producer responsibility in cleaner production: Policy principle to promote environmental improvements of product systems*. International Institute for Industrial Environmental Economics (Internationella miljöinstitutet), Univ.
- Lindhqvist, T. & Lidgren, K. (1990). *Modeller för förlängt producentansvar* (Ds 1991:9, pp. 7–44). Swedish Ministry of the Environment.
- LINE Corporation. (2019). *[Japan] Investment Made Easy—LINE Securities, a New Mobile Investment Service, Launches Today* | LINE Corporation | News.
- Lingeswaran, S. (2019). *Levelling up: Shattering myths about philanthropy in Asia.*
- Lion Hirth. (n.d.). *Lion Hirth on Twitter: "Carbon pricing is not there to punish people. It's there to remind us, when we take travel, heating, consumption decisions that the true cost of fossil fuels comprises not only mining and processing, but also the damage done by the CO2 they release. Very simple."* / Twitter.
- Liu, A. (2017). *Overview < Brain-Controlled Interface for the Motile Control of Spermatozoa — MIT Media Lab.*
- Liu, B. & Wei, L. (2021). Machine gaze in online behavioral targeting: The effects of algorithmic human likeness on social presence and social influence. *Computers in Human Behavior*, 124,

106926. <https://doi.org/10.1016/j.chb.2021.106926>
- Liu, C.-H., Horng, J.-S., Chou, S.-F., Yu, T.-Y., Lee, M.-T. & Lapuz, M. C. B. (2023). Digital capability, digital learning, and sustainable behaviour among university students in Taiwan: A comparison design of integrated mediation-moderation models. *The International Journal of Management Education*, 21(3), 100835. <https://doi.org/10.1016/j.ijme.2023.100835>
- Liu, H. (2021). *In-depth Q&A: Will China's emissions trading scheme help tackle climate change?*
- Liu, J. (2022). *LlamaIndex*. <https://doi.org/10.5281/zenodo.1234>
- Liu, K., Tan, Q., Yu, J. & Wang, M. (2023). A global perspective on e-waste recycling. *Circular Economy*, 2(1), 100028. <https://doi.org/10.1016/j.cec.2023.100028>
- Liu, Shikun, Fan, L., Johns, E., Yu, Z., Xiao, C. & Anandkumar, A. (2023). *Prismer: A Vision-Language Model with An Ensemble of Experts*. <https://doi.org/10.48550/ARXIV.2303.02506>
- Liu, Shiyu, House, J. & Kádár, D. Z. (2024). Bargaining in Chinese livestream sales events. *Discourse, Context & Media*, 60, 100787. <https://doi.org/10.1016/j.dcm.2024.100787>
- Liu, Sheng, Zhang, Z., Yang, J., Zhao, Y., Zhang, X., Hu, B., Zhang, G., Yang, D., Sun, G., Wei, H., Wu, J., Guo, X., Zhang, Y., Li, S. & Zhu, J. (2024). El Niño-Southern Oscillation and East Asian Monsoon controlled Kuroshio Current evolution over the last 42 kyr. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 637, 111981. <https://doi.org/10.1016/j.palaeo.2023.111981>
- Liu, W.-H., Lee, H.-C., Sung, W.-Y. & Yang, T.-Y. (2022). The roles of Taiwanese universities in coastal revitalization: A study of two case projects. *Marine Policy*, 139, 105050. <https://doi.org/10.1016/j.marpol.2022.105050>
- Liu, X., Tamminen, S., Korhonen, T. & Röning, J. (2019). How Physical Exercise Level Affects Sleep Quality? Analyzing Big Data Collected from Wearables. *Procedia Computer Science*, 155, 242–249. <https://doi.org/10.1016/j.procs.2019.08.035>
- Liu, Y.-H., Shaheen, S. M., Rinklebe, J. & Hseu, Z.-Y. (2021). Pedogeochemical distribution of gallium, indium and thallium, their potential availability and associated risk in highly-weathered soil profiles of Taiwan. *Environmental Research*, 197, 110994. <https://doi.org/10.1016/j.envres.2021.110994>
- Liu, Z., Deng, Z., Davis, S. & Ciais, P. (2023). Monitoring global carbon emissions in 2022. *Nature Reviews Earth & Environment*, 4(4), 205–206. <https://doi.org/10.1038/s43017-023-00406-z>
- Livingston, I. (2023). It's midwinter, but it's over 100 degrees in South America. *Washington Post (Washington, D.C. : 1974)*.
- lizlivingblue. (n.d.). *It's so important we support companies making a positive IMPACT in the #impactinvesting ☀️ #investwithIMPACT #sustainabilitytok*.
- lmsys.org. (2024). *GPT-4-Turbo has just reclaimed the No. 1 spot on the Arena leaderboard again! Woah! We collect over 8K user votes from diverse domains and observe its strong coding & reasoning capability over others.*
- Lohmann, P. M., Gsottbauer, E., Doherty, A. & Kontoleon, A. (2022). Do carbon footprint labels promote climatarian diets? Evidence from a large-scale field experiment. *Journal of Environmental Economics and Management*, 114, 102693. <https://doi.org/10.1016/j.jeem.2022.102693>

- Lohr, S. (2004). Microsoft, Amid Dwindling Interest, Talks Up Computing as a Career. *The New York Times*.
- Loizos, C. (2025). *OpenAI's planned data center in Abu Dhabi would be bigger than Monaco*.
- Lomas, N. (2024). *Deal on EU AI Act gets thumbs up from European Parliament*.
- Lopez, R. E., Pastén, R. & Gutiérrez Cubillos, P. (2022). Climate change in times of economic uncertainty: A perverse tragedy of the commons? *Economic Analysis and Policy*, 75, 209–225. <https://doi.org/10.1016/j.eap.2022.05.005>
- Lorenzo, D., Lorenzo, D. & Lorenzo, D. (2015). *Daisy Ginsberg Imagines A Friendlier Biological Future*.
- Lose, A. (2023). *5 Ways UX Design Can Tackle Climate Change Issues*.
- Low, G., Dalhaus, T. & Meuwissen, M. P. M. (2023). Mixed farming and agroforestry systems: A systematic review on value chain implications. *Agricultural Systems*, 206, 103606. <https://doi.org/10.1016/j.agsy.2023.103606>
- Low, S., Baum, C. M. & Sovacool, B. K. (2022). Rethinking Net-Zero systems, spaces, and societies: “Hard” versus “soft” alternatives for nature-based and engineered carbon removal. *Global Environmental Change*, 75, 102530. <https://doi.org/10.1016/j.gloenvcha.2022.102530>
- Lower, C. (2017). *Chatbots: Too Good to Be True? (They Are, Here's Why)*.
- Loyst, M. (2024). *TikTok and the live shopping revolution*.
- LSEG. (2025). *MarketPsych Analytics*.
- LSEG & Susanna Twidale. (02/12/2024, 02:37 PM). Global carbon markets value hit record \$949 billion last year. *Investing.com*.
- Lu, Z. & Li, H. (2023). Does environmental information disclosure affect green innovation? *Economic Analysis and Policy*, 80, 47–59. <https://doi.org/10.1016/j.eap.2023.07.011>
- Lucas Matney. (2022). *VC-backed DAO startups are racing to define what DAOs actually are* | *TechCrunch*.
- Luik, L. (2025). *Where does the carbon credit price come from?*
- Lulovicova, A. & Bouissou, S. (2023). Environmental Assessment of Local Food Policies through a Territorial Life Cycle Approach. *Sustainability*, 15(6), 4740. <https://doi.org/10.3390/su15064740>
- Luo, D. (2022). ESG, liquidity, and stock returns. *Journal of International Financial Markets, Institutions and Money*, 78, 101526. <https://doi.org/10.1016/j.intfin.2022.101526>
- Luo, J., Paduraru, C., Voicu, O., Chervonyi, Y., Munns, S., Li, J., Qian, C., Dutta, P., Davis, J. Q., Wu, N., Yang, X., Chang, C.-M., Li, T., Rose, R., Fan, M., Nakhost, H., Liu, T., Kirkman, B., Altamura, F., ... Mankowitz, D. J. (2022). *Controlling Commercial Cooling Systems Using Reinforcement Learning*. <https://doi.org/10.48550/ARXIV.2211.07357>
- Lüttin, L. (2025). *Full overview of the EU textile strategy and regulations*.
- Luz, V., Schauer, V. & Viehweger, M. (2024). Beyond preferences: Beliefs in sustainable investing. *Journal of Economic Behavior & Organization*, 220, 584–607. <https://doi.org/10.1016/j.jebo.2024.02.018>
- Lv, X., Luo, J., Liang, Y., Liu, Y. & Li, C. (2022). Is cuteness irresistible? The impact of cuteness on customers' intentions to use AI applications. *Tourism Management*, 90, 104472. <https://doi.org/10.1016/j.tourman.2021.104472>

- LY Corporation. (2023). *LY Corporation Takes Its First Step*.
- Mabuza, L., Sonnenberg, N. & Marx-Pienaar, N. (2023). Natural versus synthetic dyes: Consumers' understanding of apparel coloration and their willingness to adopt sustainable alternatives. *Resources, Conservation & Recycling Advances*, 18, 200146. <https://doi.org/10.1016/j.rcradv.2023.200146>
- MacAskill, S., Roca, E., Liu, B., Stewart, R. A. & Sahin, O. (2021). Is there a green premium in the green bond market? Systematic literature review revealing premium determinants. *Journal of Cleaner Production*, 280, 124491. <https://doi.org/10.1016/j.jclepro.2020.124491>
- Maccioni, F. (2025). *Abu Dhabi sovereign wealth fund Mubadala's assets jump 9% in 2024* | Reuters.
- Mackler, S., Fishman, X. & Broberg, D. (2021). A policy agenda for gigaton-scale carbon management. *The Electricity Journal*, 34(7), 106999. <https://doi.org/10.1016/j.tej.2021.106999>
- Mai, N., Vourvachis, P. & Grubnic, S. (2023). The impact of the UK's Modern Slavery Act (2015) on the disclosure of FTSE 100 companies. *The British Accounting Review*, 55(3), 101115. <https://doi.org/10.1016/j.bar.2022.101115>
- Main, D. (2024). Microplastics are infiltrating brain tissue, studies show: "There's nowhere left untouched." *The Guardian*.
- Makersite. (n.d.). *Improve Your Product Sustainability With Makersite*.
- Malliaris, M. & Salchenberger, L. (1996). Using neural networks to forecast the S&P 100 implied volatility. *Neurocomputing*, 10(2), 183–195. [https://doi.org/10.1016/0925-2312\(95\)00019-4](https://doi.org/10.1016/0925-2312(95)00019-4)
- Mamede, R., Duarte, I. A., Caçador, I., Tanner, S. E., Silva, M., Jacinto, D., Fonseca, V. F. & Duarte, B. (2022). Elemental fingerprinting of sea urchin (*Paracentrotus lividus*) gonads to assess food safety and trace its geographic origin. *Journal of Food Composition and Analysis*, 114, 104764. <https://doi.org/10.1016/j.jfca.2022.104764>
- Manchanda, P., Arora, N., Nazir, O. & Islam, J. U. (2023). Cultivating sustainability consciousness through mindfulness: An application of theory of mindful-consumption. *Journal of Retailing and Consumer Services*, 75, 103527. <https://doi.org/10.1016/j.jretconser.2023.103527>
- Manzardo, A., Marson, A., Zuliani, F., Bacenetti, J. & Scipioni, A. (2021). Combination of product environmental footprint method and eco-design process according to ISO 14006: The case of an Italian vineyard. *Science of The Total Environment*, 799, 149507. <https://doi.org/10.1016/j.scitotenv.2021.149507>
- Mapping the Gap: The Road from Paris*. (2016).
- Marc Germain. (2016). *A simple degrowth model* (No. 2016.21). FAERE - French Association of Environmental and Resource Economists.
- Marc Lien. (2022). *How is the “green gap” affecting small businesses?*
- Marco-Fondevila, M. & Álvarez-Etxeberria, I. (2023). Trends in private sector engagement with biodiversity: EU listed companies' disclosure and indicators. *Ecological Economics*, 210, 107864. <https://doi.org/10.1016/j.ecolecon.2023.107864>
- Marcus, A. (06-11-23). *Multispecies Materialities | Cohabitation*.
- Margaryta Kirakosian & Angus Foote. (2022). “*Methodologies are all over the place*”: Banks name sectors lacking ESG funds.
- MARIA LUÍS FERNANDES. (2023). *A Reality Check on the Industrial Emissions Directive -*

*META.*

- MARISA ADÁN GIL. (2022). "As criptomoedas vão acabar - e o dinheiro físico também", diz autor de best-seller - *Época Negócios | Futuro do Dinheiro*.
- Marlon, J. R., Bloodhart, B., Ballew, M. T., Rolfe-Redding, J., Roser-Renouf, C., Leiserowitz, A. & Maibach, E. (2019). How Hope and Doubt Affect Climate Change Mobilization. *Frontiers in Communication*, 4, 20. <https://doi.org/10.3389/fcomm.2019.00020>
- Marquis, C. (2021). *RSF Is Leading The Way In Moving From Impact Investing To Regenerative Finance*.
- Marrucci, L., Marchi, M. & Daddi, T. (2020). Improving the carbon footprint of food and packaging waste management in a supermarket of the Italian retail sector. *Waste Management*, 105, 594–603. <https://doi.org/10.1016/j.wasman.2020.03.002>
- Marshall, A. (1997). *Principles of economics*. Prometheus Books.
- Marten Põllumees. (2022). *Kuhu investeeri LHV Kasvukontoga IV kvartalis 2021? - Kasvukonto - Uudised - LHV finantsportaal*.
- Martinez-Alier, Joan. (2021). Mapping ecological distribution conflicts: The EJAtlas. *The Extractive Industries and Society*, 8(4), 100883. <https://doi.org/10.1016/j.exis.2021.02.003>
- Martinez-Alier, J., Neyra, R. & Rincón, M. A. P. (2022). Reply to Orihuela et al's "Extractivism of the Poor." *The Extractive Industries and Society*, 10, 101065. <https://doi.org/10.1016/j.exis.2022.101065>
- Martiny, A., Taglialatela, J., Testa, F. & Iraldo, F. (2024). Determinants of environmental social and governance (ESG) performance: A systematic literature review. *Journal of Cleaner Production*, 456, 142213. <https://doi.org/10.1016/j.jclepro.2024.142213>
- Martiskainen, M., Axon, S., Sovacool, B. K., Sareen, S., Furszyfer Del Rio, D. & Axon, K. (2020). Contextualizing climate justice activism: Knowledge, emotions, motivations, and actions among climate strikers in six cities. *Global Environmental Change*, 65, 102180. <https://doi.org/10.1016/j.gloenvcha.2020.102180>
- Marvel, K. (2023). Opinion | I'm a Climate Scientist. I'm Not Screaming Into the Void Anymore. *The New York Times*.
- Mastercard. (2021). *Mastercard Unveils New Carbon Calculator Tool for Banks Globally, as Consumer Passion for the Environment Grows*.
- Masters, J. (2025). *April 2025 was the planet's 2nd-warmest April on record » Yale Climate Connections*.
- Masterworks. (2023). *How It Works*.
- Matos, G. (2024). *Aave Labs unveils plan to stabilize GHO with BlackRock's BUIDL shares*.
- Matteo Sciortino. (2024). *Generative UI: How AI is automating the creation of digital interfaces*.
- Matthew Gore, Alessio Sbraga & Joseph Malpas. (2022). *Emissions Regulations In Shipping - Will The Polluter Pay?*
- Mauritzen, T., Tsushima, Y., Meyssignac, B., Loeb, N. G., Hakuba, M., Pilewskie, P., Cole, J., Suzuki, K., Ackerman, T. P., Allan, R. P., Andrews, T., Bender, F. A.-M., Bloch-Johnson, J., Bodas-Salcedo, A., Brookshaw, A., Ceppi, P., Clerbaux, N., Dessler, A. E., Donohoe, A., ... Zelinka, M. D. (2025). Earth's Energy Imbalance More Than Doubled in Recent Decades. *AGU Advances*, 6(3), e2024AV001636. <https://doi.org/10.1029/2024AV001636>
- May, R. M. (2011). Why should we be concerned about loss of biodiversity. *Comptes Rendus*

- Biologies*, 334(5-6), 346–350. <https://doi.org/10.1016/j.crvi.2010.12.002>
- Mazzocchi, C., Orsi, L., Zilia, F., Costantini, M. & Bacenetti, J. (2022). Consumer awareness of sustainable supply chains: A choice experiment on Parma ham PDO. *Science of The Total Environment*, 836, 155602. <https://doi.org/10.1016/j.scitotenv.2022.155602>
- Mazzucato, M. (2018). *The value of everything: Making and taking in the global economy*. Allen Lane, an imprint of Penguin Books.
- McCarthy, B. & Liu, H. B. (2017). Food Waste and the “Green” Consumer. *Australasian Marketing Journal*, 25(2), 126–132. <https://doi.org/10.1016/j.ausmj.2017.04.007>
- McClure, T. (2025). “*Half the tree of life*”: Ecologists’ horror as nature reserves are emptied of insects.
- McCorduck, P. (2004). *Machines who think: A personal inquiry into the history and prospects of artificial intelligence* (25th anniversary update). A.K. Peters.
- McCulloch, W. S. & Pitts, W. (1943). A logical calculus of the ideas immanent in nervous activity. *The Bulletin of Mathematical Biophysics*, 5(4), 115–133. <https://doi.org/10.1007/BF02478259>
- McDonough, W. & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things* (1st ed). North Point Press.
- McKeough, T. (2018). *McKinsey Design Launches, Confirming the Importance of Design to Business*.
- McKibben, B. (1989). *The end of nature* (1st ed). Random House.
- McKibben, B. (2006). *The end of nature* (Random House trade pbk. ed). Random House Trade Paperbacks.
- McKibben, B. (2023). ‘Where Should I Live?’.
- McKinsey. (2020). *The next frontier in Asia payments*.
- McKinsey & Company. (2022). *Mind the Gap: What do Gen Zers in Asia want?*
- McKinsey & Company. (2023). *McKinsey Global Private Markets Review 2023*.
- Meadows, D. H. & Club of Rome (Eds.). (1972). *The Limits to growth: A report for the Club of Rome’s project on the predicament of mankind*. Universe Books.
- Meet the fintechs leading Sweden’s green revolution. (2021).
- Meisinger, N. (2022). A tragedy of intangible commons: Riding the socioecological wave. *Eco-logical Economics*, 193, 107298. <https://doi.org/10.1016/j.ecolecon.2021.107298>
- Mensah, V., Jan, S., Chiou, M.-D., Kuo, T. H. & Lien, R.-C. (2014). Evolution of the Kuroshio Tropical Water from the Luzon Strait to the east of Taiwan. *Deep Sea Research Part I: Oceanographic Research Papers*, 86, 68–81. <https://doi.org/10.1016/j.dsr.2014.01.005>
- Mercado Libre. (2024). *2024 Impact Report: 25 Years Driving Transformation in Latin America*. Mercado Libre.
- Merritt, R. (2022). *What Is a Transformer Model?*
- META. (2024). *Introducing Meta Llama 3: The most capable openly available LLM to date*.
- Meta AI. (2023). *AudioCraft: A simple one-stop shop for audio modeling*.
- Metcalfe, D. (2015). *MULTISPECIES DESIGN* [PhD thesis].
- Metcalfe, J. & Shimamura, A. P. (Eds.). (1994). *Metacognition: Knowing about Knowing*. The MIT Press. <https://doi.org/10.7551/mitpress/4561.001.0001>
- Methodology - Google Environmental Insights Explorer - Make Informed Decisions. (n.d.).

- Methodology for GHG & Co-Benefits in Grazing Systems.* (2022).
- METR.* (2023).
- Michael Abrash. (2017). *Inventing the Future*.
- Microsoft. (2023). *Microsoft Designer - Stunning designs in a flash*.
- Migozzi, J., Urban, M. & Wójcik, D. (2023). “You should do what India does”: FinTech ecosystems in India reshaping the geography of finance. *Geoforum: Journal of Physical, Human, and Regional Geosciences*, 103720. <https://doi.org/10.1016/j.geoforum.2023.103720>
- Mikael Eriksson Björling & Ahmed H. Ali. (2020). *UX design in AI, A trustworthy face for the AI brain*.
- Mike Haley. (2022). *Sustainability starts in the design process, and AI can help*.
- Mike Hower. (Dec 9, 2015 7am EST). *Trucost and TruValue Labs Partner to Provide Enhanced ESG Data for Investors*.
- Millard, R. (2025). Drax “misled government” over sourcing of wood for biomass, says ex-lobbyist. *Financial Times*.
- Miller, R. (2019). *Citizens Reserve is building a supply chain platform on the blockchain*.
- Mills, R., De Paoli, S., Diplaris, S., Gkatziaiki, V., Papadopoulos, S., Prasad, S. R., McCutchen, E., Kapadia, V. & Hirche, P. (2016). WikiRate.org – Leveraging Collective Awareness to Understand Companies’ Environmental, Social and Governance Performance. In F. Bagnoli, A. Satsiou, I. Stavrakakis, P. Nesi, G. Pacini, Y. Welp, T. Tiropanis & D. DiFranzo (Eds.), *Internet Science* (Vol. 9934, pp. 74–88). Springer International Publishing. [https://doi.org/10.1007/978-3-319-45982-0\\_7](https://doi.org/10.1007/978-3-319-45982-0_7)
- Millward-Hopkins, J., Purnell, P. & Baurley, S. (2023). A material flow analysis of the UK clothing economy. *Journal of Cleaner Production*, 407, 137158. <https://doi.org/10.1016/j.jclepro.2023.137158>
- Milmo, D. (2024). French AI summit to focus on environmental impact of energy-hungry tech. *The Guardian*.
- Milne, G. R., Villarroel Ordenes, F. & Kaplan, B. (2020). Mindful Consumption: Three Consumer Segment Views. *Australasian Marketing Journal*, 28(1), 3–10. <https://doi.org/10.1016/j.ausmj.2019.09.003>
- Minderoo Foundation. (2023). *Plastic Waste Makers Index*.
- Ministerie van Infrastructuur en Waterstaat. (2019). *Circular Dutch economy by 2050 - Circular economy - Government.nl*. Ministerie van Algemene Zaken.
- Ministry of Digital Affairs. (2024a). 台灣電力公司過去電力供需資訊 | 政府資料開放平臺.
- Ministry of Digital Affairs. (2024b). 政府資料開放平臺.
- Ministry of Education of Taiwan. (2024a). *Main Education Statistical Indicators*.
- Ministry of Education of Taiwan. (2024b). *Net Enrollment Rate of Tertiary Education*.
- Ministry of Education of Taiwan. (2024c). *Universities, Colleges & Junior Colleges*.
- Ministry of the Environment, Government of Japan. (2000). *Act on promotion of procurement of eco-friendly goods and services by the state and other entities (act on promoting green procurement)*.
- Mitchell, J. (2025). *A Sustainable Future*Hortense Biyo, Morningstar Head of Research, on Sustainable Investing Under Trump 2.0 | Man Group.
- Mittal, A. (2024). *Inflection-2.5: The Powerhouse LLM Rivaling GPT-4 and Gemini*.

- Mittal, V. (2025). *Little by Little, a Little Becomes a Lot.*
- Miyoshi, S., Segawa, T., Takii, M., Imamura, T., Sakurai, H., Kurosawa, Y., Kondo, S., Kishita, Y. & Umeda, Y. (2022). Evaluation of circularity of components for life cycle design: A toner bottle case study. *Procedia CIRP*, 105, 267–272. <https://doi.org/10.1016/j.procir.2022.02.044>
- Moberg, K. R., Aall, C., Dorner, F., Reimerson, E., Ceron, J.-P., Sköld, B., Sovacool, B. K. & Piana, V. (2019). Mobility, food and housing: Responsibility, individual consumption and demand-side policies in European deep decarbonisation pathways. *Energy Efficiency*, 12(2), 497–519. <https://doi.org/10.1007/s12053-018-9708-7>
- Mobilizing Capital Into Emerging Markets and Developing Economies.* (2022).
- Mohit Moondra. (n.d.). *Navigate more sustainably and optimize for fuel savings with eco-friendly routing.*
- Møller, B. & Tang, E. (2024). *Energy within planetary boundaries - Green Transition Denmark.*
- Mollick, E. (2025). *Personality and Persuasion.*
- Monetary Authority of Singapore. (2023). *MAS Launches Digital Platform for Seamless ESG Data Collection and Access.*
- Montano, L., Giorgini, E., Notarstefano, V., Notari, T., Ricciardi, M., Piscopo, M. & Motta, O. (2023). Raman Microspectroscopy evidence of microplastics in human semen. *Science of The Total Environment*, 901, 165922. <https://doi.org/10.1016/j.scitotenv.2023.165922>
- Monzo. (2023). *Online Banking Made Easy.*
- Moolman, A. (2024). *Eco-Modulation and EPR: The New Playbook for Packaging Brands.*
- Morana, S., Gnewuch, U., Jung, D. & Granig, C. (2020, June). *The effect of anthropomorphism on investment decision-making with robo-advisor chatbots.*
- Morgan Stanley. (2019). *Sustainable Signals: Individual Investor Interest Driven by Impact, Conviction and Choice.*
- Morone, P., Caferra, R., D'Adamo, I., Falcone, P. M., Imbert, E. & Morone, A. (2021). Consumer willingness to pay for bio-based products: Do certifications matter? *International Journal of Production Economics*, 240, 108248. <https://doi.org/10.1016/j.ijpe.2021.108248>
- Mos - The money app for students. (n.d.).
- Moss, S. (2025). *OpenAI CFO: Stargate targeting multiple locations in Texas, considering AI data centers in Pennsylvania, Oregon, and Wisconsin - DCD.*
- Mouterde, P. (2024). *Biodiversity: The world is not on track to protect 30% of land and sea by 2030.*
- Mowbray, J. (2018). *World's first free digital map of apparel factories.*
- mrblock 區塊先生. (2025). *Mrblock 區塊先生.*
- Mühlhoff, R. (2019). *Human-aided artificial intelligence: Or, how to run large computations in human brains? Toward a media sociology of machine learning.* <https://doi.org/10.14279/DEPOSITONCE-11329>
- Munaro, M. R., Tavares, S. F. & Bragança, L. (2022). The ecodesign methodologies to achieve buildings' deconstruction: A review and framework. *Sustainable Production and Consumption*, 30, 566–583. <https://doi.org/10.1016/j.spc.2021.12.032>
- Muñoz, M., Reul, A., Guijarro, B. & Hidalgo, M. (2023). Carbon footprint, economic benefits and sustainable fishing: Lessons for the future from the Western Mediterranean. *Science of*

- The Total Environment*, 865, 160783. <https://doi.org/10.1016/j.scitotenv.2022.160783>
- Munro, P., Kapitan, S. & Wooliscroft, B. (2023). The sustainable attitude-behavior gap dynamic when shopping at the supermarket: A systematic literature review and framework for future research. *Journal of Cleaner Production*, 426, 138740. <https://doi.org/10.1016/j.jclepro.2023.138740>
- Muradian, R. & Gómez-Bagethun, E. (2021). Beyond ecosystem services and nature's contributions: Is it time to leave utilitarian environmentalism behind? *Ecological Economics*, 185, 107038. <https://doi.org/10.1016/j.ecolecon.2021.107038>
- Murase, Y. & Baek, S. K. (2018). Seven rules to avoid the tragedy of the commons. *Journal of Theoretical Biology*, 449, 94–102. <https://doi.org/10.1016/j.jtbi.2018.04.027>
- Musk, E. & Neuralink. (2019). An Integrated Brain-Machine Interface Platform With Thousands of Channels. *Journal of Medical Internet Research*, 21(10), e16194. <https://doi.org/10.2196/16194>
- 'My wife is dead': How a software update 'lobotomised' these online lovers. (2023). *ABC News*.
- Myclimate – your partner for climate protection*. (2023).
- Nabipour Afrouzi, H., Ahmed, J., Mobin Siddique, B., Khairuddin, N. & Hassan, A. (2023). A comprehensive review on carbon footprint of regular diet and ways to improving lowered emissions. *Results in Engineering*, 18, 101054. <https://doi.org/10.1016/j.rineng.2023.101054>
- Naderi, I. & Van Steenburg, E. (2018). Me first, then the environment: Young Millennials as green consumers. *Young Consumers*, 19(3), 280–295. <https://doi.org/10.1108/YC-08-2017-00722>
- Naishadham, S. (2023a). Arizona to cancel leases allowing Saudi-owned farm access to state's groundwater. *AP News*.
- Naishadham, S. (2023b). In drought-stricken Arizona, fresh scrutiny of Saudi Arabia-owned farm's water use. *PBS News*.
- Naito, H., Ismailov, A. & Kimaro, A. B. (2021). The effect of mobile money on borrowing and saving: Evidence from Tanzania. *World Development Perspectives*, 23, 100342. <https://doi.org/10.1016/j.wdp.2021.100342>
- Napper, I. E. & Thompson, R. C. (2019). Environmental Deterioration of Biodegradable, Oxo-biodegradable, Compostable, and Conventional Plastic Carrier Bags in the Sea, Soil, and Open-Air Over a 3-Year Period. *Environmental Science & Technology*, 53(9), 4775–4783. <https://doi.org/10.1021/acs.est.8b06984>
- Nastaran Vadoodi. (2022). *Ecodesign requirements to drive sustainable product development*.
- Natasha Lomas. (2024). *UK AI startup Greyparrot bags strategic tie-up with recycling giant Bollegraaf*.
- Nathan Benaich & Ian Hogarth. (2022). *State of AI Report 2022*.
- Nathan Reiff. (2023). *Decentralized Autonomous Organization (DAO): Definition, Purpose, and Example*.
- National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. (2023). *Earth just had its hottest June on record*.
- National Public Utilities Council. (2022). *Annual Utility Decarbonization Report*.
- naturalinvest. (2020). *Malaika Maphalala - Natural Investments*.
- Nature, R. C. by S. (2020). *Individual action versus systemic change: Lessons from COVID19*

- for climate change.*
- Navigating Net Zero with Co-founder of BeZero Carbon,.* (2023).
- Neuhoff, R., Simeone, L. & Laursen, L. H. (2023). Forms of participatory futuring for urban sustainability: A systematic review. *Futures*, 154, 103268. <https://doi.org/10.1016/j.futures.2023.103268>
- Neuron, T. (2025). □Get ready for your AI shopping spree...
- New EPR requirements for textiles in Latvia from July 2024 on.* (2024).
- New Standard Institute.* (n.d.).
- Newbold, T., Hudson, L. N., Arnell, A. P., Contu, S., De Palma, A., Ferrier, S., Hill, S. L. L., Hoskins, A. J., Lysenko, I., Phillips, H. R. P., Burton, V. J., Chng, C. W. T., Emerson, S., Gao, D., Pask-Hale, G., Hutton, J., Jung, M., Sanchez-Ortiz, K., Simmons, B. I., ... Purvis, A. (2016). Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. *Science*, 353(6296), 288–291. <https://doi.org/10.1126/science.aaf2201>
- Next Generation Customer Experience. (n.d.). *Acorns Targets Millennials With Shopping as Investing.*
- Ng, A. (2024). *AI Restores ALS Patient's Voice, AI Lobby Grows, and more.*
- NGFS. (2023). *NGFS.*
- Ngo, H. (2020). *How getting rid of dustbins helped Taiwan clean up its cities.*
- Nguyen, T. & Nguyen, T. (2023). *Vietnam's first unicorn startup VNG files to go public in US.*
- Nick Clegg. (2023). *How AI Influences What You See on Facebook and Instagram.*
- Nicole Lombardo. (2021). *Reducing city transport emissions with Maps and AI.*
- Nielsen, J. (2024a). *Accessibility Has Failed: Try Generative UI = Individualized UX.*
- Nielsen, J. (2024b). *Information Scent: How Users Decide Where to Click.*
- Nielsen, J. (2024c). *UX Roundup: AI Empathy | Submit Buttons | European Job Changes | Runway AI Video | Writing Questions for User Research | Leonardo Sold | Midjourney New Release.*
- Nielsen, J. (2025). *No More User Interface?*
- Nissinen, A., Seppälä, J. & Heinonen, T. (2022). Make carbon footprints available – And it is not just one value. *Cleaner Logistics and Supply Chain*, 3, 100023. <https://doi.org/10.1016/j.clsn.2021.100023>
- No Priors: AI, Machine Learning, Tech, & Startups. (2023). *With Inceptive CEO Jakob Uszko-reit: Vols. Ep. 29.*
- NOAA National Centers for Environmental Information. (2023). *Monthly Global Climate Report for June 2023.*
- Noble, S. M., Mende, M., Grewal, D. & Parasuraman, A. (2022). The Fifth Industrial Revolution: How Harmonious Human–Machine Collaboration is Triggering a Retail and Service [R]evolution. *Journal of Retailing*, 98(2), 199–208. <https://doi.org/10.1016/j.jretai.2022.04.003>
- Noor, D. (2023). Big oil quietly walks back on climate pledges as global heat records tumble. *The Guardian.*
- Nordhaus, W. D. (2013). *The climate casino: Risk, uncertainty, and economics for a warming world.* Yale University Press.
- Nordic Council of Ministers. (2020). *Post-consumer textile circularity in the baltic countries*

- (No. 2020:526; TemaNord). Nordic Council of Ministers.
- Noriega, J. A., Hortal, J., Azcárate, F. M., Berg, M. P., Bonada, N., Briones, M. J. I., Del Toro, I., Goulson, D., Ibanez, S., Landis, D. A., Moretti, M., Potts, S. G., Slade, E. M., Stout, J. C., Ulyshen, M. D., Wackers, F. L., Woodcock, B. A. & Santos, A. M. C. (2018). Research trends in ecosystem services provided by insects. *Basic and Applied Ecology*, 26, 8–23. <https://doi.org/10.1016/j.baae.2017.09.006>
- Norman, D. A. (2016). *Living with complexity*. MIT Press.
- Normative. (2025). *Corporate Sustainability Reporting Directive (CSRD), explained*.
- Novoradovskaya, E., Mullan, B., Hasking, P. & Uren, H. V. (2021). My cup of tea: Behaviour change intervention to promote use of reusable hot drink cups. *Journal of Cleaner Production*, 284, 124675. <https://doi.org/10.1016/j.jclepro.2020.124675>
- Novotny, T. (2025). *Human Rights Due Diligence (HRDD) in your Supply Chain*.
- Nubank - Finalmente você no controle do seu dinheiro*. (n.d.).
- Nuez, I., Ruiz-García, A. & Osorio, J. (2022). A comparative evaluation of CO<sub>2</sub> emissions between internal combustion and electric vehicles in small isolated electrical power systems - Case study of the Canary Islands. *Journal of Cleaner Production*, 369, 133252. <https://doi.org/10.1016/j.jclepro.2022.133252>
- NVIDIA. (2025). *NVIDIA CEO Jensen Huang Keynote at COMPUTEX 2025*.
- NVIDIA Developer. (2025). *Frontiers of AI and Computing: A Conversation With Yann LeCun and Bill Dally | NVIDIA GTC 2025*.
- O'Connor, S. & ChatGPT. (2023). Open artificial intelligence platforms in nursing education: Tools for academic progress or abuse? *Nurse Education in Practice*, 66, 103537. <https://doi.org/10.1016/j.nepr.2022.103537>
- OECD. (2024a). *Defining AI incidents and related terms* (No. 16).
- OECD. (2024b). *OECD Economic Outlook, Volume 2024 Issue 1: Preliminary version*. OECD. <https://doi.org/10.1787/69a0c310-en>
- Oelkers, K. (2020). The accessibility of data on environmental risk assessment of pharmaceuticals – are environmental risk assessments information on emissions with respect to international and European environmental information law? *Regulatory Toxicology and Pharmacology*, 111, 104571. <https://doi.org/10.1016/j.yrtph.2019.104571>
- of Malaysia, G. (2024). *Permanent Forest Reserve Area | data.gov.my*.
- Offset your flight with WIZZ*. (n.d.).
- Ogram, A., Sayler, G. S. & Barkay, T. (1987). The extraction and purification of microbial DNA from sediments. *Journal of Microbiological Methods*, 7(2-3), 57–66. [https://doi.org/10.1016/0167-7012\(87\)90025-X](https://doi.org/10.1016/0167-7012(87)90025-X)
- Oguh, C. & Oguh, C. (2023). Blackstone reaches record \$1 trillion in assets; Q2 earnings slump. *Reuters*.
- Ogunbode, C. A., Doran, R., Hanss, D., Ojala, M., Salmela-Aro, K., van den Broek, K. L., Bhullar, N., Aquino, S. D., Marot, T., Schermer, J. A., Włodarczyk, A., Lu, S., Jiang, F., Maran, D. A., Yadav, R., Ardi, R., Chegeni, R., Ghanbarian, E., Zand, S., ... Karasu, M. (2022). Climate anxiety, wellbeing and pro-Environmental action: Correlates of negative emotional responses to climate change in 32 countries. *Journal of Environmental Psychology*, 84, 101887. <https://doi.org/10.1016/j.jenvp.2022.101887>

- Oikos Denktank. (2021). *Webinar: Doughnut Economics in practice w/ Kate Raworth, Barbara Trachte & Marieke Van Doorninck*.
- Oinas-Kukkonen, H. & Harjumaa, M. (2009). Persuasive Systems Design: Key Issues, Process Model, and System Features. *Communications of the Association for Information Systems*, 24. <https://doi.org/10.17705/1CAIS.02428>
- Ojoatre, S. & Atkinson, N. (2023). *Trialling eDNA for biodiversity measurement*.
- Oliveira De Mendonça, G., Coelho Rocha, A. R. & Bogéa Da Costa Tayt-son, D. (2021). The minimalist process: An interpretivist study. *Journal of Consumer Behaviour*, 20(5), 1040–1050. <https://doi.org/10.1002/cb.1912>
- Ollinaho, O. I. & Kröger, M. (2023). Separating the two faces of “bioeconomy”: Plantation economy and sociobiodiverse economy in Brazil. *Forest Policy and Economics*, 149, 102932. <https://doi.org/10.1016/j.forepol.2023.102932>
- Olsson, D., Gericke, N., Boeve-de Pauw, J., Berglund, T. & Chang, T. (2019). Green schools in Taiwan – Effects on student sustainability consciousness. *Global Environmental Change*, 54, 184–194. <https://doi.org/10.1016/j.gloenvcha.2018.11.011>
- On Nielsen’s ideas about generative UI for resolving accessibility*. (2024).
- Open Government Partnership. (2021). *OGP Participation and Co-Creation Standards*.
- Open Knowledge Foundation. (2017). *Global Open Data Index*.
- Open Product Data*. (n.d.).
- OpenAI. (2022). *Introducing ChatGPT*.
- OpenAI. (2023). *GPT-4*.
- OpenAI. (2024a). *Extracting Concepts from GPT-4*.
- OpenAI. (2024b). *Hello GPT-4o*.
- OpenAI. (2024c). *Introducing the Model Spec*.
- OpenAI. (2025). *A practical guide to building agents*.
- opencorporates [@opencorporates]. (2024). *Hidden data is a big problem, and it's limiting our understanding of the world's largest #Multinational enterprises. The #UNSD and the @OECD have created the MNE Information Platform to shine a light on this, with help from @opencorporates data* □ <https://blog.opencorporates.com/2023/03/14/unsd-oecd-use-opencorporates-data-to-help-the-world-understand-multinational-enterprises/> <https://t.co/PWPfQRIVso>.
- OpenSea. (2022). *Top Taiwan Influencers - Collection*.
- Orozco, L. G. N., Battiston, F., Iñiguez, G. & Szell, M. (2020). *Budapest bicycle network growth; Manhattan bicycle network growth from Data-driven strategies for optimal bicycle network growth*. 7642364 Bytes. <https://doi.org/10.6084/M9.FIGSHARE.13336684.V1>
- Osaka, S. (2023). Why climate “doomers” are replacing climate “deniers.” *Washington Post (Washington, D.C. : 1974)*.
- Ouyang, L., Wu, J., Jiang, X., Almeida, D., Wainwright, C. L., Mishkin, P., Zhang, C., Agarwal, S., Slama, K., Ray, A., Schulman, J., Hilton, J., Kelton, F., Miller, L., Simens, M., Askell, A., Welinder, P., Christiano, P., Leike, J. & Lowe, R. (2022). *Training language models to follow instructions with human feedback*. <https://doi.org/10.48550/ARXIV.2203.02155>
- Over 600 Million People Planted More Than 326 Million Trees via Alipay Ant Forest in Five Years*. (2021).

- Oviyam™ , D. (2019). *Red Route in Application Design*.
- Oyedokun, T. B. (2017). Green premium as a driver of green-labelled commercial buildings in the developing countries: Lessons from the UK and US. *International Journal of Sustainable Built Environment*, 6(2). <https://doi.org/10.1016/j.ijsbe.2017.12.007>
- Pachama. (2023). *How much should reforestation cost?*
- Packaging World*. (n.d.).
- Paddle Doll | Middle Kingdom*. (2023).
- Pan, S. L. & Nishant, R. (2023). Artificial intelligence for digital sustainability: An insight into domain-specific research and future directions. *International Journal of Information Management*, 72, 102668. <https://doi.org/10.1016/j.ijinfomgt.2023.102668>
- Panaro, P., Parlow, S. & Amman, F. (2024). *How can pairing #AI with #digitaltwin technology help cut building #emissions?*
- Pandey, S. & Freiberg, B. (2025). *Introducing AWS Serverless MCP Server: AI-powered development for modern applications | AWS Compute Blog*.
- Pandya, V. (2025). *Adobe Analytics: Traffic to U.S. Retail Websites from Generative AI Sources Jumps 1,200 Percent | Adobe Blog*.
- Panzarino, M. (2020). *Crypto-driven marketplace Zora raises \$2M to build a sustainable creator economy*.
- Papaioannou, M. G. & Rentsendorj, B. (2015). Sovereign Wealth Fund Asset Allocations—Some Stylized Facts on the Norway Pension Fund Global. *Procedia Economics and Finance*, 29, 195–199. [https://doi.org/10.1016/S2212-5671\(15\)01122-3](https://doi.org/10.1016/S2212-5671(15)01122-3)
- Park, H. J. & Lin, L. M. (2020). Exploring attitude–behavior gap in sustainable consumption: Comparison of recycled and upcycled fashion products. *Journal of Business Research*, 117, 623–628. <https://doi.org/10.1016/j.jbusres.2018.08.025>
- Parlasca, M. C., Johnen, C. & Qaim, M. (2022). Use of mobile financial services among farmers in Africa: Insights from Kenya. *Global Food Security*, 32, 100590. <https://doi.org/10.1016/j.gfs.2021.100590>
- Parrish, B. (2025). *An Overview of the Updated EU DR Guidance: Implications for Wood Exports*.
- Parundekar, R. (2021). *The Essential Guide to Creating an AI Product in 2020*.
- Pastore, M. (2025). *More consumers using genAI tools to research purchases: Adobe*.
- Patel, A. S., Brahmbhatt, M. N., Bariya, A. R., Nayak, J. B. & Singh, V. K. (2023). “Blockchain technology in food safety and traceability concern to livestock products.” *Heliyon*, 9(6), e16526. <https://doi.org/10.1016/j.heliyon.2023.e16526>
- Patel, N. (2024). *Replika CEO Eugenia Kuyda says the future of AI might mean friendship and marriage with chatbots*.
- Patel, P. (2025). *Aws-samples/aws-smst-geospatial-analysis-deforestation*. AWS Samples.
- patrizia-slongo. (2020). *AI-powered tools for web designers* □.
- Paul, T. (2024). *Douugh, a fintech budgeting app, launches a new robo-advisor feature*.
- Pavlik, J. V. (2023). Collaborating With ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education. *Journalism & Mass Communication Educator*, 78(1), 84–93. <https://doi.org/10.1177/10776958221149577>
- Pearson, P. J. G. & Foxon, T. J. (2012). A low carbon industrial revolution? Insights and chal-

- lenges from past technological and economic transformations. *Energy Policy*, 50, 117–127. <https://doi.org/10.1016/j.enpol.2012.07.061>
- Peng, J., Shi, X. & Tong, X. (2023). Extended producer responsibility for low carbon transition in automobile industry. *Circular Economy*, 2(2), 100036. <https://doi.org/10.1016/j.cec.2023.100036>
- Peng, S., Prentice, C., Shams, S. & Sarker, T. (2024). A systematic literature review on the determinants of cryptocurrency pricing. *China Accounting and Finance Review*, 26(1), 1–30. <https://doi.org/10.1108/CAFR-05-2023-0053>
- Peng, W. & Xiong, L. (2022). Managing financing costs and fostering green transition: The role of green financial policy in China. *Economic Analysis and Policy*, 76, 820–836. <https://doi.org/10.1016/j.eap.2022.09.014>
- People + AI Guidebook*. (n.d.).
- Pérez Roda, M. A., Gilman, E., Huntington, T., Kennelly, S. J. & Suuronen, P. (2019). *A third assessment of global marine fisheries discards*. Food and Agriculture Organization of the United Nations.
- Perez-Cueto, F. J. A. (2021). Nudging plant-based meals through the menu. *International Journal of Gastronomy and Food Science*, 24, 100346. <https://doi.org/10.1016/j.ijgfs.2021.100346>
- Perkins-Kirkpatrick, S. & Green, D. (2023). Extreme heat and climate change. In *Heat Exposure and Human Health in the Context of Climate Change* (pp. 5–36). Elsevier. <https://doi.org/10.1016/B978-0-12-819080-7.00006-9>
- Perri, L. (2022). *What Is a Superapp?*
- Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L., Fantke, P., Hassellöv, M., MacLeod, M., Ryberg, M. W., Søgaard Jørgensen, P., Villarrubia-Gómez, P., Wang, Z. & Hauschild, M. Z. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. *Environmental Science & Technology*, 56(3), 1510–1521. <https://doi.org/10.1021/acs.est.1c04158>
- Pete. (2023). *We hosted #emergencychatgpt hackathon this past Sunday for the new ChatGPT and Whisper APIs. It all came together in just 4 days, but we had 250+ people and 70+ teams demo! Here's a recap of our winning demos: https://t.co/6oIPvR9gRJ*.
- Peter Andrey Smitharchive page. (2024). *How environmental DNA is giving scientists a new way to understand our world*.
- Peter Kareiva, Heather Tallis, Taylor H. Ricketts, Gretchen C. Daily & Stephen Polasky. (2011). *Natural Capital: Theory and Practice of Mapping Ecosystem Services*. Oxford University Press.
- Peters, J. (2023). *Google Chrome will summarize entire articles for you with built-in generative AI*.
- Peters-Lazaro, G., Shresthova, S. & Jenkins, H. (2020). *Popular culture and the civic imagination: Case studies of creative social change*. New York University Press.
- Pfeiffer, M. (2024). Coral giants sound the alarm for the Great Barrier Reef. *Nature*, 632(8024), 265–266. <https://doi.org/10.1038/d41586-024-02329-1>
- Phelan, D. (2024). *Oura Ring: CEO Talks Health, Fitness And The Challenge Of Samsung's Galaxy Ring*.

- Phocuswright. (2023). *Super Connected w/ Rappi and Uber - The #Phocuswright Conference 2023*. YouTube.
- Phoebe Arslanagić-Wakefield. (n.d.). *Replika users mourn the loss of their chatbot girlfriends*.
- PhonePe. (2023). *PhonePe crosses 500 million lifetime registered users*.
- Picard, R. W. (1997). *Affective computing*. MIT Press.
- Picó, Y., Campo, J., Alfarhan, A. H., El-Sheikh, M. A. & Barceló, D. (2023). Wild and ruderal plants as bioindicators of global urban pollution by air, water and soil in Riyadh and Abha, Saudi Arabia. *Science of The Total Environment*, 888, 164166. <https://doi.org/10.1016/j.scitotenv.2023.164166>
- PIETRO CECERE. (2023). “It’s a total mess”: Fund selectors don’t hold back on ESG labelling.
- Pigou, A. C. (2002). *The economics of welfare*. Transaction Pub.
- Pilacinski, A., Pinto, A., Oliveira, S., Araújo, E., Carvalho, C., Silva, P. A., Matias, R., Menezes, P. & Sousa, S. (2023). The robot eyes don’t have it. The presence of eyes on collaborative robots yields marginally higher user trust but lower performance. *Heliyon*, 9(8), e18164. <https://doi.org/10.1016/j.heliyon.2023.e18164>
- Pinto, J. P., Ramírez-Angulo, P. J., Crissien, T. J. & Bonett-Balza, K. (2021). The creation of dystopias as an alternative for imagining and materializing a university of the future. *Futures*, 134, 102832. <https://doi.org/10.1016/j.futures.2021.102832>
- Pirolli, P. & Card, S. (1999). Information foraging. *Psychological Review*, 106(4), 643–675. <https://doi.org/10.1037/0033-295X.106.4.643>
- Plan A. (n.d.). *What are Scope 4 emissions?*
- Planet of the Klimates - Luis Adaime - Founder & CEO of MOSS.Earth*. (n.d.).
- Planetary Health Alliance. (2024a). *Planetary Health*.
- Planetary Health Alliance. (2024b). *The Planetary Health Roadmap and Action Plan*.
- Plantinga, A. & Scholtens, B. (2024). The finance perspective on fossil fuel divestment. *Current Opinion in Environmental Sustainability*, 66, 101394. <https://doi.org/10.1016/j.cosust.2023.101394>
- Plastic Recycling Podcast*. (2024).
- Platzer, M. F. (2023). A perspective on the urgency for green aviation. *Progress in Aerospace Sciences*, 100932. <https://doi.org/10.1016/j.paerosci.2023.100932>
- Plociennik, C., Pourjafarian, M., Nazeri, A., Windholz, W., Knetsch, S., Rickert, J., Ciroth, A., Precci Lopes, A. D. C., Hagedorn, T., Vogelgesang, M., Benner, W., Gassmann, A., Bergweiler, S., Ruskowski, M., Schebek, L. & Weidenkaff, A. (2022). Towards a Digital Lifecycle Passport for the Circular Economy. *Procedia CIRP*, 105, 122–127. <https://doi.org/10.1016/j.procir.2022.02.021>
- Plotkina, D., Orkut, H. & Karageyim, M. A. (2024). Give me a human! How anthropomorphism and robot gender affect trust in financial robo-advisory services. *Asia Pacific Journal of Marketing and Logistics*, 36(10), 2689–2705. <https://doi.org/10.1108/APJML-09-2023-0939>
- Pokrass, M. (2024). *Introducing Structured Outputs in the API*.
- Pollo, L. (2025). *Nu Holdings Ltd. Reports Fourth Quarter and Full Year 2024 Financial Results*.
- Poore, J. & Nemecek, T. (2018). Reducing food’s environmental impacts through producers and consumers. *Science*, 360(6392), 987–992. <https://doi.org/10.1126/science.aaq0216>

- Popescu, I.-S., Gibon, T., Hitaj, C., Rubin, M. & Benetto, E. (2023). Are SRI funds financing carbon emissions? An input-output life cycle assessment of investment funds. *Ecological Economics*, 212, 107918. <https://doi.org/10.1016/j.ecolecon.2023.107918>
- Popkova, E. G., De Bernardi, P., Tyurina, Y. G. & Sergi, B. S. (2022). A theory of digital technology advancement to address the grand challenges of sustainable development. *Technology in Society*, 68, 101831. <https://doi.org/10.1016/j.techsoc.2021.101831>
- Posner, M. (2024). *How BlackRock Abandoned Social And Environmental Engagement*.
- Potter, R. (2025). “*Google Just Flipped the Switch*”: *10MW Geothermal Energy Will Power Massive AI Chip Expansion in Taiwan, Igniting Green Tech Revolution*.
- Potting, J., Hekkert, M., Worrell, E. & Hanemaaijer, A. (2017). *Circular economy: Measuring innovation in the product chain* (No. 2544). PBL Netherlands Environmental Assessment Agency.
- Pournaras, E., Nikolic, J., Velásquez, P., Trovati, M., Bessis, N. & Helbing, D. (2016). Self-regulatory information sharing in participatory social sensing. *EPJ Data Science*, 5(1), 14. <https://doi.org/10.1140/epjds/s13688-016-0074-4>
- Prasad, R. (2022). *How will Alexa, Amazon’s AI voice assistant, advance by talking to us less?*
- Press, C. F.-A. (2023). *A fungal disease is rapidly spreading across the U.S. Scientists are alarmed*.
- PrimaDollar Media. (2021). *PrimaDollar - Giving the supply chain a voice*.
- Priscila Azevedo Rocha, Akshat Rathi & Todd Gillespie. (2022). *Greenwashing Enters a \$22 Trillion Debt Market, Derailing Climate Goals*.
- Protein Brands and Consumers Alike Focus on Sustainability. (2022).
- Public Health Linkages with Sustainability: Workshop Summary (p. 18375). (2013). National Academies Press. <https://doi.org/10.17226/18375>
- Purkiss, D., Allison, A. L., Lorencatto, F., Michie, S. & Miodownik, M. (2022). The Big Compost Experiment: Using citizen science to assess the impact and effectiveness of biodegradable and compostable plastics in UK home composting. *Frontiers in Sustainability*, 3, 942724. <https://doi.org/10.3389/frsus.2022.942724>
- PwC. (2020). *2022 - The growth opportunity of the century*.
- PwC. (2025). *Can Financial Innovation Save The Planet’s Biodiversity?* World Governments Summit.
- PwC Global. (2024). *2024 voice of the consumer survey*.
- PXPay Plus. (n.d.). *PXPay Plus and J.P Morgan Asset Management Taiwan Join Forces to Launch Industry-First Direct Fund Dividend Direct Deposit into E-Wallet Accounts*.
- Pylarinou, E. (2024). *Telegram’s Journey to Web3: A SuperApp in the Making*.
- PYMNTS. (2023). *Staying Ahead Through Payments Innovation*.
- Qayyum Rajan. (2021). *ESG Analytics Introduction*.
- Qiao, Q. & Lee, H. Y. (2024). *OpenAI cuts off access to users in China, Hong Kong and Macau*.
- QIMA. (2024). *Global Supply Chain Quality Control: Industry News & Updates*.
- Qin, M., Zhang, X., Li, Y. & Badarcea, R. M. (2023). Blockchain market and green finance: The enablers of carbon neutrality in China. *Energy Economics*, 118, 106501. <https://doi.org/10.1016/j.eneco.2022.106501>
- Qiu, T. (2021). *A Psychiatrist’s Perspective on Social Media Algorithms and Mental Health |*

*Stanford HAI.*

- Qorus. (2023). *The Great Reinvention: The Global Digital Banking Radar 2023*.
- Quatrini, S. (2021). Challenges and opportunities to scale up sustainable finance after the COVID-19 crisis: Lessons and promising innovations from science and practice. *Ecosystem Services*, 48, 101240. <https://doi.org/10.1016/j.ecoser.2020.101240>
- Quinson, T. (2020). Trump Plan to Block Green 401(k)s Stirs Fund Industry Fury. *Bloomberg*.
- Radford, A., Narasimhan, K., Salimans, T. & Sutskever, I. (2018). *Improving language understanding by generative pre-training*. OpenAI.
- Ragas. (2023). *Metrics-Driven Development*.
- Rahul Agarwal, Ida Kristensen, Andreas Kremer & Angela Luget. (2024). *How generative AI can help banks manage risk and compliance* | McKinsey.
- Raido Tõnisson. (2022a). *LHV töi klientide ni uue metaversumi kriptoraha*.
- Raido Tõnisson. (2022b). *Seda aktsionärid ostaksid - Artiklid - Uudised - LHV finantsportaal*.
- Raihan, A., Hasan, Md. A., Voumik, L. C., Pattak, D. C., Akter, S. & Ridwan, M. (2024). Sustainability in Vietnam: Examining economic growth, energy, innovation, agriculture, and forests' impact on CO<sub>2</sub> emissions. *World Development Sustainability*, 4, 100164. <https://doi.org/10.1016/j.wds.2024.100164>
- Rajagopalan, S. & Landigan, P. J. (2023). The Inflation Reduction Act – implications for climate change, air pollution, and health. *The Lancet Regional Health - Americas*, 23, 100522. <https://doi.org/10.1016/j.lana.2023.100522>
- Rajan, Q. (2025). *The future of Sustainability Reporting: How Envify supports SMEs with Environmental Data Reporting*.
- Ramchurn, S. D., Stein, S. & Jennings, N. R. (2021). Trustworthy human-AI partnerships. *iScience*, 24(8), 102891. <https://doi.org/10.1016/j.isci.2021.102891>
- Ranking Canada's Top Growing Companies of 2024. (2024). *The Globe and Mail*.
- Rao, P. (2023). *Visualizing the \$105 Trillion World Economy in One Chart*.
- Rapid Transitions Alliance. (2019). *Taiwan's Transition – from Garbage Island to Recycling Leader*.
- Ratkovic, M. (2023). *Leading the Way in Real-Time ESG Scoring: An Overview of ESG Analytics*.
- Rauch, G. (2024). *A fascinating finding from @v0 has been that when something fails, newcomers' instincts are to tell \*us\*, @vercel, about it, but if they had told the AI, in most cases it would fix the issue immediately and flawlessly. I think the inertia comes from the fact that it's so.*
- RavenPack. (2021). *The B Corp Movement and ESG*.
- Raworth, K. (2017). *Doughnut economics: Seven ways to think like a 21st century economist*. Chelsea Green Publishing.
- Ray Dalio. (2023). *The Fourth Big Force: Climate Change*.
- Ray, P. P. (2023). Web3: A comprehensive review on background, technologies, applications, zero-trust architectures, challenges and future directions. *Internet of Things and Cyber-Physical Systems*, 3, 213–248. <https://doi.org/10.1016/j.iotcps.2023.05.003>
- ReadyAI. (2020). *Human-AI Interaction: How We Work with Artificial Intelligence*.
- Real Time ESG Tracking From StockSnips. (2021).

- Redazione, L. (2025). *Solar power in China hits 60 GW in Q1 2025*.
- Reeves, B. & Nass, C. I. (1998). *The media equation: How people treat computers, television, and new media like real people and places* (1. paperback ed). CSLI Publications.
- ReFi DAO. (2022). *ReFi Podcast S2E9: Kolektivo Framework with Luuk and Pat*.
- Reformat, M. (2014). Special section: Applications of computational intelligence and machine learning to software engineering. *Information Sciences*, 259, 393–395. <https://doi.org/10.1016/j.ins.2013.11.019>
- Reformosatw. (2024). *Anti-Greenwashing*.
- Regen Network. (22-01). *Community Development Call 1/19/22*.
- Regen Network. (2023). *Regen Network / Invest in high-integrity carbon credits. Regenerative capitalism: A new era of economics*. (2023).
- Rehash: A Web3 Podcast. (2022). *Building a Human-Centered Web3 w/Paris Rouzati | S3 E14*.
- Reich, R. H., Ayan, J., Alaerts, L. & Van Acker, K. (2023). Defining the goals of Product Passports by circular product strategies. *Procedia CIRP*, 116, 257–262. <https://doi.org/10.1016/j.procir.2023.02.044>
- Reid, S. (2020). *University of Edinburgh goes big on green investment after HSBC tie-up*.
- Remington, C. (2020). *Zalando's Zign label "fully dedicated" to sustainability*.
- Remley, H. W. (2025). *Why These Rare Mushrooms Can Go For \$1,000 Per Pound*.
- Renato Capelj. (February 16, 2021 6:47 PM). *Mobile Hedge Fund Platform Titan Raises \$12.5M Series A Led By General Catalyst - Benzinga*.
- Renee Cho. (2020). *How Buying Stuff Drives Climate Change*.
- Renée Salmonsen. (2018). *Asia's largest vertical farm is located in northern Taiwan*.
- Rennert, K., Errickson, F., Prest, B. C., Rennels, L., Newell, R. G., Pizer, W., Kingdon, C., Wingenroth, J., Cooke, R., Parthum, B., Smith, D., Cromar, K., Diaz, D., Moore, F. C., Müller, U. K., Plevin, R. J., Raftery, A. E., Ševčíková, H., Sheets, H., ... Anthoff, D. (2022). Comprehensive evidence implies a higher social cost of CO<sub>2</sub>. *Nature*, 610(7933), 687–692. <https://doi.org/10.1038/s41586-022-05224-9>
- Replit. (2023). *Replit — Openv0: The Open-Source, AI-Driven Generative UI Component Framework*.
- Review of the 2023 Helsinki Biennial*. (2023).
- Revolut. (2020). *Revolut explains fractional shares*.
- Revolut. (2024a). *Our 2023 Annual Report is here! (Thread) □ 1. Thanks to your trust and support, Revolut is the most downloaded finance app in the UK and Europe □ https://t.co/wlQ9dgibOH*.
- Revolut. (2024b). *Revolut hits 50 million customer milestone globally on mission to build world's first truly global bank*.
- Revolut. (2024c). *Revolut unlocks bonds investing market to customers in EEA*.
- Revolut. (2025). *Revolut's trading fees*.
- Revolut launches ETF trading platform in Europe*. (2023).
- Reynolds, C. (2001). *Designing for affective interactions*.
- Ribeiro, L. L. & Lemos Marinho, E. L. (2017). Gross National Happiness in Brazil: An analysis of its determinants. *Economía (Pontificia Universidad Católica Del Perú. Departamento de Economía)*, 18(2), 156–167. <https://doi.org/10.1016/j.econ.2016.07.002>

- Riboli, E., Beland, F. A., Lachenmeier, D. W., Marques, M. M., Phillips, D. H., Schernhammer, E., Afghan, A., Assunção, R., Caderni, G., Corton, J. C., De Aragão Umbuzeiro, G., De Jong, D., Deschasaux-Tanguy, M., Hodge, A., Ishihara, J., Levy, D. D., Mandrioli, D., McCullough, M. L., McNaughton, S. A., ... Madia, F. (2023). Carcinogenicity of aspartame, methyleugenol, and isoeugenol. *The Lancet Oncology*, 24(8), 848–850. [https://doi.org/10.1016/S1470-2045\(23\)00341-8](https://doi.org/10.1016/S1470-2045(23)00341-8)
- Richard Yang. (2021). *Interaction design is more than just user flows and clicks*.
- Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., Drücke, M., Fetzer, I., Bala, G., Von Bloh, W., Feulner, G., Fiedler, S., Gerten, D., Gleeson, T., Hofmann, M., Huiskamp, W., Kummu, M., Mohan, C., Nogués-Bravo, D., ... Rockström, J. (2023). Earth beyond six of nine planetary boundaries. *Science Advances*, 9(37), eadh2458. <https://doi.org/10.1126/sciadv.adh2458>
- Rieger, E., Costanza, R., Kubiszewski, I. & Dugdale, P. (Eds.). (2023). *Toward an integrated science of wellbeing*. Oxford University Press.
- Rigby, J. (2023). WHO cancer arm deems aspartame 'possible carcinogen'; consumption limits unchanged. *Reuters*.
- Rishi Sunak to green-light hundreds of new oil and gas licenses in North Sea*. (2023).
- Ritchie, H. & Roser, M. (2021). Fish and Overfishing. *Our World in Data*.
- Ritz, R. A. (2022). Global carbon price asymmetry. *Journal of Environmental Economics and Management*, 114, 102687. <https://doi.org/10.1016/j.jeem.2022.102687>
- Roa, L., Correa-Bahnsen, A., Suarez, G., Cortés-Tejada, F., Luque, M. A. & Bravo, C. (2021). Super-app behavioral patterns in credit risk models: Financial, statistical and regulatory implications. *Expert Systems with Applications*, 169, 114486. <https://doi.org/10.1016/j.eswa.2020.114486>
- Robeco. (2023). *2023 Global Climate Survey*.
- ROBIN DHANWANI. (2021). *Fintech UI/UX Design: Driving Growth by Creating a Better User Experience | Parallel - Blog*.
- Rockoff, H. (2020). *Off to a Good Start: The NBER and the Measurement of National Income* (No. w26895; p. w26895). National Bureau of Economic Research. <https://doi.org/10.3386/w26895>
- Rogers, C. R. (1995). *A way of being*. Houghton Mifflin Co.
- Rogers, Y. (2022). The Four Phases of Pervasive Computing: From Vision-Inspired to Societal-Challenged. *IEEE Pervasive Computing*, 21(3), 9–16. <https://doi.org/10.1109/MPRV.2022.3179145>
- Romain Beaumont. (2022). *LAION-5B: A NEW ERA OF OPEN LARGE-SCALE MULTIMODAL DATASETS*.
- Rontard, B. & Reyes Hernández, H. (2022). Political construction of carbon pricing: Experience from New Zealand emissions trading scheme. *Environmental Development*, 43, 100727. <https://doi.org/10.1016/j.envdev.2022.100727>
- Rooney-Varga, J., Kapmeier, F., Sterman, J., Jones, A., Putko, M. & Rath, K. (2019). The climate action simulation. *Simulation & Gaming*, 51, 104687811989064. <https://doi.org/10.1177/1046878119890643>
- Röös, E., Wood, A., Säll, S., Abu Hatab, A., Ahlgren, S., Hallström, E., Tidåker, P. & Hans-

- son, H. (2023). Diagnostic, regenerative or fossil-free - exploring stakeholder perceptions of Swedish food system sustainability. *Ecological Economics*, 203, 107623. <https://doi.org/10.1016/j.ecolecon.2022.107623>
- Rosales Carreón, J. & Worrell, E. (2018). Urban energy systems within the transition to sustainable development. A research agenda for urban metabolism. *Resources, Conservation and Recycling*, 132, 258–266. <https://doi.org/10.1016/j.resconrec.2017.08.004>
- Rose, D. (2015). *Enchanted objects: Innovation, design, and the future of technology* (1. Scribner trade paperback ed).
- Ross, L., Arrow, K., Cialdini, R., Diamond-Smith, N., Diamond, J., Dunne, J., Feldman, M., Horn, R., Kennedy, D., Murphy, C., Pirages, D., Smith, K., York, R. & Ehrlich, P. (2016). The Climate Change Challenge and Barriers to the Exercise of Foresight Intelligence. *BioScience*, 66(5), 363–370. <https://doi.org/10.1093/biosci/biw025>
- Rossberg, A. G., O’Sullivan, J. D., Malysheva, S. & Shnerb, N. M. (2024). A metric for tradable biodiversity credits quantifying impacts on global extinction risk. *Journal of Industrial Ecology*, 28(4), 1009–1021. <https://doi.org/10.1111/jiec.13518>
- Rossi, M., Cappelletti, F. & Germani, M. (2022). Design for environmental sustainability: Collect and use company information to design green products. *Procedia CIRP*, 105, 823–828. <https://doi.org/10.1016/j.procir.2022.02.136>
- Rousse, O. (2008). Environmental and economic benefits resulting from citizens’ participation in CO<sub>2</sub> emissions trading: An efficient alternative solution to the voluntary compensation of CO<sub>2</sub> emissions. *Energy Policy*, 36(1), 388–397. <https://doi.org/10.1016/j.enpol.2007.09.019>
- Routescan Research Team. (2025). *State of the market Q1 2025*. Routescan.
- Ruba, U. B. & Talucder, M. S. A. (2023). Potentiality of homestead agroforestry for achieving sustainable development goals: Bangladesh perspectives. *Heliyon*, 9(3), e14541. <https://doi.org/10.1016/j.heliyon.2023.e14541>
- Rubino, M., Etheridge, D., Thornton, D., Allison, C., Francey, R., Langenfelds, R., Steele, P., Trudinger, C., Spencer, D., Curran, M., Van Ommen, T. & Smith, A. (2019). *Law Dome Ice Core 2000-Year CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and d<sup>13</sup>C-CO<sub>2</sub>* (pp. 255.62 KB). CSIRO. <https://doi.org/10.25919/5BFE29FF807FB>
- Rudd, M. A. (2015). Pathways from marine protected area design and management to ecological success. *PeerJ*, 3, e1424. <https://doi.org/10.7717/peerj.1424>
- Ruiz Estrada, M. A. (2024). The Seventh Industrial Revolution (IR 7.0). *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4720983>
- Ruiz-Pastor, L., Chulvi, V., Mulet, E. & Royo, M. (2022). A metric for evaluating novelty and circularity as a whole in conceptual design proposals. *Journal of Cleaner Production*, 337, 130495. <https://doi.org/10.1016/j.jclepro.2022.130495>
- Ruiz-Pastor, L. & Mesa, J. A. (2023). Proposing an integrated indicator to measure product repairability. *Journal of Cleaner Production*, 395, 136434. <https://doi.org/10.1016/j.jclepro.2023.136434>
- Ryan, M. (2022). The ethics of dietary apps: Technology, health, and the capability approach. *Technology in Society*, 68, 101873. <https://doi.org/10.1016/j.techsoc.2022.101873>
- S HUB. (2018). *H&M invests in sustainable innovation from the Norwegian company Repairable*.

- Saba, Y. & Saba, Y. (2022). MENA emerges as world's fastest-growing crypto adopter -study. *Reuters*.
- Safaricom. (2024). *Safaricom's M-PESA Hits 34 Million Customers in Kenya*.
- Sahota, N. (2021). *An AI analysis of 800 companies finds that greenwashing is rampant*.
- Saini, R. (2025). *Apple Uses Bug Report Data for AI Training in iOS 18.5 Beta*.
- Sala, E., Mayorga, J., Bradley, D., Cabral, R. B., Atwood, T. B., Auber, A., Cheung, W., Costello, C., Ferretti, F., Friedlander, A. M., Gaines, S. D., Garilao, C., Goodell, W., Halpern, B. S., Hinson, A., Kaschner, K., Kesner-Reyes, K., Leprieur, F., McGowan, J., ... Lubchenco, J. (2021). Protecting the global ocean for biodiversity, food and climate. *Nature*, 592(7854), 397–402. <https://doi.org/10.1038/s41586-021-03371-z>
- Salah-Tantawy, A., Chang, C.-S. G., Young, S.-S. & Lee, C.-F. (2025). Multivariate analyses to evaluate the contamination, ecological risk, and source apportionment of heavy metals in the surface sediments of Xiang-Shan wetland, Taiwan. *Frontiers in Public Health*, 13, 1459060. <https://doi.org/10.3389/fpubh.2025.1459060>
- San Roman, R., Adi, Y., Deleforge, A., Serizel, R., Synnaeve, G. & Défossez, A. (2023). From discrete tokens to high-fidelity audio using multi-band diffusion. *arXiv Preprint arXiv*:
- Sanchez, O. T., Fernandes, J. M., Rodrigues, A., Silva, J. S., Boavida, F., Rivadeneira, J. E., De Lemos, A. V. & Raposo, D. (2022). Green Bear - A LoRaWAN-based Human-in-the-Loop case-study for sustainable cities. *Pervasive and Mobile Computing*, 87, 101701. <https://doi.org/10.1016/j.pmcj.2022.101701>
- Sandor, H. B. and K. (2024). *Tokenized Treasury Funds Pass \$2B Market Cap Amid BlackRock's Explosive Growth*.
- Saner, D., Beretta, C., Jäggi, B., Juraske, R., Stoessel, F. & Hellweg, S. (2015). FoodPrints of households. *The International Journal of Life Cycle Assessment*, 21. <https://doi.org/10.1007/s11367-015-0924-5>
- Sanjai Bhagat. (2022). *An Inconvenient Truth About ESG Investing*.
- Santos, A., Ricardo, F., Domingues, M. R. M., Patinha, C. & Calado, R. (2023). Current trends in the traceability of geographic origin and detection of species-mislabeling in marine bivalves. *Food Control*, 152, 109840. <https://doi.org/10.1016/j.foodcont.2023.109840>
- Sarah Ludwig Rausch & Neha Pathak. (2021). *Sustainability and Your Health*.
- Sarah Perez. (2022). *Google rolls out a new set of search tools for eco-conscious travelers*.
- Sarah Perez. (2023). *Character.AI, the A16z-backed chatbot startup, tops 1.7M installs in first week* | TechCrunch.
- Saubade, M., Karatzios, C., Besson, C., Farasse, A.-C., Charles, B. & Gremion, G. (2016). Promoting physical activity: What do we have available to motivate our patients? *Annals of Physical and Rehabilitation Medicine*, 59, e54–e55. <https://doi.org/10.1016/j.rehab.2016.07.125>
- Saudi firm that grows hay in California and Arizona to lose farm leases over water issue. (2023). *The Los Angeles Times*.
- Scarr, S. & Sharma, M. (2021). Devoured. *Reuters*.
- Scheidel, A., Del Bene, D., Liu, J., Navas, G., Mingorría, S., Demaria, F., Avila, S., Roy, B., Ertör, I., Temper, L. & Martínez-Alier, J. (2020). Environmental conflicts and defenders: A global overview. *Global Environmental Change*, 63, 102104. <https://doi.org/10.1016/j.gloenvcha.2020.102104>

- gloenvcha.2020.102104
- Schoonderwoerd, T. A. J., Jorritsma, W., Neerincx, M. A. & van den Bosch, K. (2021). Human-centered XAI: Developing design patterns for explanations of clinical decision support systems. *International Journal of Human-Computer Studies*, 154, 102684. <https://doi.org/10.1016/j.ijhcs.2021.102684>
- Schuhmann, C., Beaumont, R., Vencu, R., Gordon, C., Wightman, R., Cherti, M., Coombes, T., Katta, A., Mullis, C., Wortsman, M., Schramowski, P., Kundurthy, S., Crowson, K., Schmidt, L., Kaczmarczyk, R. & Jitsev, J. (2022). *LAION-5B: An open large-scale dataset for training next generation image-text models*. <https://doi.org/10.48550/ARXIV.2210.08402>
- Schumacher, E. F. (1985). *Small is beautiful: Economics as if people mattered* (21. [ed]). Harper & Row.
- Schwartz, L. (n.d.). Paradigm leads \$225 million round for Monad Labs, which is building a layer 1 blockchain to take on Ethereum and Solana. In *Fortune Crypto*. <https://fortune.com/crypto/2024/04/09/monad-paradigm-greenoaks-jump-crypto-funding-225-million/>.
- Schwartz, S. E. O., Benoit, L., Clayton, S., Parnes, M. F., Swenson, L. & Lowe, S. R. (2022). Climate change anxiety and mental health: Environmental activism as buffer. *Current Psychology*. <https://doi.org/10.1007/s12144-022-02735-6>
- Schwartzkopff, F. & Kishan, S. (2022). ESG Funds Managing \$1 Trillion Are Stripped of Sustainable Tag by Morningstar. *Bloomberg*.
- Scientists urge European Parliament to vote for nature restoration law*. (2023). <https://doi.org/10.1126/science.adj6767>
- Scottish Government. (2022). *Wellbeing Economy Governments (WEGo)*.
- Seabrook, D. (2020). Music therapy in the era of climate crisis: Evolving to meet current needs. *The Arts in Psychotherapy*, 68, 101646. <https://doi.org/10.1016/j.aip.2020.101646>
- Sean McGowan. (2018). *UX Design For FinTech: 4 Things To Remember*.
- Searls, D. (2012). *The intention economy: When customers take charge*. Harvard Business Review Press.
- Securitize. (2024). *BlackRock Launches Its First Tokenized Fund, BUIDL, on the Ethereum Network*.
- Seeber, I., Bittner, E., Briggs, R. O., de Vreede, T., de Vreede, G.-J., Elkins, A., Maier, R., Merz, A. B., Oeste-Reiß, S., Randrup, N., Schwabe, G. & Söllner, M. (2020). Machines as teammates: A research agenda on AI in team collaboration. *Information & Management*, 57(2), 103174. <https://doi.org/10.1016/j.im.2019.103174>
- Selma – Your finances done right*. (n.d.).
- Selman, S. U., Saroglou, S. T., Joschinski, J., Calbi, M., Vogler, V., Barath, S. & Grobman, Y. J. (2023). Toward multi-species building envelopes: A critical literature review of multi-criteria decision-making for design support. *Building and Environment*, 231, 110006. <https://doi.org/10.1016/j.buildenv.2023.110006>
- Semantics3. (2017). *Why the “U” in UPC doesn’t mean Universal*.
- Sengottuvelu, R. (2025). *Rethinking how we Scaffold AI Agents - Rahul Sengottuvelu, Ramp*. YouTube.
- Sepandar Kamvar. (2022). *Sep Kamvar from Celo & Mosaic*.

- Şerban, C. & Todericiu, I.-A. (2020). Alexa, what classes do I have today? The use of artificial intelligence via smart speakers in education. *Procedia Computer Science*, 176, 2849–2857. <https://doi.org/10.1016/j.procs.2020.09.269>
- Serrano-Notivoli, R., Tejedor, E., Sarricolea, P., Meseguer-Ruiz, O., De Luis, M., Saz, M. Á., Longares, L. A. & Olcina, J. (2023). Unprecedented warmth: A look at Spain's exceptional summer of 2022. *Atmospheric Research*, 106931. <https://doi.org/10.1016/j.atmosres.2023.106931>
- Shabrina Nurqamarani, A., Robin Jonathan, L., NH Gaffar, E. & Indrawati, A. (2020). THE EFFECTS OF MOBILE SERVICE QUALITIES ON CUSTOMER REUSE INTENTION OF GOJEK SUPER APP. *Humanities & Social Sciences Reviews*, 8(4), 1134–1146. <https://doi.org/10.18510/hssr.2020.84108>
- Shahaf, D. & Amir, E. (2007). Towards a theory of AI completeness. *AAAI Spring Symposium: Logical Formalizations of Commonsense Reasoning*.
- Sharing.Lab. (2015). *What is a social object?*
- Shashwat Mohanty. (2022). *Green push or greenwash: Sustainable funds don't buy Zomato's ESG narrative.*
- Sheep Inc. - Softcore Radicals.* (2023).
- Shen, M.-L., Tseng, Y.-H., Jan, S., Young, C.-C. & Chiou, M.-D. (2014). Long-term variability of the Kuroshio transport east of Taiwan and the climate it conveys. *Progress in Oceanography*, 121, 60–73. <https://doi.org/10.1016/j.pocean.2013.10.009>
- Shenoi, S. (2018). *Participatory design and the future of interaction design.*
- Sherren, K. (2024). *Flood risk mapping is a public good, so why the public resistance in Canada? Lessons from Nova Scotia.*
- Sherwood, S. C., Webb, M. J., Annan, J. D., Armour, K. C., Forster, P. M., Hargreaves, J. C., Hegerl, G., Klein, S. A., Marvel, K. D., Rohling, E. J., Watanabe, M., Andrews, T., Braconnot, P., Bretherton, C. S., Foster, G. L., Hausfather, Z., Von Der Heydt, A. S., Knutti, R., Mauritzen, T., ... Zelinka, M. D. (2020). An Assessment of Earth's Climate Sensitivity Using Multiple Lines of Evidence. *Reviews of Geophysics*, 58(4), e2019RG000678. <https://doi.org/10.1029/2019RG000678>
- Shibu, S. (2024). *Model From OpenAI Rival Anthropic Shows 'Metacognition': Report.*
- Shiller, R. J. (2019). *Narrative economics: How stories go viral & drive major economic events.* Princeton University Press.
- Shin, Donghee. (2020). How do users interact with algorithm recommender systems? The interaction of users, algorithms, and performance. *Computers in Human Behavior*, 109, 106344. <https://doi.org/10.1016/j.chb.2020.106344>
- Shin, Don, Zhong, B. & Biocca, F. (2020). Beyond user experience: What constitutes algorithmic experiences? *International Journal of Information Management*, 52, 102061. <https://doi.org/10.1016/j.ijinfomgt.2019.102061>
- Shin, G., Jarrahi, M. H., Fei, Y., Karami, A., Gafinowitz, N., Byun, A. & Lu, X. (2019). Wearable activity trackers, accuracy, adoption, acceptance and health impact: A systematic literature review. *Journal of Biomedical Informatics*, 93, 103153. <https://doi.org/10.1016/j.jbi.2019.103153>
- Shinde, S. (2023). *Tata Neu 2.0 Plans Better Experience.*

- Shipper, D. (2023). *GPT-4 Is a Reasoning Engine*.
- Siddiqui, Z., Sakunia, S. & Mahmud, F. (2024). *Riders in the smog: Pollution is poisoning gig workers*.
- SIFMA. (2023). *Research Quarterly: Equities*.
- Silo AI's new release Viking 7B, bridges the gap for low-resource languages.* (2024).
- Silverman, J. (2017). *Business as a Force for Good: Defining Etsy's Path*.
- Simões-Coelho, M., Figueira, A. R. & Russo, E. (2023). Balancing global corporate sustainability engagement in asymmetric markets: The Coca-Cola Co. Case. *Sustainable Production and Consumption*, 40, 89–100. <https://doi.org/10.1016/j.spc.2023.06.005>
- Simon, H. A. (1955). A Behavioral Model of Rational Choice. *The Quarterly Journal of Economics*, 69(1), 99. <https://doi.org/10.2307/1884852>
- Simon Sterne. (2023). *Unlocking the Power of Design to Help Users Make Smart Decisions*.
- Singer, U., Polyak, A., Hayes, T., Yin, X., An, J., Zhang, S., Hu, Q., Yang, H., Ashual, O., Gafni, O., Parikh, D., Gupta, S. & Taigman, Y. (2022). Make-A-video: Text-to-video generation without text-video data. *ArXiv*, *abs/2209.14792*.
- Singh, P. K. & Sarkar, P. (2023). An artificial neural network tool to support the decision making of designers for environmentally conscious product development. *Expert Systems with Applications*, 212, 118679. <https://doi.org/10.1016/j.eswa.2022.118679>
- Singhal, K., Tu, T., Gottweis, J., Sayres, R., Wulczyn, E., Hou, L., Clark, K., Pfohl, S., Cole-Lewis, H., Neal, D., Schaeckermann, M., Wang, A., Amin, M., Lachgar, S., Mansfield, P., Prakash, S., Green, B., Dominowska, E., y Arcas, B. A., ... Natarajan, V. (2023). *Towards Expert-Level Medical Question Answering with Large Language Models* (No. arXiv:2305.09617). arXiv. <https://arxiv.org/abs/2305.09617>
- Sipthorpe, A., Brink, S., Van Leeuwen, T. & Staffell, I. (2022). Blockchain solutions for carbon markets are nearing maturity. *One Earth (Cambridge, Mass.)*, 5(7), 779–791. <https://doi.org/10.1016/j.oneear.2022.06.004>
- Sjöström, E., Waltré, N., Nilsson, A., Carrion, A. R., Eriksson, A., Agerström, M. & Vanhuyse, F. (2020). *Financing sustainable city goals in Sweden: Preliminary findings*. Stockholm Environment Institute.
- Slack, J. (2021). *The Atura Process*.
- Smale, D. A., Wernberg, T., Oliver, E. C. J., Thomsen, M., Harvey, B. P., Straub, S. C., Burrows, M. T., Alexander, L. V., Benthuysen, J. A., Donat, M. G., Feng, M., Hobday, A. J., Holbrook, N. J., Perkins-Kirkpatrick, S. E., Scannell, H. A., Sen Gupta, A., Payne, B. L. & Moore, P. J. (2019). Marine heatwaves threaten global biodiversity and the provision of ecosystem services. *Nature Climate Change*, 9(4), 306–312. <https://doi.org/10.1038/s41558-019-0412-1>
- SmartWealth. (2021). *How to Become an Investor Instead of a Consumer*.
- Smith, B. (2021). *One year later: The path to carbon negative – a progress report on our climate “moonshot”*.
- Smith, T. (2019). *For China's Ultra Elite, Personal Growth is the New Luxury*.
- Social Enterprises, B Corps, Benefit Companies, ESG.* (2025).
- Socially Responsible Investing Advisors.* (n.d.).
- Sohl-Dickstein, J. (2024). *The boundary of neural network trainability is fractal* (No.

- arXiv:2402.06184). arXiv. <https://arxiv.org/abs/2402.06184>
- SOJO - door-to-door clothing alterations and repairs.* (2023).
- Soleimani, L. (2018). *10 UI Patterns For a Human Friendly AI*.
- Soliman, A. (2024). “Unacceptable”: A staggering 4.4 billion people lack safe drinking water, study finds. *Nature*, d41586-024-02621-0. <https://doi.org/10.1038/d41586-024-02621-0>
- Sommer, F., Demirtaş, G. & Muirhead, D. (2024). *Who's the Climate Expert on Board?*
- Song, W. (2025). *China Briefing: The “Shenzen model”; Record solar growth; NDRC rejected industrial “rat race”*.
- Song, X., She, S., Xin, M., Chen, L., Li, Y., Heyden, Y. V., Rogers, K. M. & Chen, L. (2020). Detection of adulteration in Chinese monofloral honey using <sup>1</sup>H nuclear magnetic resonance and chemometrics. *Journal of Food Composition and Analysis*, 86, 103390. <https://doi.org/10.1016/j.jfca.2019.103390>
- Soundarya Jayaraman. (2023). *How Big Is Big? 85+ Big Data Statistics You Should Know in 2023*.
- Sourcemap. (2025). *Supply Chain Mapping*.
- Sovacool, B. K. (2021). When subterranean slavery supports sustainability transitions? Power, patriarchy, and child labor in artisanal Congolese cobalt mining. *The Extractive Industries and Society*, 8(1), 271–293. <https://doi.org/10.1016/j.exis.2020.11.018>
- S&P Global. (2019). *The world’s 100 largest banks*.
- S&P rolls out Trucost ESG data to its customers.* (2019).
- Springmann, M., Clark, M. A., Rayner, M., Scarborough, P. & Webb, P. (2021). The global and regional costs of healthy and sustainable dietary patterns: A modelling study. *The Lancet Planetary Health*, 5(11), e797–e807. [https://doi.org/10.1016/S2542-5196\(21\)00251-5](https://doi.org/10.1016/S2542-5196(21)00251-5)
- Staff, C. K. (2021). *2021 Global 100 ranking*.
- Stall-Paquet, C. (2021). Fresh from the city: The rise of urban farming. *Canadian Geographic*.
- Stand.earth. (2023). *Stand.earth - For the people and places you love*.
- Stanford Encyclopedia of Philosophy. (2021). *The Turing Test*.
- Stanford University. (2021). *Professors explain the social cost of carbon*.
- Statista. (2021). *Global retail e-commerce sales 2026*.
- Statista. (2023a). *Annual CO<sub>2</sub> emissions worldwide 1940-2022*.
- Statista. (2023b). *Retail market worldwide - Statistics & Facts*.
- Statista. (2024). *Cryptocurrencies - Worldwide | Statista Market Forecast*.
- Statista & IEA. (2022). *Global transport CO<sub>2</sub> emissions breakdown 2021*.
- Steenmans, K. & Ulfbeck, V. (2023). Fostering the circular economy through private law: Perspectives from the extended producer responsibility concept. *Resources, Conservation and Recycling*, 195, 107016. <https://doi.org/10.1016/j.resconrec.2023.107016>
- Stefan Klebert. (2022). *Carbon-neutral manufacturing is possible: Here's how*.
- Steger, A. (2019). *Defining Growth Design: The Guide to the Role Most Startups are Missing*.
- Steinhoff, L. & Zondag, M. M. (2021). Loyalty programs as travel companions: Complementary service features across customer journey stages. *Journal of Business Research*, 129, 70–82. <https://doi.org/10.1016/j.jbusres.2021.02.016>
- Steph Hay. (2017). *Eno - Financial AI Understands Emotions*.
- Stephanie Aaronson & Aaron Tilley. (2023). *How Apple Became a \$3 Trillion Company*.

- Stephanie Donahole. (2021). *How Artificial Intelligence Is Impacting UX Design*.
- Stern, N. (2022a). A Time for Action on Climate Change and a Time for Change in Economics. *The Economic Journal*, 132(644), 1259–1289. <https://doi.org/10.1093/ej/ueac005>
- Stern, N. (2022b). Towards a carbon neutral economy: How government should respond to market failures and market absence. *Journal of Government and Economics*, 6, 100036. <https://doi.org/10.1016/j.jge.2022.100036>
- Stern, N., Stiglitz, J. & Taylor, C. (2022). The economics of immense risk, urgent action and radical change: Towards new approaches to the economics of climate change. *Journal of Economic Methodology*, 29(3), 181–216. <https://doi.org/10.1080/1350178X.2022.2040740>
- Steverman, B. (2022). What the \$73 Trillion Great Wealth Transfer Means for America's Super Rich - Bloomberg. *Bloomberg*.
- Stiglitz, J., Kaufman, N. & Barrett, S. (2024). *How Economics Can Tackle the “Wicked Problem” of Climate Change*. Columbia Institute of Global Politics.
- Stockton, N. (2017). If AI Can Fix Peer Review in Science, AI Can Do Anything. *Wired*.
- Stöhr, C., Ou, A. W. & Malmström, H. (2024). Perceptions and usage of AI chatbots among students in higher education across genders, academic levels and fields of study. *Computers and Education: Artificial Intelligence*, 7, 100259. <https://doi.org/10.1016/j.caeari.2024.100259>
- Stone Skipper. (2022). *How AI is changing “interactions”*.
- Storbeck, O. (2021). Fast fashion must be shelved within a decade, says Zalando CEO. *Financial Times*.
- Strava. (2022). *Strava’s Global Community Continues Strong Growth Surpassing 100M Registered Athletes on the Platform*.
- Stretton, C. (2022a). *Digital product passports (DPP): What, how, and why?*
- Stretton, C. (2022b). *German Supply Chain Act: Due diligence obligations explained*.
- Su, J., Ng, D. T. K. & Chu, S. K. W. (2023). Artificial Intelligence (AI) Literacy in Early Childhood Education: The Challenges and Opportunities. *Computers and Education: Artificial Intelligence*, 4, 100124. <https://doi.org/10.1016/j.caeari.2023.100124>
- Su, J. & Yang, W. (2022). Artificial intelligence in early childhood education: A scoping review. *Computers and Education: Artificial Intelligence*, 3, 100049. <https://doi.org/10.1016/j.caeari.2022.100049>
- Suarez, G., Raful, J., Luque, M. A., Valencia, C. F. & Correa-Bahnse, A. (2021). *Enhancing User’s Income Estimation with Super-App Alternative Data*. <https://doi.org/10.48550/ARXIV.2104.05831>
- Suarez, M., Anne, J., Sylor-Miller, K., Mounter, D. & Stanfield, R. (2020). *Design Systems Handbook*.
- Sulapac – Replacing plastic.* (n.d.).
- Sullivan, G. M. & Artino, A. R. (2013). Analyzing and Interpreting Data From Likert-Type Scales. *Journal of Graduate Medical Education*, 5(4), 541–542. <https://doi.org/10.4300/jgme-5-4-18>
- Sundar Pichai. (2021). *Giving you more sustainable choices with Google*.
- Sung, M. (2023). *While parents worry, teens are bullying Snapchat AI*.
- Susskind, D. (2017). *A model of technological unemployment*.
- Sveriges dataportal. (2025).

- Swap Society. (2023). *The Recycling Symbol Designer Gary Anderson*.
- Swedbank. (2022). *EasySaver*.
- swissinfo.ch/urs. (2022). Swiss “Crypto Valley” boasts 14 ‘unicorns’.
- Sylvera. (2023). Sylvera & Singapore: Empowering nations towards climate action and expanding into APAC | Press Release. In *Reccessary*. <https://www.reccessary.com/en/corporate/sylvera-singapore-empowering-nations-climate-action-and-expanding-apac>.
- Syndicate. (2022). *Phase Two: Investing is a Financial and Social Network*.
- Szczuka, J. M., Strathmann, C., Szymbczyk, N., Mavrina, L. & Krämer, N. C. (2022). How do children acquire knowledge about voice assistants? A longitudinal field study on children’s knowledge about how voice assistants store and process data. *International Journal of Child-Computer Interaction*, 33, 100460. <https://doi.org/10.1016/j.ijcci.2022.100460>
- TAIFEX. (2025). 臺灣期貨交易所.
- Taiwan Index. (2024). *TIP 臺灣指數公司*.
- Taiwan News. (Mar. 14, 2025 11:31). *PXPay Plus 1st Taiwan e-wallet brand to launch in S Korea*.
- Taiwan’s O-Bank launches ‘Consumer Spending Carbon Calculator,’ rewards carbon reduction.* (2022).
- Taiwan Stock Exchange Corporation. (2023). *TWSE 公司治理中心*.
- Taleb, N. N. (2012). *Antifragile: Things that gain from disorder* (1st ed). Random House.
- Tamkin, A., Brundage, M., Clark, J. & Ganguli, D. (2021). *Understanding the capabilities, limitations, and societal impact of large language models*. arXiv. <https://doi.org/10.48550/arxiv.2102.02503>
- Tamkin, A., McCain, M., Handa, K., Durmus, E., Lovitt, L., Rathi, A., Huang, S., Mountfield, A., Hong, J., Ritchie, S., Stern, M., Clarke, B., Goldberg, L., Sumers, T. R., Mueller, J., McEachen, W., Mitchell, W., Carter, S., Clark, J., ... Ganguli, D. (2024). *Clio: Privacy-Preserving Insights into Real-World AI Use*. arXiv. <https://doi.org/10.48550/ARXIV.2412.13678>
- Tan, G. K. S. (2020). Robo-advisors and the financialization of lay investors. *Geoforum; Journal of Physical, Human, and Regional Geosciences*, 117, 46–60. <https://doi.org/10.1016/j.geoforum.2020.09.004>
- Tan, P. (2018). *MIT Sloan Prof: How To Persuade Climate Skeptics*.
- Tan, Y.-M., Szulcocyk, K. & Sii, Y.-H. (2023). Performance of ESG-integrated smart beta strategies in Asia-Pacific stock markets. *Research in International Business and Finance*, 66, 102008. <https://doi.org/10.1016/j.ribaf.2023.102008>
- Tang, C. & Pan, J. (2014). *Ritual burning threatens health - Taipei Times*.
- Tang, J., LeBel, A., Jain, S. & Huth, A. G. (2022). *Semantic reconstruction of continuous language from non-invasive brain recordings*. Neuroscience. <https://doi.org/10.1101/2022.09.29.509744>
- Tarnoff, B. (2023). Weizenbaum’s nightmares: How the inventor of the first chatbot turned against AI. *The Guardian*.
- Tartu loodusmaja. (2019). *Tartu loodusmajas avatakse homme traditsiooniline seenenäitus „Seente mitu nägu“*.
- Tash Keuneman. (2022). *We love to hate Clippy — but what if Clippy was right?*

- Tay, A. (2023). Why science needs a protein emoji. *Nature*. <https://doi.org/10.1038/d41586-023-00674-1>
- Taylor, K. (2025). *Q&A: EU to propose 2040 emissions reduction target*.
- TDRI. (2021). 北歐循環設計論壇 *Nordic Circular Design Forum*.
- Team, O. (2025). *Introducing Oura Advisor: Your AI-Powered Personal Health Companion*.
- Tencent. (2024). *Tencent Holdings 2024 Annual Report*.
- TED. (2018). *A healthy economy should be designed to thrive, not grow | Kate Raworth*.
- TED. (2024). *The Tipping Points of Climate Change — and Where We Stand | Johan Rockström | TED*.
- TEDx Talks. (2020). *Sustainable Business | Frank Wijen | TEDxErasmusUniversityRotterdam*.
- TEDx Talks. (2022). *A Disruptive New Model for Corporate Sustainability and ESG | Georgia Elliott-Smith | TEDxUCL*.
- Textile Exchange. (2021). *FASHION INDUSTRY TRADE POLICY REQUEST*.
- Textile Exchange. (2023). *Textile Exchange*.
- Textile Genesis*. (n.d.).
- Thai Fintech Association (TFA)*. (n.d.).
- Thaler, R. H. & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness* (Rev. and expanded ed). Penguin Books.
- The Carbon Trust. (n.d.). *Q&A: How to reduce your carbon footprint through your everyday shopping*.
- The Copernicus Climate Change Service. (2024). *Climate Pulse*.
- The Economic Times. (2022). *Climate change: Earth at 8 billion: Consumption not crowd is key to climate*.
- The Economist. (2023). How to sell to the young. *The Economist*.
- The European fintechs to watch in 2022*. (2022).
- The Future of ESG Investing*. (n.d.).
- The Green Factor. (2022). *EP 62 Gamification in Sustainability with Joshua Lim*.
- The Green Web Foundation*. (2023).
- The importance of ESG measurement and Canada's opportunity for improvement*. (2022). PWC.
- The Influencer Factory. (2021). *Status of Social Commerce Report*.
- The International Ergonomics Association. (2019). *Human Factors/Ergonomics (HF/E)*.
- The Minderoo Foundation & Commonwealth Human Rights Initiative. (2020). *Eradicating Modern Slavery*.
- The Ministry of Environment of Taiwan. (2024). *Take action! Green procurement and green consumption reap significant results*.
- The Norwegian Ministry of Agriculture and Food. (2025). *New seed samples deposited in Svalbard Global Seed Vault*. regjeringen.no.
- The Rockefeller Foundation. (2022). *What Gets Measured Gets Financed*.
- The University of Melbourne, Australia & Roudavski, S. (2020, September). Multispecies Co-habitation and Future Design. *Design Research Society Conference 2020*. <https://doi.org/10.21606/drs.2020.402>
- Thiagarajah, K. & Kay, N. S. (2017). Plant-based Diets! What Do College Students in Taiwan, Thailand, and the USA Think? *Journal of Nutrition Education and Behavior*, 49(7), S74.

- https://doi.org/10.1016/j.jneb.2017.05.215
- Thibodeau, T. (2022). *Three Companies Closing the Climate Crisis Intention-Action Gap*. Thinking Ahead Institute & Willis Towers Watson.
- Thinking Ahead Institute & Willis Towers Watson. (2023). *Global Pension Assets Study*.
- Thomaes, S., Grapsas, S., Van De Wetering, J., Spitzer, J. & Poorthuis, A. (2023). Green teens: Understanding and promoting adolescents' sustainable engagement. *One Earth (Cambridge, Mass.)*, 6(4), 352–361. https://doi.org/10.1016/j.oneear.2023.02.006
- Thomas, J. & Mantri, P. (2022). Design for financial sustainability. *Patterns*, 3(9), 100585. https://doi.org/10.1016/j.patter.2022.100585
- Thomas-Walters, L., Scheuch, E. G., Ong, A. & Goldberg, M. H. (2025). The impacts of climate activism. *Current Opinion in Behavioral Sciences*, 63, 101498. https://doi.org/10.1016/j.cobeha.2025.101498
- Thompson, T. (2021). Young people's climate anxiety revealed in landmark survey. *Nature*, 597(7878), 605–605. https://doi.org/10.1038/d41586-021-02582-8
- Thukral, S. & Singh, M. (2023). An exploratory study on producer's perspective towards E-waste management: A case of emerging markets. *Cleaner Waste Systems*, 5, 100090. https://doi.org/10.1016/j.clwas.2023.100090
- Tian Daphne & Chris Stretton. (2023). *What data goes into a digital product passport?*
- Tian Macleod Ji. (2024). Fast fashion dominates in China despite recycling push | AP News. *Associated Press*.
- Tiernan, H., Friedman, S., Clube, R. K. M., Burgman, M. A., Castillo, A. C., Stettler, Marc. E. J., Kazarian, S. G., Wright, S. & De Nazelle, A. (2022). Implementation of a structured decision-making framework to evaluate and advance understanding of airborne microplastics. *Environmental Science & Policy*, 135, 169–181. https://doi.org/10.1016/j.envsci.2022.05.005
- TikTok. (2024a). #Deinfluencing.
- TikTok. (2024b). #Underconsumption.
- Tilsted, J. P., Bauer, F., Deere Birkbeck, C., Skovgaard, J. & Rootzén, J. (2023). Ending fossil-based growth: Confronting the political economy of petrochemical plastics. *One Earth (Cambridge, Mass.)*, 6(6), 607–619. https://doi.org/10.1016/j.oneear.2023.05.018
- Tim Nicolle. (2021). “Real-time ESG” data on supply chains, a breakthrough. *CTMfile*.
- Tiwana, A., Konsynski, B. & Bush, A. A. (2010). **Research Commentary** —Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Information Systems Research*, 21(4), 675–687. https://doi.org/10.1287/isre.1100.0323
- Todorova, B., Steininger, M. O., Lamm, C. & Doell, K. C. (2025). Neuroscience and climate action: Intersecting pathways for brain and planetary health. *Current Opinion in Behavioral Sciences*, 63, 101522. https://doi.org/10.1016/j.cobeha.2025.101522
- Toffel, M. & Sice, S. (2011). *Trucost: Valuing Corporate Environmental Impacts*.
- Toh, E. (2024). *Fast and Forward: Everything You Need to Know About the Fast-Moving Consumer Goods (FMCG) Industry*.
- Tokyo Simple Eco Life. (2021). *What I learned from my Zero Waste life in Japan*.
- Tol, R. S. J. (2019). A social cost of carbon for (almost) every country. *Energy Economics*, 83, 555–566. https://doi.org/10.1016/j.eneco.2019.07.006
- Tommy Tindall. (2023). *Financial Actions Speak Louder Than Goals*.

- Top 100 Consumer Goods Companies of 2021.* (n.d.).
- Towards 2025 - separate collection and treatment of textiles in six EU countries.* (2020). Miljøstyrelsen.
- Trading Economics. (2023). *EU Carbon Permits*.
- Trager, R. (2025). *PFAS regulations for US drinking water are being dismantled after just a year*.
- Trahant, G. (2022). *Interactive Brokers Built an Innovative Mobile Trading App for Socially Conscious Investors* (No. 39).
- Transparency and sustainability platform - Renoon.* (2023).
- Trees for the Future.* (2023).
- Tristan Greene. (2022). *Confused Replika AI users are trying to bang the algorithm*.
- Troiano, L. & Birtolo, C. (2014). Genetic algorithms supporting generative design of user interfaces: Examples. *Information Sciences*, 259, 433–451. <https://doi.org/10.1016/j.ins.2012.01.006>
- Trucost & TEEB for Business Coalition. (2023). *Natural Capital at Risk: The Top 100 Externalities of Business*.
- TruEra. (2023). *TruLens*.
- Tsai, P.-L. (1999). Explaining Taiwan's Economic Miracle: Are the Revisionists Right? *Agenda: A Journal of Policy Analysis and Reform*, 6(1), 69–82.
- Tsai, Y.-J., Syu, F.-T., Shieh, C.-L., Chung, C.-R., Lin, S.-S. & Yin, H.-Y. (2021). Framework of Emergency Response System for Potential Large-Scale Landslide in Taiwan. *Water*, 13(5), 712. <https://doi.org/10.3390/w13050712>
- TSCM. (2019). 水管理.
- Tsing, A. L. (2015). *The mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton University Press.
- TSMC. (2023). 氣候⊗自然. TSMC.
- Tu, X., Zou, J., Su, W. J. & Zhang, L. (2023). *What Should Data Science Education Do with Large Language Models?* <https://doi.org/10.48550/ARXIV.2307.02792>
- Tubik Studio. (2018). *UX Design Glossary: How to Use Affordances in User Interfaces*.
- Turing, A. M. (1950). I.—COMPUTING MACHINERY AND INTELLIGENCE. *Mind; a Quarterly Review of Psychology and Philosophy*, LIX(236), 433–460. <https://doi.org/10.1093/mind/LIX.236.433>
- Turrin, R. (2021). *Cashless: China's digital currency revolution*. Authority Publishing.
- Twitter. (2023). *Twitter's Recommendation Algorithm*. Twitter.
- Tyce, M. (2020). Beyond the neoliberal-statist divide on the drivers of innovation: A political settlements reading of Kenya's M-Pesa success story. *World Development*, 125, 104621. <https://doi.org/10.1016/j.worlddev.2019.104621>
- Tyler, J., Boldi, M.-O. & Cherubini, M. (2022). Contemporary self-reflective practices: A large-scale survey. *Acta Psychologica*, 230, 103768. <https://doi.org/10.1016/j.actpsy.2022.103768>
- Uber. (2025). *Uber Announces Results for Fourth Quarter and Full Year 2024*.
- Uber UK. (2023). *Uber takes to the skies with flight bookings now available in the UK Uber app* | Uber Newsroom.
- UEBT. (2022). *Biodiversity Barometer*.

- UK Parliament. (2024). *Modern Slavery Act 2015*. Statute Law Database.
- Understanding searches better than ever before*. (2019).
- UNDP. (2021). *The Peoples' Climate Vote*. United Nations Development Programme.
- UNEP. (2022). *UNEP and Green Finance Institute partner on podcast series for nature ahead of COP27*.
- UNEP. (Tue, 12/20/2022 - 07:44). *COP15 ends with landmark biodiversity agreement*.
- UNFCCC. (2019). *Alipay Ant Forest: Using Digital Technologies to Scale up Climate Action | China* | UNFCCC.
- UNFCCC. (2023a). *Climate Credit Card – Switzerland*.
- UNFCCC. (2023b). *Sharm el-Sheikh Implementation Plan*.
- UNFCCC. Secretariat. (2022). *Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat*. UNFCCC.
- Ungood-Thomas, J. (2024). Beekeepers halt honey awards over “huge fraud” in global supply chain. *The Guardian*.
- Unit, B. (2023). *History of the Convention*. Secretariat of the Convention on Biological Diversity.
- United Nations. (2016). *The Paris Agreement*. United Nations.
- United Nations Department of Economic and Social Affairs, Population Division. (2022). *World Population Prospects 2022: Summary of Results*. United Nations.
- United Nations Environment Programme. (2022). *Emissions Gap Report 2022: The Closing Window — Climate crisis calls for rapid transformation of societies*.
- United Nations Environment Programme. (2023). *Emissions Gap Report 2023: Broken Record – Temperatures hit new highs, yet world fails to cut emissions (again)*. United Nations Environment Programme. <https://doi.org/10.59117/20.500.11822/43922>
- United Nations Environment Programme (UNEP). (2021). *Emissions Gap Report 2021: The Heat Is On – A World of Climate Promises Not Yet Delivered*.
- United States. Bureau of Foreign and Domestic Commerce, Seventy-Third Congress & Kuznets, Simon. (1934). *National Income, 1929-1932*. U.S. Government Printing Office.
- Unleash. (2017). *Sebastian.ai*.
- U.S. Securities and Exchange Commission. (2023). *Notice of filing of proposed rule change to amend the NYSE listed company manual to adopt listing standards for natural asset companies* (Release No. 34-98665; File No. SR-NYSE-2023-09). U.S. Securities and Exchange Commission.
- U.S. Securities and Exchange Commission. (2025). *Investment Products | Investor.gov*.
- US Department of Commerce, N. O. and A. A. (n.d.). *What is a Rossby wave?*
- US EPA, O. (2016). *Global Greenhouse Gas Emissions Data*.
- US Securities and Exchange Commission. (2022). *Office Hours with Gary Gensler*.
- US Treasury. (2023). *Fiscal Data Explains the National Debt*.
- UXPin. (2020). *Interaction Design Best Practices — Part 1*.
- Vadén, T., Lähde, V., Majava, A., Järvensivu, P., Toivanen, T., Hakala, E. & Eronen, J. T. (2020). Decoupling for ecological sustainability: A categorisation and review of research literature. *Environmental Science & Policy*, 112, 236–244. <https://doi.org/10.1016/j.envsci.2020.06.016>

- Van Capelleveen, G., Vegter, D., Olthaar, M. & Van Hillegersberg, J. (2023). The anatomy of a passport for the circular economy: A conceptual definition, vision and structured literature review. *Resources, Conservation & Recycling Advances*, 17, 200131. <https://doi.org/10.1016/j.rcradv.2023.200131>
- van der Wal, A. J., van Horen, F. & Grinstein, A. (2016). The paradox of “green to be seen”: Green high-status shoppers excessively use (branded) shopping bags. *International Journal of Research in Marketing*, 33(1), 216–219. <https://doi.org/10.1016/j.ijresmar.2015.11.004>
- van Doorn, P. (2020). *5 stocks that should thrive as the digital payments trend ramps up*.
- Van Doorsselaer, K. (2022). Chapter 12 - The role of ecodesign in the circular economy. In A. Stefanakis & I. Nikolaou (Eds.), *Circular economy and sustainability* (pp. 189–205). Elsevier. <https://doi.org/10.1016/B978-0-12-819817-9.00018-1>
- van Oost, M. (2024). *Brazilian FinTech PicPay Prepares for US IPO*.
- Van Wassenaer, L., Verdouw, C., Kassahun, A., Van Hilten, M., Van Der Meij, K. & Tekinerdogan, B. (2023). Tokenizing circularity in agri-food systems: A conceptual framework and exploratory study. *Journal of Cleaner Production*, 413, 137527. <https://doi.org/10.1016/j.jclepro.2023.137527>
- Van Zanten, J. A. & Rein, B. (2023). Who owns (un)sustainable companies? Examining institutional determinants of sustainable investing. *Journal of Cleaner Production*, 422, 138542. <https://doi.org/10.1016/j.jclepro.2023.138542>
- Vanish UK. (2021). *GENERATION REWEAR: Full Length Documentary*.
- Varjo. (2025). *VR IS DEAD – Stories Beyond The Metaverse*. YouTube.
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L. & Polosukhin, I. (2017). *Attention Is All You Need*. <https://doi.org/10.48550/ARXIV.1706.03762>
- VDI Zentrum Ressourceneffizienz. (2020). *The carbon-neutral Green Factory*.
- Vecchi, A. & Brennan, L. (2022). Two tales of internationalization – Chinese internet firms’ expansion into the European market. *Journal of Business Research*, 152, 106–127. <https://doi.org/10.1016/j.jbusres.2022.07.024>
- Veitch, E. & Andreas Alsos, O. (2022). A systematic review of human-AI interaction in autonomous ship systems. *Safety Science*, 152, 105778. <https://doi.org/10.1016/j.ssci.2022.105778>
- Velmovitsky, P. E., Alencar, P., Leatherdale, S. T., Cowan, D. & Morita, P. P. (2022). Using apple watch ECG data for heart rate variability monitoring and stress prediction: A pilot study. *Frontiers in Digital Health*, 4, 1058826. <https://doi.org/10.3389/fdgth.2022.1058826>
- Venturelli, F., Mancuso, P., Vicentini, M., Ottone, M., Storchi, C., Roncaglia, F., Bisaccia, E., Ferrarini, C., Pezzotti, P. & Giorgi Rossi, P. (2023). High temperature, COVID-19, and mortality excess in the 2022 summer: A cohort study on data from Italian surveillances. *Science of The Total Environment*, 887, 164104. <https://doi.org/10.1016/j.scitotenv.2023.164104>
- Vercel. (2023). *Introducing v0: Generative UI*.
- Verma, P. (2024). *Paytm Q3 FY24: Revenue surges 38% YoY to ₹ 2,850 Cr, reports EBITDA before ESOP of ₹ 219 Cr, PAT improves by ₹ 170 Cr YoY to (₹ 222 Cr) | Paytm Blog*.
- Verra. (2023). *Verra Releases Revised Methodology for Improved Agricultural Land Management*.
- Viana Espinosa De Oliveira, H. & Moutinho, V. (2022). Do renewable, non-renewable en-

- ergy, carbon emission and KOF globalization influencing economic growth? Evidence from BRICS' countries. *Energy Reports*, 8, 48–53. <https://doi.org/10.1016/j.egyr.2022.01.031>
- Vise. (2023).
- Vitaletti, A. (2025). *Share a Tiny Space of Your Freezer to Preserve Seed Diversity*. arXiv. <https://doi.org/10.48550/ARXIV.2501.15962>
- Vitillo, J. G., Eisaman, M. D., Aradóttir, E. S. P., Passarini, F., Wang, T. & Sheehan, S. W. (2022). The role of carbon capture, utilization, and storage for economic pathways that limit global warming to below 1.5°C. *iScience*, 25(5), 104237. <https://doi.org/10.1016/j.isci.2022.104237>
- Vo, T.-H. & Liou, Y.-A. (2024). Four-decade spring droughts in Taiwan. *Journal of Hydrology: Regional Studies*, 54, 101849. <https://doi.org/10.1016/j.ejrh.2024.101849>
- Volkova, L., Roxburgh, S. H. & Weston, C. J. (2021). Effects of prescribed fire frequency on wildfire emissions and carbon sequestration in a fire adapted ecosystem using a comprehensive carbon model. *Journal of Environmental Management*, 290, 112673. <https://doi.org/10.1016/j.jenvman.2021.112673>
- Vosburg, K. & Biyo, H. (2025). *What Do DEI Rollbacks Mean for Investors?*
- Waddell, K. (2018). *AI might need a therapist, too.*
- Wade, J. L., Lopez Marques, H., Wang, W., Flory, J. & Freeman, B. (2023). Moisture-driven CO<sub>2</sub> pump for direct air capture. *Journal of Membrane Science*, 685, 121954. <https://doi.org/10.1016/j.memsci.2023.121954>
- Wagner, I. & Boiten, E. (2023). *What's going on at the back-end? Risks and benefits of smart toilets*. arXiv. <https://doi.org/10.48550/ARXIV.2308.15935>
- Walk Free. (2023). *Global Slavery Index Map*.
- Walmart. (2023). *Project Gigaton*.
- Walt, V. (2023). Inside the Billion-Dollar Effort to Clean Up the Seine. *TIME*.
- Wang, B. (2025). *OpenAI Stargate Phase 1 Construction of 200 Megawatts and 980,000 Square Feet*.
- Wang, L., Kim, S. & Zhou, X. (2023). Money in a “Safe” place: Money anthropomorphism increases saving behavior. *International Journal of Research in Marketing*, 40(1), 88–108. <https://doi.org/10.1016/j.ijresmar.2022.02.001>
- Wang, M. C., Sarah. (2023). *The Economic Case for Generative AI and Foundation Models*.
- Wang, S., Ibrahem, M. H. & Li, M. (2022). Motivations Influencing Alipay Users to Participate in the Ant Forest Campaign: An Empirical Study. *International Journal of Environmental Research and Public Health*, 19(24), 17034. <https://doi.org/10.3390/ijerph192417034>
- Wang, T.-P. & Teng, F. (2022). A multi-model assessment of climate change damage in China and the world. *Advances in Climate Change Research*, 13(3), 385–396. <https://doi.org/10.1016/j.accre.2022.04.005>
- Wang, X. & Yao, X. (2020). Fueling Pro-Environmental Behaviors with Gamification Design: Identifying Key Elements in Ant Forest with the Kano Model. *Sustainability*, 12(6), 2213. <https://doi.org/10.3390/su12062213>
- Wang, Yuqing, Liu, J., Guan, D., Meng, J., Liu, Z., Xiang, S., Yang, H., Fu, X., Hu, X., Yang, Q., Yi, K., Zhang, Y., Ma, J., Wang, X. & Tao, S. (2022). The volume of trade-induced cross-border freight transportation has doubled and led to 1.14 gigatons CO<sub>2</sub> emissions in

2015. *One Earth* (Cambridge, Mass.), 5(10), 1165–1177. <https://doi.org/10.1016/j.oneear.2022.09.007>
- Wang, Yong, Ma, Y. & Wang, T. (2022). Measurement of China's provincial social cost of carbon under the integrated socioeconomic-climate framework. *Journal of Environmental Management*, 321, 115993. <https://doi.org/10.1016/j.jenvman.2022.115993>
- Wang, Yueqi, Song, J., Duan, L., Yuan, H., Li, X., Li, N., Wang, Q. & Zhang, Q. (2021). Paleo-productivity and climate evolution in the Kuroshio mainstream area over the past millennium. *Ecological Indicators*, 121, 107035. <https://doi.org/10.1016/j.ecolind.2020.107035>
- Wardani, J., Bos, J. J. (Annette), Ramirez-Lovering, D. & Capon, A. G. (2023). Boundaries as Spaces of Knowledge Integration: Learning from transdisciplinary collaboration on planetary health in Indonesia. *The Journal of Climate Change and Health*, 11, 100242. <https://doi.org/10.1016/j.joclim.2023.100242>
- Ware, D. (2024). *Green skills gap threatens UK's sustainability goals*.
- Warsame, A. A., Mohamed, J. & Sarkodie, S. A. (2024). Natural disasters, deforestation, and emissions affect economic growth in Somalia. *Heliyon*, 10(6), e28214. <https://doi.org/10.1016/j.heliyon.2024.e28214>
- Waters, J. (2015). Ethics and the choice of animal advocacy campaigns. *Ecological Economics*, 119, 107–117. <https://doi.org/10.1016/j.ecolecon.2015.08.014>
- Waterstones. (2021). *Kazuo Ishiguro on Klara and the Sun*.
- Watts, J. (2023). Amazon deforestation falls over 60% compared with last July, says Brazilian minister. *The Guardian*.
- Weaver, 2025. J. F. (2023). *A terawatt of solar module capacity expected within 16 months*.
- Web, M. (2023). *South Korea president vows climate change response after deadly monsoon rains*.
- Weber, A. (2021). Mobile apps as a sustainable shopping guide: The effect of eco-score rankings on sustainable food choice. *Appetite*, 167, 105616. <https://doi.org/10.1016/j.appet.2021.105616>
- Wee, S.-C., Choong, W.-W. & Low, S.-T. (2021). Can “Nudging” play a role to promote pro-Environmental behaviour? *Environmental Challenges*, 5, 100364. <https://doi.org/10.1016/j.envc.2021.100364>
- Weinschenk, S. (2011). *100 things every designer needs to know about people*. New Riders.
- Weise, Z. (2025). Brussels to propose “pragmatic” 90 percent climate target for 2040. *POLITICO*.
- Weizenbaum, J. (1966). ELIZA—a computer program for the study of natural language communication between man and machine. *Communications of the ACM*, 9(1), 36–45. <https://doi.org/10.1145/365153.365168>
- Welhunt. (2025). Welhunt and Sylvera Co-host Exclusive Seminar to Accelerate Taiwan’s Integration into the Global Carbon Market | Press Release. In *Reccessary*.
- Wellbeing Economy Alliance. (2022). *What is a Wellbeing Economy*.
- WeMove Europe. (2022). *Ban forest-killing products*.
- Westengen, O. T., Jeppson, S. & Guarino, L. (2013). Global Ex-Situ Crop Diversity Conservation and the Svalbard Global Seed Vault: Assessing the Current Status. *PLoS ONE*, 8(5), e64146. <https://doi.org/10.1371/journal.pone.0064146>

- What is Open Data?* (n.d.).
- What is ReFi | Regenerative Finance explained.* (2023).
- White, A. D. (2023). The future of chemistry is language. *Nature Reviews Chemistry*, 7(7), 457–458. <https://doi.org/10.1038/s41570-023-00502-0>
- Whitmarsh, L., Player, L., Jiongco, A., James, M., Williams, M., Marks, E. & Kennedy-Williams, P. (2022). Climate anxiety: What predicts it and how is it related to climate action? *Journal of Environmental Psychology*, 83, 101866. <https://doi.org/10.1016/j.jenvp.2022.101866>
- Who Benefits the most from Generative UI.* (2024).
- Wholegrain Digita. (2023). *How does it work?*
- Why design is key to building trust in FinTech | Star.* (2021).
- Why UX should guide AI.* (2021).
- Wiggers, K. (2023). *Inworld, a generative AI platform for creating NPCs, lands fresh investment.*
- WikiRate. (2021). *Webinar: Envisioning and finding your place in an integrated and open labor data ecosystem.*
- Wikirate. (2022a). *Introducing the Facility Checker: A new search tool uncovering living wage gaps in fashion supply....*
- Wikirate. (2022b). *Sharing data and creating impact: Fashion Revolution Brasil open up their data on WikiRate.*
- WikiRate. (2023). *WikiRate.*
- Wikirate. (2025). *Metrics Introduction.*
- Wilkes, T. (2023). Exclusive: Banks vote to limit accounting of emissions in bond and stock sales. *Reuters*.
- Wilkes, T. R., Jones, M., Wilkes, T. R. & Jones, M. (2021). Turkey's lira dives back into crisis territory. *Reuters*.
- Williams, P. D. & Joshi, M. M. (2013). Intensification of winter transatlantic aviation turbulence in response to climate change. *Nature Climate Change*, 3(7), 644–648. <https://doi.org/10.1038/nclimate1866>
- WIPO GREEN: The Global Marketplace for Sustainable Technology.* (n.d.).
- Women in AI. (2018). *How can AI assistants help patients monitor their health?*
- Wood, J. (2022). *Gen Z cares about sustainability more than anyone else – and is starting to make others feel the same way.*
- Worker Voice. (2022).
- World Bank. (2018). *World Bank Prices First Global Blockchain Bond, Raising A\$110 Million.*
- World Bank. (2019). *World Bank Issues Second Tranche of Blockchain Bond Via Bond-i.*
- World Bank. (2021). *Changing Wealth of Nations (CWON).*
- World Bank. (2024). *World Bank partners with Swiss National Bank and SIX Digital Exchange to advance digitalization in capital markets.*
- World Bank & World Bank. (2024). *Global Economic Prospects, January 2024.* World Bank. <https://doi.org/10.1596/978-1-4648-2058-8>
- World Commission on Environment and Development (Ed.). (1987). *Our common future.* Oxford University Press.
- World Economic Forum. (n.d.). *Global Risks Report 2024.*

- World Economic Forum. (2016). *Bio-Inspired Design | Neri Oxman*.
- World Governments Summit. (2024). *A Conversation with the Founder of NVIDIA: Who Will Shape the Future of AI?*
- World Health Organization. (2022). *Ambient (outdoor) air pollution*.
- World Resources Institute. (2020). *CO<sub>2</sub> emissions (metric tons per capita) | Data*.
- World's first year-long breach of key 1.5C warming limit.* (2024).
- Worthington, B. (2025a). *Google's Climate Tightrope: AI Innovation vs Emissions | Ep203: Kate Brandt*.
- Worthington, B. (2025b). *Making America Dumb Again: The Stakes of Slashing Climate Science — Ep200: Ralph Keeling & Ray Weiss*.
- WSJ News. (2025). *OpenAI COO on Jony Ive, New 'Ambient' Devices, Data Centers in UAE and More | WSJ*.
- Wu, C.-Y., Hu, M.-C. & Ni, F.-C. (2021). Supporting a circular economy: Insights from Taiwan's plastic waste sector and lessons for developing countries. *Sustainable Production and Consumption*, 26, 228–238. <https://doi.org/10.1016/j.spc.2020.10.009>
- Wu, Jingda, Huang, Z., Hu, Z. & Lv, C. (2023). Toward Human-in-the-Loop AI: Enhancing Deep Reinforcement Learning via Real-Time Human Guidance for Autonomous Driving. *Engineering*, 21, 75–91. <https://doi.org/10.1016/j.eng.2022.05.017>
- Wu, Jeffery & Thompson, J. (2025). *Google announces 'milestone' deal to purchase Taiwan geothermal energy - Focus Taiwan*.
- Wulff, P. (2020). The climate legacy of svante arrhenius. *Icon*, 25(2), 163–169.
- WWF. (2022). *Beyond Forests: Reducing the EU's footprint on all natural ecosystems*. World Wide Fund For Nature.
- Xie, M., Duan, H., Kang, P., Qiao, Q. & Bai, L. (2021). Toward an Ecological Civilization: China's Progress as Documented by the Second National General Survey of Pollution Sources. *Engineering*, 7(9), 1336–1341. <https://doi.org/10.1016/j.eng.2020.11.003>
- Xu, M. & Lin, B. (2022). Towards low-carbon economy by carbon label?: Survey evidence from first-tier cities in China. *Environmental Impact Assessment Review*, 97, 106902. <https://doi.org/10.1016/j.eiar.2022.106902>
- Xu, R.-H. (2024). Declined quality? A poststructural policy analysis of the “quality problem” in Taiwanese higher education. *Journal of Education Policy*, 1–20. <https://doi.org/10.1080/02680939.2024.2355939>
- Xu, S., Chen, G., Guo, Y.-X., Yang, J., Li, C., Zang, Z., Zhang, Y., Tong, X. & Guo, B. (2024). *VASA-1: Lifelike Audio-Driven Talking Faces Generated in Real Time*. <https://doi.org/10.48550/ARXIV.2404.10667>
- Xu, X. & Sar, S. (2018). Do We See Machines The Same Way As We See Humans? A Survey On Mind Perception Of Machines And Human Beings. *2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, 472–475. <https://doi.org/10.1109/ROMAN.2018.8525586>
- Xu, Y. & Ramanathan, V. (2017). Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes. *Proceedings of the National Academy of Sciences*, 114(39), 10315–10323. <https://doi.org/10.1073/pnas.1618481114>
- Xuan, Y. (2022). *How to prioritise product features*.

- Y Combinator. (2023). *Kontigo: USDC-neobank for Latinos. (With a Bitcoin Piggy bank)*.
- Yadav, S. P. S., Lahutiya, V., Ghimire, N. P., Yadav, B. & Paudel, P. (2023). Exploring innovation for sustainable agriculture: A systematic case study of permaculture in Nepal. *Heliyon*, 9(5), e15899. <https://doi.org/10.1016/j.heliyon.2023.e15899>
- Yahoo Finance. (2022). *The challenges facing China's digital yuan, economist explains*.
- Yale Center for Environmental Law & Policy. (2018). *Environmental Performance Index*. *Yale, Princeton, Stanford, MIT and Vanderbilt students take legal action to try to force fossil fuel divestment - The Washington Post*. (n.d.).
- Yang, J., Hauser, R. & Goldman, R. H. (2013). Taiwan food scandal: The illegal use of phthalates as a clouding agent and their contribution to maternal exposure. *Food and Chemical Toxicology*, 58, 362–368. <https://doi.org/10.1016/j.fct.2013.05.010>
- Yang, S., Zhang, H., Zhang, Q. & Liu, T. (2022). Peer effects of enterprise green financing behavior: Evidence from China. *Frontiers in Environmental Science*, 10, 1033868. <https://doi.org/10.3389/fenvs.2022.1033868>
- Yang, W. (2022). Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation. *Computers and Education: Artificial Intelligence*, 3, 100061. <https://doi.org/10.1016/j.caeari.2022.100061>
- Yang, X., He, J., Li, C., Ma, J., Yang, Y. & Xu, J. (2008). Matsutake Trade in Yunnan Province, China: An Overview. *Economic Botany*, 62(3), 269–277. <https://doi.org/10.1007/s12231-008-9019-6>
- Yang, Z., Kong, X., Sun, J. & Zhang, Y. (2018). Switching to Green Lifestyles: Behavior Change of Ant Forest Users. *International Journal of Environmental Research and Public Health*, 15(9), 1819. <https://doi.org/10.3390/ijerph15091819>
- Yap, K. S., Leow, Y. J., Chung, S. Y., Loke, C. P. H., Tan, D. Z. L., Yeo, Z. & Low, J. S. C. (2023). Life Cycle Assessment of Plastic Waste End-of-life Treatments in Singapore. *Procedia CIRP*, 116, 522–527. <https://doi.org/10.1016/j.procir.2023.02.088>
- Yeh, I.-C. (2016). *Default of credit card clients*. UCI Machine Learning Repository.
- Yeh, I.-C. & Lien, C. (2009). The comparisons of data mining techniques for the predictive accuracy of probability of default of credit card clients. *Expert Systems with Applications*, 36(2), 2473–2480. <https://doi.org/10.1016/j.eswa.2007.12.020>
- Yen, C., Huang, Y.-L., Chung, M. & Chen, Y.-C. (2022). Sugar Content and Warning Criteria Evaluation for Popular Sugar-Sweetened Beverages in Taipei, Taiwan. *Nutrients*, 14(16), 3339. <https://doi.org/10.3390/nu14163339>
- Yin, Yidan, Jia, N. & Wakslak, C. J. (2024). AI can help people feel heard, but an AI label diminishes this impact. *Proceedings of the National Academy of Sciences*, 121(14), e2319112121. <https://doi.org/10.1073/pnas.2319112121>
- Yin, Yuqi, Lin, X. & Hou, Y. (2019). Seasonality of the Kuroshio intensity east of Taiwan modulated by mesoscale eddies. *Journal of Marine Systems*, 193, 84–93. <https://doi.org/10.1016/j.jmarsys.2019.02.001>
- Young Consumers' (Complicated) Love For Fast Fashion In 3 Stats*. (n.d.).
- YPulse. (2020). *Millennials & Gen Z Teens' Combined Spending Power Is Nearly \$3 Trillion in 2020*.
- Yu, C. (2021). *How AI can help instos spot green-washing*.

- Yu, T.-Y., Yu, T.-K. & Chao, C.-M. (2017). Understanding Taiwanese undergraduate students' pro-Environmental behavioral intention towards green products in the fight against climate change. *Journal of Cleaner Production*, 161, 390–402. <https://doi.org/10.1016/j.jclepro.2017.05.115>
- Yuan, C., Zhang, C. & Wang, S. (2022). Social anxiety as a moderator in consumer willingness to accept AI assistants based on utilitarian and hedonic values. *Journal of Retailing and Consumer Services*, 65, 102878. <https://doi.org/10.1016/j.jretconser.2021.102878>
- Yüksel, S., Kalyoncu, G. & Özdurak, C. (2023). Constructing an index for participation finance. *Borsa Istanbul Review*, 23(4), 895–905. <https://doi.org/10.1016/j.bir.2023.03.003>
- Yuqing Zhao. (2021). 2021 离开金融区啦.
- Zafar, N. & Ahamed, J. (2022). Emerging technologies for the management of COVID19: A review. *Sustainable Operations and Computers*, 3, 249–257. <https://doi.org/10.1016/j.susoc.2022.05.002>
- Zangróniz, R., Martínez-Rodrigo, A., Pastor, J., López, M. & Fernández-Caballero, A. (2017). Electrodermal Activity Sensor for Classification of Calm/Distress Condition. *Sensors*, 17(10), 2324. <https://doi.org/10.3390/s17102324>
- Zannettou, S., Caulfield, T., Blackburn, J., De Cristofaro, E., Sirivianos, M., Stringhini, G. & Suarez-Tangil, G. (2018). *On the Origins of Memes by Means of Fringe Web Communities*. <https://doi.org/10.48550/ARXIV.1805.12512>
- Zellers, R., Holtzman, A., Bisk, Y., Farhadi, A. & Choi, Y. (2019). *HellaSwag: Can a Machine Really Finish Your Sentence?* <https://doi.org/10.48550/ARXIV.1905.07830>
- Zerilli, J., Bhatt, U. & Weller, A. (2022). How transparency modulates trust in artificial intelligence. *Patterns*, 3(4), 100455. <https://doi.org/10.1016/j.patter.2022.100455>
- Zero Waste Europe, Ekologi brez meja, Estonian University of Life Sciences, Tallinn University & Let's Do It Foundation. (2022). *The zero waste handbook*.
- Zeroheight Team. (2025). *Design systems report 2025*. Zeroheight.
- Zhang, A. W., Wharton, C., Cloonan, S., Boronowsky, R., Magesh, V., Braverman, I., Marquez, A., Leidy, H., Wang, M. C., Cleveland, D. A., Jay, J. & Stecher, C. (2024). Changing the default meal option at university events to reduce harmful environmental impacts: Six randomized controlled trials. *Appetite*, 200, 107572. <https://doi.org/10.1016/j.appet.2024.107572>
- Zhang, B., Hu, X. & Gu, M. (2022). Promote pro-environmental behaviour through social media: An empirical study based on Ant Forest. *Environmental Science & Policy*, 137, 216–227. <https://doi.org/10.1016/j.envsci.2022.08.020>
- Zhang, G., Chong, L., Kotovsky, K. & Cagan, J. (2023). Trust in an AI versus a Human teammate: The effects of teammate identity and performance on Human-AI cooperation. *Computers in Human Behavior*, 139, 107536. <https://doi.org/10.1016/j.chb.2022.107536>
- Zhang, H., Da, J., Lee, D., Robinson, V., Wu, C., Song, W., Zhao, T., Raja, P., Slack, D., Lyu, Q., Hendryx, S., Kaplan, R., Lunati, M. & Yue, S. (2024). *A Careful Examination of Large Language Model Performance on Grade School Arithmetic*. arXiv. <https://doi.org/10.48550/ARXIV.2405.00332>
- Zhang, J., Skene, K. R., Wang, S., Ji, Q., Zheng, H., Zhou, C., Tian, K., Pradhan, P., Meadows, M. E. & Fu, B. (2025). Beyond borders: Assessing global sustainability through interconnected systems. *Sustainable Development*, 33(2), 1909–1920. <https://doi.org/10.1002/sd>.

- Zhang, M. & Yang, X. (2024). *Google or ChatGPT: Who is the Better Helper for University Students*. arXiv. <https://doi.org/10.48550/ARXIV.2405.00341>
- Zhang, S. (2018). *Personal Carbon Economy*.
- Zhang, X. (2025). Cultural Consumption of Chinese Generation Z. *Science Insights*, 46(2), 1749–1755. <https://doi.org/10.15354/si.25.re1156>
- Zhang, Z., Shen, Z., Liu, L., Zhang, Y., Yu, C., Cui, L. & Gao, Y. (2023). Integrating ecosystem services conservation into the optimization of urban planning policies in eco-fragile areas: A scenario-based case study. *Cities (London, England)*, 134, 104200. <https://doi.org/10.1016/j.cities.2023.104200>
- Zhao, X. & Qin, L. (2015). Embodied Carbon Based Integrated Optimal Seismic Design for Super Tall Buildings with Viscoelastic Coupling Dampers. *Procedia Engineering*, 118, 223–231. <https://doi.org/10.1016/j.proeng.2015.08.421>
- Zhen, Z., Tian, L. & Ye, Q. (2018). A simple estimate for the social cost of carbon. *Energy Procedia*, 152, 768–773. <https://doi.org/10.1016/j.egypro.2018.09.243>
- Zhijian, X. (2023). *Shenzhen becomes first Chinese city to announce a carbon cap*.
- Zhou, F., Lin, Y. & Mou, J. (2023). Unpacking the effect of gamified virtual CSR cocreated on users' pro-Environmental behavior: A holistic view of gamification affordance. *Technology in Society*, 73, 102228. <https://doi.org/10.1016/j.techsoc.2023.102228>
- Zhou, S., Wang, H., Li, S., Chen, Y. & Wu, J. (2019). Carbon labels and “horizontal location effect”: Can carbon labels increase the choice of green product? *Global Ecology and Conservation*, 18, e00609. <https://doi.org/10.1016/j.gecco.2019.e00609>
- Zhou, X., Hang, Y., Zhou, D., Ang, B. W., Wang, Q., Su, B. & Zhou, P. (2022). Carbon-economic inequality in global ICT trade. *iScience*, 25(12), 105604. <https://doi.org/10.1016/j.isci.2022.105604>
- Zhou, Y., Muresanu, A. I., Han, Z., Paster, K., Pitis, S., Chan, H. & Ba, J. (2022). *Large Language Models Are Human-Level Prompt Engineers*. <https://doi.org/10.48550/ARXIV.2211.01910>
- Zhu, H., Vigren, O. & Söderberg, I.-L. (2024). Implementing artificial intelligence empowered financial advisory services: A literature review and critical research agenda. *Journal of Business Research*, 174, 114494. <https://doi.org/10.1016/j.jbusres.2023.114494>
- Zhu, L., Kang, Y., Ma, M., Wu, Z., Zhang, L., Hu, R., Xu, Q., Zhu, J., Gu, X. & An, L. (2024). Tissue accumulation of microplastics and potential health risks in human. *Science of The Total Environment*, 915, 170004. <https://doi.org/10.1016/j.scitotenv.2024.170004>
- Zhu, Y. (2023). *China's solar capacity surges; predicted to top 1 TW by 2026*.
- Zidani, S. & Miltner, K. (2022). *How to Conduct Internet Meme Research*. SAGE Publications, Ltd. <https://doi.org/10.4135/9781529609714>
- Ziglu | *The fast, simple way to buy and sell crypto, with no hidden fees*. (n.d.).
- Zimmerman, J., Oh, C., Yildirim, N., Kass, A., Tung, T. & Forlizzi, J. (2021). UX designers pushing AI in the enterprise: A case for adaptive UIs. *Interactions*, 28(1), 72–77. <https://doi.org/10.1145/3436954>
- Z.M.L. (2023). “*Computers enable fantasies*” – On the continued relevance of Weizenbaum’s warnings.

- Zonneveld, L. & Biggemann, S. (2014). Emotional Connections to Objects as Shown through Collecting Behaviour: The Role of Ardour. *Australasian Marketing Journal*, 22(4), 325–334.  
<https://doi.org/10.1016/j.ausmj.2013.10.002>
- 上市公司用水量之冠不是台積電 它用水比台積電多 20 幾倍. (2022). *Liberty Times*.
- 中央社. (2021). 竹科 5/21 提前節水 17%，台積電、聯電增水車載水. *TechNews*.
- 中央社. (2022). 台灣金融生活調査：27%儲蓄 4 萬元以下逾 4 成近金融文盲.
- 今周刊. (2024). COP29 氣候追蹤》台中火力發電廠、中龍鋼 … 台灣 8 處列全球 500 大碳排放源！人均碳排已達全球平均兩倍 – ESG 永續台灣.
- 劉大正. (2010). 環境永續：草溝及生態型滯洪設施配置，以涵養水源減免坡地災害 [PhD thesis]. National Taiwan University.
- 劉芸嘉. (2024). 臺灣華語幽默策略 – 網路迷因之語用研究與教學應用. 國立臺灣師範大學學位論文.
- 動腦 Brain.com.tw. (2024). 2024 年第三季台灣民生消費品市場景氣熱絡，年增 6% 再創成長.
- 台灣營養師. (2022). 【統計懶人包】2017~2020 年國民營養健康狀況變遷調查懶人包.
- 台灣設計研究院 (TDRI) on Instagram: " ■ 北歐循環設計論壇 | 開放報名中 - 近幾年，全球的極端氣候造成各地災害頻傳，人們更加意識到要珍惜地球資源，丹麥從 10 幾年前就開始推行低碳生活，哥本哈根海洋上成排的風力發電機供應丹麥 20% 以上的能源，哥本哈根的學校建造出全世界最大的太陽能板，甚至丹麥的設計團隊進行設計皆從永續環境為本心出發，在丹麥，每一個生活環節都是循環設計！ - 但丹麥談的循環永續不只是不具經濟效益的理念，循環經濟對丹麥來說不僅具有環境層面的效益，還可提升企業的競爭力，對資源生產力、就業機會、資源供應安全和自然資源的可持續利用都有極正向的回饋。 - 本次國際論壇，我們邀請來自丹麥的設計師 Ditte Lysgaard Vind 從循環經濟策略、Rosa Nøss Bendixen 從產品設計、Helene Jensen 從時尚產業、更有台灣的團隊奇想創造、光寶科技、RENATO Lab 從不同產業類別，以跨領域的思維，分享他們循環再造的創意點子！ - ■ 北歐循環設計論壇 Nordic Circular Design Forum 活動日期 | 11 / 12 (五) 16:00 ~ 18:20 講座方式 | 線上直播與線下參與講座費用 | 免費 報名 | 請至個人檔案點選 □ #TDRI #台灣設計研究院 #設計 #設計 #design". (2021).
- 姚品全. & 侯雪娟. (2011). 『能源科技與環境永續』之重要議題初探. *大葉大學通識教育學報*, 8, 133–146.
- 廖柏雅. (2024). 社群媒體使用與錯失恐懼之相關探討. 國立臺灣師範大學學位論文.
- 廣編企劃. (2022). 金管會下禁令，要求禁止信用卡買加密貨幣 - INSIDE.
- 张越熙. (2024). 集体公布种树 8 年成果：捐超 40 万棵|内蒙古\_新浪科技\_新浪网.
- 彭巧珍, 劉美媛 & 何宗翰. (2023). 我國 2013-2016 年國民營養調查體位分析與常模建立 – (I) 身高、體重、身體質量指數. *台灣營養學會雜誌*, 47(3). [https://doi.org/10.6691/NSJ.202309\\_47\(3\).0003](https://doi.org/10.6691/NSJ.202309_47(3).0003)
- 時代財經. (2023). 消費信心扭轉要靠年輕人.
- 朱映潔 (Ying-Chieh Chu). (2021). 你的梗圖，紅了嗎？ 分享網路迷因行為意圖之研究. 中原大學學位論文.
- 李桂媚. (2022). 半導體業不能說的秘密：那些連專家都沒聽過的毒物，如何影響健康和環境？.
- 李连环 & 姜舒译. (2017). 合国境大会：2.3 中国人手机种引关注 - 海外网.
- 林建輝. (2009). 高中學生環境永續發展行為意圖及其相關因素研究～以台北市某高中學生為例 (PhD thesis No. 2009 年). 國立臺灣師範大學.

- 林美惠. & 莊財福. (2015). 教師對環境永續發展的態度與實踐之關聯性分析. *明道學術論壇*, 9(4), 45–90.
- 林高賢. (2024). 「失控的焦慮世代？」：臺灣青少年的社群媒體使用與焦慮感受. 中央研究院人社中心博士後研究員.
- 樊一寧, 羅文輝 & 張博翰. (2024). 與人分享，幸福提升：社群媒體自我表露對台灣民眾心理幸福感的影響. *傳播與社會學刊*, 70. [https://doi.org/10.30180/CS.202410\\_\(70\).0008](https://doi.org/10.30180/CS.202410_(70).0008)
- 歐宇祥. (2024). 2023 年各企業排碳台電、台塑化、中鋼、台積電破千萬公噸 | 財富自由.
- 永鑫能源 New Green Power. (2022). *BlackRock to acquire 100% of Taiwanese New Green Power*.
- 江昭倫. (2025). 調査：9 成青少年透過社群媒體學習金融知識.
- 潘智謙 & Pan, C.-C. (2006). 國民小學校園實質環境永續性評估之研究 [PhD thesis].
- 獨家觀察 - 電子發票年減碳量相當 2,700 座大安森林公園. (2025).
- 環境資訊中心記者. (2022). 總碳排破億 全國近 4 成碳排來自 10 家企業台塑、台積電都入列.
- 環境部. (2025). 守護山河：榮耀緝先鋒—國土保育跨部會共同緝成果表揚大會.
- 綠色公民行動聯盟. (2022). 綠盟公布第四屆環境金害獎經濟部主管的台灣中油、工業區服務中心連莊，鋼鐵、石化、食品供應鏈的上市櫃企業也榜上有名.
- 綠色公民行動聯盟. (2024). 打造反漂綠生態系：2024 企業永續追蹤報告 - 綠色公民行動聯盟.
- 網軟股份有限公司. (n.d.). 2022 全台青年財金素養調查.
- 聯合新聞網. (2024). 電商教父何英圻預言：今年是 momo 與 Coupang B2C 龍頭爭霸年.
- 胡綺珍. (2024). 當我們爛在一起：厭世迷因讀者的情感、認同與抵抗 [PhD thesis]. 國立臺灣師範大學.
- 胡群 & 宋璠. (2024). 線上調查 - 集合 ESG 告：近一半中国人投身森林-線上調查 - 新網站.
- 蕭婷方. (2021). 空氣品質又紫爆！全台測站多處紅燈 空污是台灣自產、還是要怪中國？. *Business Today*.
- 行動支付結合雲端發票 節能減碳最環保|經理人. (2018).
- 許維寧. (2023). 中原大學調查：七成學生認為無需訂定 ChatGPT 使用規範| 大學研究所 | 文教 | 聯合新聞網. *聯合報*.
- 財團法人主婦聯盟環境保護基金會. (2020). *本會簡介*.
- 財團法人台灣網路資訊中心 & 台灣資訊社會研究學會. (2023). *2023 年台灣網路報告*. 財團法人台灣網路資訊中心.
- 財金智慧 FINLEA. (2020). *財金智慧 FINLEA - YouTube*.
- 金管會 & Financial Supervisory Commission. (2022). *金融監督管理委員會-永續金融網*.
- 陳思凝. (2023). 探究臺灣 Z 世代的 Instagram 使用強度與社群媒體壓力源、社群媒體倦怠及線上主觀幸福感之關聯| 學術產出 | 政大學術集成 [PhD thesis].
- 陳珮英. (2003). 國中學生永續發展行為意圖及其相關因素研究～以台北市大安區國中學生為例 (PhD thesis No. 2003 年). 國立臺灣師範大學.
- 陳美君. (n.d.). 台灣青少年金融素養落差調查結果出爐近五分之一遇過金融詐騙.
- 順風婦產科 @followwindlover (@followwindlover) on Threads. (2024).
- 食力 foodNEXT. (2025). 2024 第 4 季台灣民生消費市場銷額年增 9.1%、創疫後新高！ 食品飲料穩健成長、乳飲品止跌.
- 黃意能 & 黃曉琪. (2016). 臺灣傳播學會 Taiwan Communication Society.

## 16 APPENDICES

### 16.1 Appendix 1: College Students' In-Person Prototype Testing Transcripts

#### 16.1.1 Transcript 2024-11-13 - Tainan (STUST) - 1YEDC

**Source Files:** \* 2024-11-13 - Tainan (STUST) - 1YEDC.json \* 2024-11-13 - Tainan (STUST) - 1YEDC.txt

**Ziran ID Code:** 1YEDC

Traditional Chinese Transcript	English Translation
<p><b>Me:</b> 好，我再問一次，這個是我的論文的一部分的一個 App，希望妳幫幫我測試。我會錄音妳的聲音，但是妳的回覆都是匿名的，可以嗎？</p>	<p><b>Me:</b> Okay, let me ask again. This is an app that's part of my thesis. I hope you can help me test it. I will record your voice, but your responses will be anonymous. Is that okay?</p>
<p><b>Interviewee:</b> 可以，可以。</p>	<p><b>Interviewee:</b> Yes, yes.</p>
<p><b>Me:</b> 好，謝謝。那可以開始了。好。呃，妳之前有用過 Momo 嗎？</p>	<p><b>Me:</b> Okay, thank you. We can start then. Okay. Uh, have you used Momo before?</p>
<p><b>Interviewee:</b> 有，可是用蝦皮比較多。</p>	<p><b>Interviewee:</b> Yes, but I use Shopee more often.</p>
<p><b>Me:</b> 好。那妳平常買什麼？</p>	<p><b>Me:</b> Okay. What do you usually buy?</p>
<p><b>Interviewee:</b> 平常嗎？衣服跟化妝品，還有動漫的娃娃。</p>	<p><b>Interviewee:</b> Usually? Clothes and cosmetics, and also anime dolls.</p>
<p><b>Me:</b> 嗯。那妳可以幫我找一個妳有興趣的產品嗎？</p>	<p><b>Me:</b> Hmm. Can you help me find a product you're interested in?</p>
<p><b>Interviewee:</b> (Searches) ...有興趣的...產品...面膜。</p>	<p><b>Interviewee:</b> (Searches) ...Interested in... product... facial mask.</p>
<p><b>Me:</b> 面膜？這個？好。這樣。這個品牌妳有之前買過嗎？</p>	<p><b>Me:</b> Facial mask? This one? Okay. Like this. Have you bought this brand before?</p>
<p><b>Interviewee:</b> 哟，有，有買過。</p>	<p><b>Interviewee:</b> Oh, yes, I've bought it before.</p>
<p><b>Me:</b> 哇哇，好酷喔。買東西基本上，買東西也是一個投資...喔，這個是可以幫忙分析的。</p>	<p><b>Me:</b> Wow, wow, so cool. Buying things basically, buying things is also an investment... Oh, this can help analyze.</p>
<p><b>Interviewee:</b> 嗯，哇，酷。</p>	<p><b>Interviewee:</b> Hmm, wow, cool.</p>
<p><b>Me:</b> 那妳覺得這個內容裡面有什麼對妳來說有用、用途嗎？有用，就是妳覺得有趣的資料，還是妳覺得不錯的材料？</p>	<p><b>Me:</b> What do you think in this content is useful for you, or serves a purpose? Useful, meaning interesting information, or materials you think are good?</p>

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 可持續性跟這個歷史問題。平常在逛的時候只會看到就是品牌國家跟那個使用材料，很少看到有這個「材料可持續性」跟「歷史問題」，所以買的時候就會覺得說，就是，哦，買完了可能就，就只是用完了也就只是垃圾，但是我沒有想到說，就是，哦，我沒有想到說就是可能面膜它裡面會有一些不明的植物萃取物跟化學保存劑。應該說是知道，可是不知道說就是它可能，嗯，會有存在風險之類的。	<b>Interviewee:</b> Sustainability and this history issue. Usually when browsing, I only see the brand's country and the materials used. I rarely see this "Material Sustainability" and "History Issues". So when buying, I would think, just, oh, after buying it, maybe it's just, after using it up, it's just trash. But I didn't think that, like, oh, I didn't think that maybe the facial mask could contain some unknown plant extracts and chemical preservatives. I should say I knew, but I didn't know that it might, hmm, pose potential risks, things like that.
<b>Me:</b> 那妳覺得這個，妳剛知道這個會影響妳的，妳的想法嗎？想法嗎？就是因為妳之前(註: TXT 用 最近)有買過這個產品，那妳剛知道好像它裡面可能有什麼化學的...妳對妳關於那個這個產品的那個品牌，妳的想法會改嗎？	<b>Me:</b> So you think this, knowing this just now, will it affect your, your thoughts? Your thoughts? Because you have bought this product before (Note: TXT used "recently"), and you just found out it might contain some chemicals... Regarding this product's brand, will your thoughts change?
<b>Interviewee:</b> 嗯，會有一點點，會有一點點。可能會去找可能更方便的吧，就是不需要用到面膜，可能只要，嗯，要怎麼說...就是有，有看到就是不需要敷面膜，就是很像就是塗那個...塗，塗那種蘆薈的那種面膜，應該可能之後會買這種。	<b>Interviewee:</b> Hmm, a little bit, a little bit. Maybe I'll look for something more convenient, like something that doesn't require using a sheet mask, maybe just, hmm, how should I say... like, I've seen ones where you don't need to apply a sheet mask, it's like applying... applying that kind of aloe mask, maybe I'll buy that kind later.
<b>Me:</b> 嗯嗯嗯。好，那下面有一個部分可以按，妳覺得這個，這個是什麼意思？	<b>Me:</b> Mm-hmm mm-hmm. Okay, there's a section below you can press. What do you think this, this means?
<b>Interviewee:</b> 積蓄(註: TXT 誤聽為 金序)嗎？嗯？假如說我不買這個東西啊，我可以存到多少錢嗎？	<b>Interviewee:</b> Savings (Note: TXT misheard as "Gold Order")? Hmm? Suppose if I don't buy this item, can I save some amount of money?
<b>Me:</b> 好。那妳要先，呃，思考。	<b>Me:</b> Okay. Then you need to first, uh, think.
<b>Interviewee:</b> 在思考...妳要吃什麼？我沒有錢吃。...妳要給我錢，好嗎？	<b>Interviewee:</b> Thinking... What do you want to eat? I have no money to eat. ... You should give me money, okay?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 哦...哦！ 所以積蓄是那個碳排放量 (註: TXT 誤聽為彈放量)，減少碳排放量？ 不會是錢？ 喔？ 然後說我不買那個面膜我可以...我可以省多少錢？ 嘴，好貴。	<b>Interviewee:</b> Oh... Oh! So savings means the carbon emissions (Note: TXT misheard as “bullet release amount”), reducing carbon emissions? Not money? Oh? And it says if I don't buy that mask I can... I can save how much money? Oh, so expensive.
<b>Me:</b> 所以中文來說，可能這個詞 (註: TXT 誤聽為 車) 不是最適合的。就是剛剛那個詞 (註: TXT 誤聽為 車)，因為妳剛剛是想...	<b>Me:</b> So in Chinese, maybe this word (Note: TXT misheard as “car”) isn't the most suitable. Just that word (Note: TXT misheard as “car”) earlier, because you were thinking...
<b>Interviewee:</b> 賺錢？ (註: TXT 誤聽為 罐牛腱/罐牛肉)	<b>Interviewee:</b> Making money? (Note: TXT misheard as “Canned beef tendon/Canned beef”)
<b>Me:</b> 對。	<b>Me:</b> Yes.
<b>Interviewee:</b> 對對對，以為是不買這個東西，或者是可能，可能就是你買這個東西可以省多少錢，或是你不買這個東西可能會省多少錢。這個積蓄的話，我覺得...要怎麼看 (註: TXT 誤聽為 乾)？	<b>Interviewee:</b> Right, right, right. I thought it was about not buying this thing, or maybe, maybe buying this thing could save how much money, or not buying this thing might save how much money. This “Savings”, I feel... how should I look at it (Note: TXT misheard as “dry”)?
<b>Me:</b> 好。那第三個部分，投資？	<b>Me:</b> Okay. Then the third section, Investment?
<b>Interviewee:</b> 投資嗎？ 投資喔？ 感覺很像是我要投資這一家的品牌？ 哪裡啊？ 投資這是...投資代號？ 美國、美國、韓國。感覺就是，對啊，就是投資這個品牌。	<b>Interviewee:</b> Investment? Investment, huh? Feels like I'm supposed to invest in this company's brand? Where? Investment this is... investment code? USA, USA, Korea. Feels like, yeah, investing in this brand.
<b>Me:</b> 那妳會嗎？	<b>Me:</b> Would you?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Me:</b> 好，那妳可以幫我回第一個部分嗎？ 第一個，買東西。然後下面下面下面...對，有兩個按鈕。如果妳不想要按也可以。	<b>Me:</b> Okay, can you help me go back to the first section? The first one, buying things. Then below, below, below... Right, there are two buttons. If you don't want to press them, that's okay too.
<b>Interviewee:</b> 欸，等我看一下。哇哇哇，這個有點跑掉了。嗯...哇喔。我想一下...「對關心環保 (註: TXT 誤聽為 光環保) 的消費者來說，選擇可持續性的品牌可能會更好。以下是可替代的品牌，並附上簡單的比較表」。哦...這個，這個...那個，它可以再隔一個空位嗎？ 對，有點看不懂。	<b>Interviewee:</b> Hey, let me take a look. Wow wow wow, this one is a bit off. Hmm... Wow oh. Let me think... “For consumers concerned about environmental protection (Note: TXT misheard as “only environmental protection”), choosing sustainable brands might be better. Below are alternative brands with a simple comparison table attached.” Oh... This, this... that, can it have another space? Right, it's a bit hard to understand.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。好。那妳覺得...妳有另外一個按鈕 (註: TXT 誤聽為案子), 呱想要問 (註: TXT 誤聽為 玩) AI 嗎？	<b>Me:</b> Okay. Okay. So do you think... you have another button (Note: TXT misheard as “case”), do you want to ask (Note: TXT misheard as “play”) the AI?
<b>Interviewee:</b> AI 嗎？ 隨便都可以。嗯...我想想看喔... 「產品會浪費掉多少的碳排放量」？(註: TXT 誤聽為 網品櫃/癱瘓量) ...按到了。	<b>Interviewee:</b> AI? Anything is fine. Hmm... Let me think... “How much carbon emission will the product waste?” (Note: TXT misheard as “Net product counter/paralysis amount”) ...Pressed it.
<b>Me:</b> 欸，等一下，按到了。	<b>Me:</b> Hey, wait a minute, you pressed it.
<b>Interviewee:</b> 我本來是要按說「會浪費掉多少的碳排放量」...	<b>Interviewee:</b> I originally wanted to press “How much carbon emission will be wasted”...
<b>Me:</b> 哇，好清楚喔。	<b>Me:</b> Wow, so clear.
<b>Me:</b> 好。那要說什麼？ 呱覺得最...重點是什麼？	<b>Me:</b> Okay. What should I say? What do you think is the most... main point?
<b>Interviewee:</b> 重點是什麼？ 蟬多的捏。就是光是從生產過程就已經開始產生碳排放，然後包裝本來就是也會產生，運輸過程也不用說就是本來就會產生的，只是我沒有想到說就是，最後的使用跟處理，使用過程中的水電消耗以及產品的包裝最終處理回收或掩埋，也會影響到碳排放。	<b>Interviewee:</b> What's the main point? There's quite a lot. Just from the production process, carbon emissions already start being generated. Then packaging itself also generates them. The transportation process goes without saying, it inherently generates them. It's just that I didn't think about, like, the final use and disposal, the water and electricity consumption during use, and the final disposal of the product's packaging – recycling or landfill – would also affect carbon emissions.
<b>Me:</b> 啊。好。那這樣就可以了。妳幫我拍照這個畫面 (註: TXT 誤聽為玩意)，還有那個剛剛那個 Momo...Momo，對。好，Momo，等一下...這個部分就可以了。好的。	<b>Me:</b> Hmm. Okay. That's fine then. Help me take a photo of this screen (Note: TXT misheard as “thingy”), and also that Momo from just now... Momo, right. Okay, Momo, wait a moment... this part is fine. Okay.
<b>Interviewee:</b> 這上面有...	<b>Interviewee:</b> On top here there's...
<b>Me:</b> ...那個號碼，接收號碼，這個，那個幫我寫。	<b>Me:</b> ...that number, the receiving number, this one, help me write that one down.

### 16.1.2 Transcript 2024-11-13 - Tainan (STUST) - 26N4W

**Source Files:** \* 2024-11-13 - Tainan (STUST) - 26N4W.json \* 2024-11-13 - Tainan (STUST) - 26N4W.txt

**Ziran ID Code:** 26N4W

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好，我先再跟您解釋一次。所以這個是我(的)論文的一部分的 App，謝謝妳幫我測試。然後我要先問妳，妳，我可以錄影妳的聲音嗎？	<b>Me:</b> Okay, let me explain again. So this is an App that's part of my thesis. Thank you for helping me test it. Then I want to ask you first, you, can I record your voice?
<b>Interviewee:</b> 可以，可以。	<b>Interviewee:</b> Yes, yes.
<b>Me:</b> 好，謝謝。那妳的回覆都是匿名的(註: JSON 誤聽為你們的)，OK？	<b>Me:</b> Okay, thank you. Your responses will be anonymous (Note: JSON misheard as “yours”), OK?
<b>Interviewee:</b> OK, OK.	<b>Interviewee:</b> OK, OK.
<b>Me:</b> 那可以開始了。喔，直接先下載這個。	<b>Me:</b> Then we can start. Oh, first download this directly.
<b>Interviewee:</b> 好。在哪裡？哪裡？	<b>Interviewee:</b> Okay. Where is it? Where?
<b>Me:</b> 呢那個，在哪裡找啊？	<b>Me:</b> That one, where did you find it?
<b>Interviewee:</b> (下載安裝中) ... 那個電話...這裡...這裡。	<b>Interviewee:</b> (Downloading and installing)... That phone... here... here.
<b>Me:</b> 呢妳之前有(用)過 Momo (註: TXT 誤聽為 夢)嗎？	<b>Me:</b> Have you used Momo (Note: TXT misheard as “dream”) before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 呢妳習慣在網路上買東西嗎？	<b>Me:</b> Are you used to buying things online?
<b>Interviewee:</b> 我不習慣。	<b>Interviewee:</b> I'm not used to it.
<b>Me:</b> 那但是有買過嗎？	<b>Me:</b> But have you bought things before?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那用什麼平台？	<b>Me:</b> What platform do you use?
<b>Interviewee:</b> Shopee (蝦皮)。	<b>Interviewee:</b> Shopee.
<b>Me:</b> 好。那 Momo (註: TXT 誤聽為 某某)上...妳覺得 Momo 上想要有什麼妳想要買的嗎？	<b>Me:</b> Okay. Then on Momo (Note: TXT used “某某” - something/someone)... do you think there's anything you want to buy on Momo?
<b>Interviewee:</b> Momo 有什麼嗎？	<b>Interviewee:</b> What does Momo have?
<b>Me:</b> 隨便都可以。	<b>Me:</b> Anything is fine.

Traditional Chinese Transcript	English Translation
<p><b>Interviewee:</b> (瀏覽中) 閉嘴...不要...對啊... (網路問題) ...清楚說我就不應該用學校 wifi 喔。好像有連欸。我這新電腦沒連過。網路都很新。有。現在都是5G (註: TXT 誤聽為探戶版)? 再一陣嗎? 有啊。(唸密碼部分省略) ...對啊,然後黑色流星之下才是惡夢圈,惡夢圈之後才是那個穿越故宮大冒險...鬼東西... (繼續瀏覽) 都慢慢的...對啊,跳一本最近看進去的,這個,《全知讀者視角》(註: TXT 誤聽為十九)? 小說啦。啊靠北賣完了啦! 開始了? 賣完了,要等補貨 (註: TXT 誤聽為 聽關頭)。</p>	<p><b>Interviewee:</b> (Browsing) Shut up... don't... yeah... (Network issue)... Clearly I shouldn't use the school wifi. Oh, seems connected. My new computer hasn't connected before. The network is very new. Yes. Is it all 5G (Note: TXT misheard as "探戶版" - household version) now? Another round? Yes. (Password part omitted)... Yeah, and then after Black Star is Nightmare Circle, after Nightmare Circle is that Traversing the Palace Museum Adventure... ghost thing... (Continues browsing) All slow... yeah, jump to one I recently got into, this one, "Omniscient Reader's Viewpoint" (Note: TXT misheard as "Nineteen")? It's a novel. Ah damn it's sold out! Started? Sold out, have to wait for restock (Note: TXT misheard as "listen to the critical moment").</p>
<p><b>Me:</b> (等待頁面加載) 過癮...清潔啊? 對啊。還沒有出來。這是...那時候好像是有網路問題吧?</p>	<p><b>Me:</b> (Waiting for page to load) Satisfying... cleaning? Yeah. Still hasn't come out. Is this... seems like there was still a network problem then, right?</p>
<p><b>Interviewee:</b> 好,有了。</p>	<p><b>Interviewee:</b> Okay, it's here.</p>
<p><b>Me:</b> 那這是什麼? 這是輕小說? 那妳最近有看過嗎?</p>	<p><b>Me:</b> What is this? Is this a light novel? Have you read it recently?</p>
<p><b>Interviewee:</b> 我有看過他的動畫。</p>	<p><b>Interviewee:</b> I've seen its anime.</p>
<p><b>Me:</b> 那剛剛有發現什麼新的東西嗎? 婦是說他的整個過程? 整個頁面嗎?</p>	<p><b>Me:</b> Did you notice anything new just now? You mean its whole process? The whole page?</p>
<p><b>Interviewee:</b> 還是說其他的?</p>	<p><b>Interviewee:</b> Or other things?</p>
<p><b>Me:</b> 小說? 頁面?</p>	<p><b>Me:</b> Novel? Page?</p>
<p><b>Interviewee:</b> 頁面新東西? 還有它顯示賣完的(註: TXT 誤聽為騰訊賣碗),有一些東西賣完的,對,然後就找不到了這樣子。</p>	<p><b>Interviewee:</b> New things on the page? And it shows sold out (Note: TXT misheard as "Tencent sells bowls"), some items are sold out, right, and then can't be found like that.</p>
<p><b>Me:</b> 好。那還有什麼嗎?</p>	<p><b>Me:</b> Okay. Anything else?</p>
<p><b>Interviewee:</b> 然後還有...我都(會)不會在意,我都直接看價錢,然後看一下還有什麼東西,然後就直接買了。</p>	<p><b>Interviewee:</b> And also... I (will) won't care, I just look at the price directly, then see what else there is, and then just buy it directly.</p>
<p><b>Me:</b> 好。那右邊呢? 右邊這個?</p>	<p><b>Me:</b> Okay. What about the right side? This one on the right?</p>
<p><b>Interviewee:</b> 這是妳,這是,這是什麼? 這應該是妳製作的那個吧? 因為通常出現不會出現這個。</p>	<p><b>Interviewee:</b> This is you, this is, what is this? This should be the thing you made, right? Because usually this doesn't appear.</p>

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那它，它的，它給妳講什麼？它有講中文？	<b>Me:</b> Okay. Then it, its, what does it tell you? Does it speak Chinese?
<b>Interviewee:</b> 品牌，就是介紹吧。然後還有她的一些其他的什麼作品啊，然後好像包裝 (註: TXT 誤聽為包藏) 一些之類的。喔，還有它的那個碳排放方面，還有它的一些投資股票嗎？之類的。	<b>Interviewee:</b> Brand, it's an introduction, right? And also some of her other works, and seems like packaging (Note: TXT misheard as "conceal"), things like that. Oh, and its carbon emission aspect, and some of its investments, stocks? Things like that.
<b>Me:</b> 那這個資料 (註: JSON 誤聽為 cdi) 裡面有什麼妳覺得比較有趣的，還是有興趣的部分嗎？	<b>Me:</b> Is there anything in this data (Note: JSON misheard as "cdi") that you find particularly interesting, or any parts you're interested in?
<b>Interviewee:</b> 有興趣的部分？對... ESG 評分 (註: TXT 誤聽為美麗徽章)。有，她說去就直接，直接棄她出版社的。蛤？對。嗯。還有勞工問題 (註: TXT 誤聽為老公問題)。	<b>Interviewee:</b> Interested parts? Right... ESG rating (Note: TXT misheard as "Beautiful Badge"). Yes, she said to go directly, directly abandon her publisher. Huh? Right. Hmm. And labor issues (Note: TXT misheard as "husband issues").
<b>Me:</b> 好。對。大概就是這樣子。好。那下面還有兩個按鈕 (註: TXT 誤聽為案子)。呃，妳想按什麼嗎？還是互相按也可以？	<b>Me:</b> Okay. Right. Roughly like this. Okay. Then below there are two buttons (Note: TXT misheard as "cases"). Uh, do you want to press anything? Or pressing each other is also okay?
<b>Interviewee:</b> (網路問題) ...然後你可以問... (AI 建議) 這個是什麼？「比較」和「資訊」，還有比較其他出版社的那些資訊吧？碳排放的那些資訊。	<b>Interviewee:</b> (Network issue)... Then you can ask... (AI suggestions) What is this? "Compare" and "Information", and also compare information from other publishers? That carbon emission information.
<b>Me:</b> 好。對。那這個，這個裡面有什麼有興趣的嗎？找到小褲子 (註: TXT 誤聽為小棍子)？	<b>Me:</b> Okay. Right. Is there anything interesting in this one? Found small pants (Note: TXT misheard as "small sticks")?
<b>Interviewee:</b> 嗯...蠻興趣的耶。我好像都沒在注意這東西耶。哇，都沒在注意耶。有一些出版社之類的。	<b>Interviewee:</b> Hmm... quite interesting. I seem to have never paid attention to this stuff. Wow, never paid attention. There are some publishers and things like that.
<b>Me:</b> 那這題妳有什麼問題想要問 Lulu AI 嗎？	<b>Me:</b> Do you have any questions you want to ask Lulu AI about this?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我想想我要問什麼...我也是...如果(註: TXT 誤聽為我很煩要)是五千元就買那個，買那個，買那個...我怎麼中獎(註: TXT 誤聽為中錢)了？嗯。再寫一些相關問題？我要問什麼？哇靠...我要想問什麼問題耶。除了這些還有其他的嗎？總感覺如果問好多...你有特點嗎？那應該是角川(註: TXT 誤聽為漫甲無敵)特點。好像很多。我看了我只知道東立跟那個，我也只知道東立、東立跟那個什麼木馬的，反正就是那些。好，尖端。對，尖端。	<b>Interviewee:</b> Let me think what I want to ask... Me too... if (Note: TXT misheard as "I'm annoyed want") it's 5000 yuan then buy that, buy that, buy that... how did I win the lottery (Note: TXT misheard as "hit money")? Hmm. Write some related questions again? What should I ask? Wow damn... I need to think what question to ask. Besides these, are there others? Feels like if I ask too many... Do you have special features? Then it should be Kadokawa's (Note: TXT misheard as "Man Jia Wu Di") special features. Seems like a lot. I looked, I only know Tong Li and that one, I also only know Tong Li, Tong Li and that what's-it-called Mu Ma, anyway just those. Okay, Sharp Point. Yes, Sharp Point.
<b>Me:</b> 好。那它剛剛說什麼？	<b>Me:</b> Okay. What did it say just now?
<b>Interviewee:</b> 它說，我剛剛問...我問說還有其他出版社的嗎？我看有沒有跟三采(註: TXT 誤聽為商政)差別。還有喔，有「位(慰)(未)」，「綠色書」，「自然之聲(註: TXT 誤聽為資深)」，「環保」、「出版」。這些的？這些出版社，可持續發展...喔！值得你考慮支持喔！	<b>Interviewee:</b> It said, I just asked... I asked if there are other publishers? See if there's a difference with Sanmin (Note: TXT misheard as "business politics"). There are, oh, there's "Wei" (comfort/future), "Green Book", "Voice of Nature (Note: TXT misheard as "senior")", "Environmental Protection", "Publishing". These? These publishers, sustainable development... Oh! Worth your consideration to support!
<b>Me:</b> 你有買過這些的嗎？	<b>Me:</b> Have you bought from these before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 那如果比如說，他會給你推薦這些出版社的書本？	<b>Me:</b> What if, for example, it recommends books from these publishers to you?
<b>Interviewee:</b> 可是它這些書有，有哪些...它有出過哪些書啊？隨便複製一個，「綠色書」，它這個，它沒有...它這個是，這是店面吧？	<b>Interviewee:</b> But these books it has, which ones... which books has it published? Just randomly copy one, "Green Book", this one, it doesn't have... this one is, this is a storefront, right?
<b>Me:</b> 對啊，這是店面啊。	<b>Me:</b> Yeah, this is a storefront.
<b>Interviewee:</b> 對，它推薦的是店面的品牌名稱。	<b>Interviewee:</b> Right, what it recommends are the brand names of storefronts.
<b>Me:</b> 所以你相信它跟你講的這些嗎？(註: TXT 誤聽為信號)	<b>Me:</b> So do you believe what it told you? (Note: TXT misheard as "signals")

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 它出...喔，出三采？ 反正真的有的應該是相信的。因為畢竟我自己也不懂，除非就像是剛剛那個複製貼上去，現在看到發現說，好像這好像其實不是，這不是出版社，而是那個一個地點。好，對。這看起來超級不像那個的...這一本書。	<b>Interviewee:</b> It published... oh, published Sanmin? Anyway, the ones that really exist, I should believe. Because after all, I don't know myself, unless it's like just now, copy-pasting it, now seeing it and finding out, seems like this actually isn't, this isn't a publisher, but rather that one location. Okay, right. This looks super unlike that... this one book.
<b>Me:</b> 好。對。好。那這樣可以了。妳再幫我拍照一下 Momo 跟它互動。	<b>Me:</b> Okay. Right. Okay. That's fine then. Help me take another photo of Momo and the interaction with it.
<b>Interviewee:</b> (拍照)	<b>Interviewee:</b> (Takes photo)
<b>Me:</b> 什麼其他的，這個網頁，不是它一定給妳回覆的，妳幫我拍照一下。讓妳熟悉它。	<b>Me:</b> Anything else, this webpage, not necessarily the one it replied with, help me take a photo. Let you get familiar with it.
<b>Interviewee:</b> (拍照) ...然後這邊。	<b>Interviewee:</b> (Takes photo)... And here.
<b>Me:</b> 好。那桌子上面有卡片，妳幫我寫在上面，這個號碼。	<b>Me:</b> Okay. There's a card on the table, help me write this number on it.
<b>Interviewee:</b> (寫號碼)	<b>Interviewee:</b> (Writes number)

### 16.1.3 Transcript 2024-11-13 - Tainan (STUST) - 5DH5F

**Source Files:** \* 2024-11-13 - Tainan (STUST) - 5DH5F.json \* 2024-11-13 - Tainan (STUST) - 5DH5F.txt

**Ziran ID Code:** 5DH5F

Traditional Chinese Transcript	English Translation
<b>Me:</b> (Testing audio levels - 水泥 abcd 請假好了嗎) 嗯好。	<b>Me:</b> (Testing audio levels - cement abcd leave okay?) Hmm okay.
<b>Me:</b> (Background noise - 打那個關掉)	<b>Me:</b> (Background noise - hit that turn off)
<b>Me:</b> 呀最近有用過 Momo (註: JSON 誤聽為 媽媽) 嗎？	<b>Me:</b> Have you used Momo (Note: JSON misheard as "mom") recently?
<b>Interviewee:</b> 嗯，我沒有用過 Momo，我有用過蝦皮。	<b>Interviewee:</b> Hmm, I haven't used Momo, I have used Shopee.
<b>Me:</b> OK。那妳平常網路上會買 (註: JSON 誤聽為 賣) 什麼樣的東西？	<b>Me:</b> OK. What kind of things do you usually buy (Note: JSON misheard as "sell") online?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 嗯...我想一下...網路上會買什麼東西...我都買一些蠻奇怪的東西。比如說，因為我喜歡做，嗯，就是吊飾之類的那種手作，所以我會去買那種材料，或是毛線之類的，我也會編織之類的，就是都會上網去買這些東西。	<b>Interviewee:</b> Hmm... let me think... what do I buy online... I buy some rather strange things. For example, because I like to make, hmm, like charms and that kind of handmade craft, so I buy those kinds of materials, or yarn, things like that, I also knit, things like that, I buy all these things online.
<b>Me:</b> 好。那妳覺得 Momo 上，有什麼妳想要買的嗎？	<b>Me:</b> Okay. Do you think there's anything you want to buy on Momo?
<b>Interviewee:</b> 我要買，我要買保健食品。我覺得最近的...我覺得我最近的記憶力有點下降，所以我要買維他命來吃。	<b>Interviewee:</b> I want to buy, I want to buy health supplements. I feel like recently... I feel like my memory has been declining recently, so I want to buy vitamins to take.
<b>Me:</b> 嗯。(Waiting for page to load) 沒有維他命啊？	<b>Me:</b> Hmm. (Waiting for page to load) No vitamins, huh?
<b>Me:</b> 所以妳想要買這個維他命？ 嗯。好像這個網頁有沒有圖片嗎？ 沒有他的圖片啊？（看到圖片）有...他還是在搜尋（註：TXT 誤聽為 設卡）嗎？ 他還沒有弄好嗎？ 婴可以試試 refresh 一次。啊，妳覺得是網路的問題嗎？ 有時候學校網路會這樣子，怪怪的喔。就是，還是妳要連我的？	<b>Me:</b> So you want to buy this vitamin? Hmm. Does this webpage seem to have no pictures? No pictures of it? (Sees picture) There is... Is it still searching (Note: TXT misheard as “setting card”)? Is it not ready yet? You can try refreshing once. Ah, do you think it's a network problem? Sometimes the school network is like this, a bit strange. So, or do you want to connect to mine?
<b>Interviewee:</b> 喔好。	<b>Interviewee:</b> Oh okay.
<b>Me:</b> 把密碼交出來。	<b>Me:</b> Hand over the password.
<b>Interviewee:</b> (Connects to hotspot) 真的，是網路的問題。有，圖片是很多的。	<b>Interviewee:</b> (Connects to hotspot) Really, it's a network problem. Yes, there are many pictures.
<b>Me:</b> 好。這個妳有最近買過嗎？	<b>Me:</b> Okay. Have you bought this recently?
<b>Interviewee:</b> 嗯...有哦。	<b>Interviewee:</b> Hmm... Yes.
<b>Me:</b> 好酷喔。	<b>Me:</b> So cool.
<b>Interviewee:</b> 我自己本身是沒有吃啦，但是我們家也有人有吃過。但是我那個家人其實沒有很熟，所以我只有聽過他有買過魚油這個東西，我沒有看過他吃過。	<b>Interviewee:</b> I haven't taken it myself, but someone in my family has taken it before. But I'm not very familiar with that family member, so I've only heard that they bought fish oil, I haven't seen them take it.
<b>Me:</b> 嗯。那剛剛有發生什麼？ 有什麼新的東西嗎？ 哇，這個直接跳出來，好酷喔。	<b>Me:</b> Hmm. So what happened just now? Was there anything new? Wow, this popped up directly, so cool.
<b>Me:</b> 那妳覺得他的最明顯的部分是什麼？	<b>Me:</b> What do you think is its most obvious part?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 他現在看到的是，他有把碳足跡列出來，就是說這一間公司有沒有那個...他對於環保的概念有沒有那個...他列了很詳細的。	<b>Interviewee:</b> What I see now is that it has listed the carbon footprint, meaning whether this company has that... whether it has the concept of environmental protection... it listed it very detailedly.
<b>Me:</b> 噢。妳覺得自己環保的人嗎？	<b>Me:</b> Hmm. Do you consider yourself an environmentally conscious person?
<b>Interviewee:</b> 噢...妳覺得自己環保的人嗎？ 還是還好？	<b>Interviewee:</b> Hmm... Do you consider yourself an environmentally conscious person? Or just okay?
<b>Interviewee:</b> 噢，環保...關心它們 (註: TXT 誤聽為 方法) 吧？ 是還好。就是我會注意這個，就是因為小時候就常講說那個，如果一個東西啊，最好要在自己，就是自己的家這樣子買，這樣子碳足跡就不會比較高。然後，聽懂的話是還好啦，但是有時候會注意。	<b>Interviewee:</b> Hmm, environmental protection... care about them (Note: TXT misheard as "method"), right? It's okay. It's just that I pay attention to this, because when I was young, people often said that, if there's an item, it's best to buy it in your own, like your own home area, that way the carbon footprint won't be as high. So, if understood, it's okay, but sometimes I do pay attention.
<b>Me:</b> 那妳覺得這個資料 (註: TXT 誤聽為細療) 有什麼有用的部分嗎？	<b>Me:</b> What do you think is the useful part of this data (Note: TXT misheard as "fine treatment")?
<b>Interviewee:</b> 有用的部分...有用的部分...我是覺得可以讓使用者看到就是說，哦，你們這一間公司，你要買的這一間公司，它那個，它在環保上面有沒有，它在環保上面有沒有用心，這樣子。哇，這個真的好多喔。我看下其他的選擇。	<b>Interviewee:</b> Useful part... useful part... I feel it can let users see, like, oh, this company you're considering buying from, its, whether it's putting effort into environmental protection, like that. Wow, there's really a lot here. Let me look at other options.
<b>Interviewee:</b> (Looking at MUJI bag) 無印？ 這是什麼樣的產品？	<b>Interviewee:</b> (Looking at MUJI bag) MUJI? What kind of product is this?
<b>Me:</b> 是購物袋。	<b>Me:</b> It's a shopping bag.
<b>Interviewee:</b> 就是那個...在學校啊，在學校我就看到蠻多人在戴這個無印的購物袋 (註: TXT 誤聽為跟我感覺)，然後出現這個，大概就...基本上呢，就是大家都會，就走在路上的時候就會，如果我們遇到十個人的話，大概有一半的人就會帶走。	<b>Interviewee:</b> It's that... at school, at school I see quite a lot of people carrying this MUJI shopping bag (Note: TXT misheard as "and my feeling"), and seeing this, probably just... basically, everyone does, when walking on the street, if we meet ten people, probably half of them will carry one away.
<b>Me:</b> 那妳剛剛有看到另外一個產品，無印的產品，然後妳把這個產品...另外一個產品可以比較嗎？ 一個報告？ 剛剛那個 AI 的報告啊。	<b>Me:</b> You just saw another product, a MUJI product, and then you put this product... can the other product be compared? A report? That AI report from just now.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 所以就要可以先開啊。「社會責任不明」，兩家店？兩家都是「社會責任不明」？嗯哼。對呀，我都聽過...（喃喃自語）...了。	<b>Interviewee:</b> So I should be able to open it first. “Social responsibility unclear,” two stores? Both are “Social responsibility unclear”? Uh-huh. Yeah, I’ve heard of them all... (muttering)... already.
<b>Me:</b> (Looking at 3M hook) 今天下雨了，真的好重喔。不然我們去走走？喔... 哟...我不知道...好像有？好像有？那個男的好像有？我決定我要連自己就好。我絕對不要連去...	<b>Me:</b> (Looking at 3M hook) It rained today, it’s really heavy. Otherwise, shall we go for a walk? Oh... hmm... I don’t know... seems like there is? Seems like there is? That guy seems to have one? I’ve decided I’ll just connect to my own. I definitely don’t want to connect to...
<b>Interviewee:</b> 他說這是車？要幾個？一個？	<b>Interviewee:</b> It says this is a car? How many? One?
<b>Me:</b> 我絕對不要連自己的。配(註: TXT誤聽為黑針)正在路上。	<b>Me:</b> I definitely don’t want to connect my own. Delivery (Note: TXT misheard as “black needle”) is on the way.
<b>Interviewee:</b> 那妳也是吃東西？	<b>Interviewee:</b> So you’re eating too?
<b>Me:</b> 對啊。那我怎麼還在這裡？	<b>Me:</b> Yeah. Then why am I still here?
<b>Interviewee:</b> 你可能...這是什麼？上面？這個是掛勾(註: TXT誤聽為掛鬥), 3M？然後，哇，這一傢好好？	<b>Interviewee:</b> You might... What is this? Above? This is a hook (Note: TXT misheard as “hanging fight”), 3M? Then, wow, this company is good?
<b>Me:</b> 那妳有發現那個AI的上面有一個號碼？	<b>Me:</b> Did you notice there’s a number above that AI?
<b>Interviewee:</b> 這個？嗯。	<b>Interviewee:</b> This one? Hmm.
<b>Me:</b> 那妳可以幫幫我寫這個...這裡好嗎？之前像一個都可以啊。	<b>Me:</b> Can you help me write this... here, okay? Like before, any one is fine.
<b>Interviewee:</b> 三個都要？	<b>Interviewee:</b> All three?
<b>Me:</b> 三個都要嗎？妳剛剛有、有、有介紹三個不一樣的商品。	<b>Me:</b> All three? You just introduced three different products.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Me:</b> 然後妳可以幫我拍照，這三個嗎？	<b>Me:</b> Then can you help me take a photo, of these three?
<b>Interviewee:</b> 都可以喔？去拍他說什麼？	<b>Interviewee:</b> All are okay? Go take a photo of what it says?
<b>Me:</b> 上面是我的。好。那圈一個，選一個，上面要選哪一個比較有用？這個？好。那下面有，有兩個按鈕(註: TXT誤聽為案子)，妳要選擇哪一個還是不用按那個？	<b>Me:</b> The top one is mine. Okay. Then circle one, choose one, which one above is more useful to choose? This one? Okay. Then below there are, there are two buttons (Note: TXT misheard as “cases”), which one do you want to press, or no need to press that one?
<b>Interviewee:</b> 不用按。	<b>Interviewee:</b> No need to press.
<b>Me:</b> 好。	<b>Me:</b> Okay.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 呃覺得剛剛 AI 跑去哪裡了？這個什麼玩意啊？	<b>Me:</b> Where do you think the AI went just now? What is this thing?
<b>Interviewee:</b> 這個是那個產地。嗯。然後，等下，然後這裡是那個...	<b>Interviewee:</b> This is the place of origin. Hmm. Then, wait, then here is that...
<b>Me:</b> �恩，AI？	<b>Me:</b> Hmm, AI?
<b>Interviewee:</b> ...替代產品。	<b>Interviewee:</b> ...alternative products.
<b>Me:</b> �恩。那妳覺得妳有什麼問題想要問 AI (註: JSON 誤聽為 餵餵餵) 嗎？	<b>Me:</b> Hmm. Do you think you have any questions you want to ask the AI (Note: JSON misheard as “wei wei wei” - feeding sounds)?
<b>Interviewee:</b> 請問...我想不太到。	<b>Interviewee:</b> Excuse me... I can't really think of any.
<b>Me:</b> 如果沒有也可以。	<b>Me:</b> It's okay if you don't have any.
<b>Interviewee:</b> �恩，那沒有。	<b>Interviewee:</b> Hmm, then no.
<b>Me:</b> 好啊。那這樣就可以了。手機，妳可以使用妳的手機掃描這個QR。那下面有一個問卷(註: TXT 誤聽為溫泉)。那這個測試代碼要就是這些，所以如果妳測試一個產品就可以了。但是妳因為妳測試三個產品，可以寫三個。	<b>Me:</b> Okay. That's fine then. Phone, you can use your phone to scan this QR. Then below there's a questionnaire (Note: TXT misheard as “hot spring”). And this test code is just these, so if you tested one product, that's fine. But since you tested three products, you can write three.
<b>Interviewee:</b> �恩。喔。	<b>Interviewee:</b> Hmm. Oh.

#### 16.1.4 Transcript 2024-11-13 - Tainan (STUST) - 5U37U

**Source Files:** \* 2024-11-13 - Tainan (STUST) - 5U37U.json \* 2024-11-13 - Tainan (STUST) - 5U37U.txt

**Ziran ID Code:** 5U37U

Traditional Chinese Transcript	English Translation
<b>Me:</b> 我要先介紹一下，所以這個是(註: JSON 誤聽為 才)我的論文的一部分(註: JSON 誤聽為衣服很多)，所以App啊，謝謝妳幫我測試。然後我要先問妳，妳，我可以錄影妳的聲音嗎？OK。這些回覆(註: JSON 誤聽為这才恢复)到時候都是(註: TXT 誤聽為匿名的/JSON 誤聽為你們的)？	<b>Me:</b> Let me introduce first, so this is (Note: JSON misheard as “only”) part of my thesis (Note: JSON misheard as “lots of clothes”), so the App, ah, thank you for helping me test it. Then I want to ask you first, you, can I record your voice? OK. These responses (Note: JSON misheard as “This only recovers”) will be (Note: TXT misheard “anonymous” / JSON misheard “yours”) later?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 嗯。好。那可以繼續。第一件事就是你要下載 (註: TXT 誤聽為即將) 那個 App。	<b>Me:</b> Hmm. Okay. Then we can continue. The first thing is you need to download (Note: TXT misheard as “will”) that App.
<b>Interviewee:</b> (Downloads app)	<b>Interviewee:</b> (Downloads app)
<b>Me:</b> 那妳最近有用過 Momo 嗎？	<b>Me:</b> Have you used Momo recently?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 那妳網路上有買過東西嗎？	<b>Me:</b> Have you bought things online?
<b>Interviewee:</b> 有，蝦皮。	<b>Interviewee:</b> Yes, Shopee.
<b>Me:</b> 蝦皮，好。那妳通常買什麼？	<b>Me:</b> Shopee, okay. What do you usually buy?
<b>Interviewee:</b> 衣服、鞋子類的。	<b>Interviewee:</b> Clothes, shoes, things like that.
<b>Me:</b> 好。那妳覺得蝦皮 (註: TXT 誤聽為 shopee) 上有什麼妳想要買的產品嗎？衣服吧。喔，或是什麼 Momo 商品？對。嗯。這些嗎？	<b>Me:</b> Okay. Do you think there's any product you want to buy on Shopee (Note: TXT used “shopee”)? Clothes, perhaps. Oh, or some Momo product? Right. Hmm. These?
<b>Interviewee:</b> 什麼都可以。妳想想。香氛。	<b>Interviewee:</b> Anything is fine. You think about it. Fragrance.
<b>Me:</b> 好。對。嗯。這一種沒辦法。有什麼有興趣的嗎？（商品頁面無法點擊）這不能點耶。欸，可以的。喔。	<b>Me:</b> Okay. Right. Hmm. This kind doesn't work. Is there anything interesting? (Product page unclickable) This can't be clicked. Hey, yes it can. Oh.
<b>Me:</b> (瀏覽商品) 這個...	<b>Me:</b> (Browsing product) This one...
<b>Interviewee:</b> 這是什麼產品？...那個唇膏。	<b>Interviewee:</b> What product is this? ...That lipstick.
<b>Me:</b> 那妳之前有買過嗎？	<b>Me:</b> Have you bought it before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 那這個品牌對妳來說怎麼樣？	<b>Me:</b> What do you think of this brand?
<b>Interviewee:</b> 沒有用過。	<b>Interviewee:</b> Haven't used it.
<b>Me:</b> 呱剛剛有發現有什麼新的？新的事情嗎？	<b>Me:</b> Did you notice anything new just now? Anything new?
<b>Interviewee:</b> 網頁上跑出來這個。	<b>Interviewee:</b> This popped up on the webpage.
<b>Me:</b> 好。那記得這是什麼？	<b>Me:</b> Okay. Do you remember what this is?
<b>Interviewee:</b> 它的資訊嗎？產品資訊？	<b>Interviewee:</b> Its information? Product information?
<b>Me:</b> 嗯。最最明顯的是什麼？	<b>Me:</b> Hmm. What's the most obvious thing?
<b>Interviewee:</b> 蟬細節的，很細節。	<b>Interviewee:</b> Quite detailed, very detailed.
<b>Me:</b> 那妳覺得這個資料 (註: TXT 誤聽為伎倆) 的重點是什麼？	<b>Me:</b> What do you think is the main point of this data (Note: TXT misheard as “trick”)?
<b>Interviewee:</b> 可以更了解這個產品吧。就是妳買，買之前妳就會比較詳細知道它的資訊跟妳買之後會產生什麼...嗯。對。	<b>Interviewee:</b> Can understand this product better. Like, before you buy, buy, you'll know its information in more detail and what will happen after you buy... Hmm. Right.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 就是說...那妳會...呃，這個部分...這個對。那下面，最下面有兩個按鈕，這個對，妳想要按什麼嗎？還是不想要也可以？	<b>Me:</b> Meaning... So will you... uh, this part... this right. Then below, at the very bottom there are two buttons, this right, do you want to press anything? Or it's okay if you don't want to?
<b>Interviewee:</b> 這個。	<b>Interviewee:</b> This one.
<b>Me:</b> 那妳覺得這個是什麼？	<b>Me:</b> What do you think this is?
<b>Interviewee:</b> 呃，就是類似產品的比較。它可以讓我選擇比較多。	<b>Interviewee:</b> Uh, like a comparison of similar products. It can give me more choices.
<b>Me:</b> 嗯。哇，還有分類耶。那妳覺得這個資料 (註: TXT 誤聽為 系列) 有什麼有用的部分嗎？	<b>Me:</b> Hmm. Wow, there are categories too. What do you think is the useful part of this data (Note: TXT misheard as "series")?
<b>Interviewee:</b> 感覺它，它蠻像那種，就是蝦皮裡面的...	<b>Interviewee:</b> Feels like it, it's quite like that kind, like inside Shopee...
<b>Me:</b> 呀，有用過蝦皮嗎？	<b>Me:</b> Have you used Shopee?
<b>Interviewee:</b> 有。就是...妳查看 (註: TXT 誤聽為 產汗) 之後，(知道) 現在皮膚是會有什麼狀況 (註: TXT 誤聽為 皂香濕)。嗯，就是類似那種感覺。	<b>Interviewee:</b> Yes. It's like... after you check (Note: TXT misheard as "produce sweat"), (you know) what condition your skin will be in now (Note: TXT misheard as "soap fragrance wet"). Hmm, it's like that kind of feeling.
<b>Me:</b> 好。那這個之外，妳還有什麼其他的問題妳想要問 AI (註: JSON 誤聽為 綠綠 ai/餵餵餵) 嗎？	<b>Me:</b> Okay. Besides this, do you have any other questions you want to ask the AI (Note: JSON misheard as "green green ai / wei wei wei")?
<b>Interviewee:</b> 這是什麼？「減少亂買」？	<b>Interviewee:</b> What's this? "Reduce impulsive buying"?
<b>Me:</b> 哦，太貼心了吧。	<b>Me:</b> Oh, how thoughtful.
<b>Interviewee:</b> 為什麼？那教妳怎麼減少亂買。	<b>Interviewee:</b> Why? Then it teaches you how to reduce impulsive buying.
<b>Me:</b> 那妳也可以自己打字 (註: TXT 誤聽為 打折)。妳有什麼問題想問嗎？	<b>Me:</b> You can also type yourself (Note: TXT misheard as "get a discount"). Do you have any questions you want to ask?
<b>Interviewee:</b> 是沒有。	<b>Interviewee:</b> No, I don't.
<b>Me:</b> 好啊。那這樣就可以了。妳幫我拍照這些，兩個畫面 (註: TXT 誤聽為 環頁)，Momo 跟這個。剛剛的...這個嗎？不是，剛剛那個 AI 的部分。對，這裡，開動繼續看。	<b>Me:</b> Okay. That's fine then. Help me take photos of these, two screens (Note: TXT misheard as "environmental page"), Momo and this one. The one from just now... this one? No, the AI part from just now. Right, here, start watching again.
<b>Interviewee:</b> 用手機拍嗎？	<b>Interviewee:</b> Use my phone to take the photo?

Traditional Chinese Transcript	English Translation
<b>Me:</b> 對。那還有，妳覺得最重要的？是兩個？在剛剛有給妳寫回覆，這裡。對，在這裡。好。那 Momo... Momo 上面，最上面有一個號碼，對，這個。來，幫我寫這裡。1...2...5...	<b>Me:</b> Yes. And also, what do you think is most important? The two? From the reply it gave you just now, here. Right, here. Okay. Then Momo... On top of Momo, at the very top there's a number, right, this one. Come, help me write it here. 1...2...5...
<b>Interviewee:</b> 呀是什麼？這樣子？ 5U37U °(註: Participant originally read 5673)	<b>Interviewee:</b> What are you? Like this? 5U37U. (Note: Participant originally read 5673)
<b>Me:</b> 好。	<b>Me:</b> Okay.

### 16.1.5 Transcript 2024-11-13 - Tainan (STUST) - EA9DV

**Source Files:** \* 2024-11-13 - Tainan (STUST) - EA9DV.json \* 2024-11-13 - Tainan (STUST) - EA9DV.txt  
**Ziran ID Code:** EA9DV

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好，我先再跟一些水準(註: 應為解釋一次)所以這個我的論文的一部分 App，謝謝你幫我解釋一下。那我可以錄影你的聲音嗎？	<b>Me:</b> Okay, let me first again with some standards (Note: Should be “explain once”). So this App is part of my thesis. Thank you for helping me explain. Can I record your voice?
<b>Interviewee:</b> 可以，可以。	<b>Interviewee:</b> Yes, yes.
<b>Me:</b> 好。那你的，你的回覆都是匿名的(註: JSON 誤聽為你名的)。OK?	<b>Me:</b> Okay. Then your, your responses are all anonymous (Note: JSON misheard as “your name”). OK?
<b>Interviewee:</b> OK.	<b>Interviewee:</b> OK.
<b>Me:</b> 那最開始喔...	<b>Me:</b> Then let's start... oh...
<b>Me:</b> ( instructing participant about downloading the app ) ...台灣...在哪裡？迪士尼...後悔我覺得超級好...對啊...旁邊...哪裡沒有啊...你那個在哪裡找吧...	<b>Me:</b> ( instructing participant about downloading the app ) ...Taiwan... Where is it? Disney... Regret I feel super good... Yeah... Beside... Where isn't there... Where did you find that...
<b>Me:</b> 呀最近有用過 Momo (註: JSON 誤聽為媽媽) 嗎？	<b>Me:</b> Have you used Momo (Note: JSON misheard as “mom”) recently?
<b>Interviewee:</b> 我沒有用過 Momo，我有用過蝦皮。	<b>Interviewee:</b> I haven't used Momo, I have used Shopee.

Traditional Chinese Transcript	English Translation
<b>Me:</b> OK。那妳平常網路上會買 (註: JSON 誤聽為 賣) 什麼樣的東西？	<b>Me:</b> OK. What kind of things do you usually buy (Note: JSON misheard as “sell”) online?
<b>Interviewee:</b> (Thinking) ...很多買嗯...你先忙...奇怪的東西...你說？ 因為我喜歡做，就是吊飾...料...	<b>Interviewee:</b> (Thinking) ...Buy a lot, hmm... you go first... strange things... you say? Because I like to make, like, charms... materials...
<b>Me:</b> (Referring to previous purchase) 維他命。	<b>Me:</b> (Referring to previous purchase) Vitamins.
<b>Me:</b> 所以妳想要買這個維他命？ 嗯。好像這個網頁有沒有圖片嗎？ 沒有他的圖片？ 好友... (圖片出現) 這個嗎？	<b>Me:</b> So you want to buy this vitamin? Hmm. Does this webpage seem to have no pictures? No pictures of it? Good friend... (Picture appears) This one?
<b>Me:</b> (instructing participant on app usage) ...就跟你要出去玩嗎...嗯...那剛剛有發現有什麼新的短期 (註: 應為 東西) ? 哇，這是直接跳出來，好可憐 (註: 應為 可interagierte 愛/酷喔) 。	<b>Me:</b> (instructing participant on app usage) ...like you want to go out to play?... Hmm... Did you notice anything new short-term (Note: Should be “things”) just now? Wow, this popped up directly, how pitiful (Note: Should be “lovable/cool”).
<b>Me:</b> 呢覺得它的最明顯的部分是什麼？	<b>Me:</b> What do you think is its most obvious part?
<b>Interviewee:</b> 把列出來，就是說這一間公司有沒有那個他的...	<b>Interviewee:</b> List it out, meaning whether this company has that its...
<b>Me:</b> 嗯嗯。	<b>Me:</b> Mm-hmm.
<b>Me:</b> 嗯，記得設計方法的人嗎？ 還是...	<b>Me:</b> Hmm, remember the person who designed the method? Or...
<b>Interviewee:</b> 嗨，嗯...關心方法不是，還好，還好。嗯。我會注意這個，就是因為小時候就常講說那個，如果一個東西啊，最好要在自己，就是自己的家這樣子買，這樣子就不會比較高。然後聽懂的話是還好啦，但是有時候會注意。	<b>Interviewee:</b> Hi, hmm... caring about the method, no, it's okay, it's okay. Hmm. I pay attention to this, because when I was young, people often said that, if there's an item, it's best to buy it in your own, like your own home area, that way it won't be higher. So, if understood, it's okay, but sometimes I do pay attention.
<b>Me:</b> 嗯嗯。	<b>Me:</b> Mm-hmm.
<b>Me:</b> 好。那妳回覆...那下面，太下面有兩個按鈕 (註: TXT 誤聽為案子/JSON 同)。這個對，妳想要按什麼嗎？	<b>Me:</b> Okay. Then your reply... then below, too far below there are two buttons (Note: TXT/JSON misheard as “cases”). This right, do you want to press anything?
<b>Interviewee:</b> (按下按鈕) ...這樣的部份。	<b>Interviewee:</b> (Presses button) ...This kind of part.
<b>Interviewee:</b> 感覺...那種就是蝦皮裡面的...	<b>Interviewee:</b> Feels... that kind is like inside Shopee...
<b>Me:</b> 內容裏下面嗎？	<b>Me:</b> Content wrapped below?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 要就是你查看之後，我現在皮膚是會有什麼狀況 (註: JSON 誤聽為 招想死)...就是類似那種感覺。好。	<b>Interviewee:</b> It requires you to check, then what condition my skin will be in now (Note: JSON misheard as “attract wanting death”)... it’s like that kind of feeling. Okay.
<b>Me:</b> 那這個之外 (註: JSON 誤聽為這碗要)，還有什麼其他的問題妳想要問 (註: JSON 誤聽為 玩)？	<b>Me:</b> Besides this (Note: JSON misheard as “this bowl wants”), are there any other questions you want to ask (Note: JSON misheard as “play”)?
<b>Me:</b> (Participant triggers AI suggestion) 這是什麼？	<b>Me:</b> (Participant triggers AI suggestion) What is this?
<b>Interviewee:</b> (Reading AI suggestion) ...兩個謠言貓貓？跟這個剛剛在...不是，剛剛那個AI的部分。	<b>Interviewee:</b> (Reading AI suggestion) ...Two lies cat cat? And this one just now... no, the AI part from just now.
<b>Me:</b> (AI suggestion disappears) ...看。	<b>Me:</b> (AI suggestion disappears) ...Look.
<b>Interviewee:</b> 手機開門？	<b>Interviewee:</b> Phone open door?
<b>Me:</b> 好。妳覺得最重要？給妳一下...	<b>Me:</b> Okay. You think it’s most important? Give you a moment...
<b>Interviewee:</b> 那個。(註: 指拍照)	<b>Interviewee:</b> That one. (Note: Referring to taking a photo)
<b>Me:</b> 好。那妳可以幫幫我寫這個嗎？之前像一個都可以啊。三個都要 (註: JSON 誤聽為 多樣) 嗎？剛剛有、有、有介紹三個不一樣的產品。	<b>Me:</b> Okay. Can you help me write this? Like before, any one is fine. All three (Note: JSON misheard as “diverse”)? Just now, yes, yes, yes, introduced three different products.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Me:</b> 呱可以幫我拍照嗎？	<b>Me:</b> Can you help me take a photo?
<b>Interviewee:</b> (拍照) ...了。	<b>Interviewee:</b> (Takes photo) ...Done.
<b>Me:</b> 好。那最上面有一個代碼 (註: JSON 誤聽為 DADA)，綠色的那個，妳可以幫我講出來嗎？	<b>Me:</b> Okay. At the very top, there’s a code (Note: JSON misheard as DADA), the green one, can you say it out loud for me?
<b>Interviewee:</b> EA9DV。	<b>Interviewee:</b> EA9DV.
<b>Me:</b> 好。妳要用剛剛那個卡片嗎？還是我給妳新的？	<b>Me:</b> Okay. Do you want to use the card from just now? Or should I give you a new one?
<b>Interviewee:</b> 都可以啊。	<b>Interviewee:</b> Either is fine.
<b>Me:</b> 好。好。那這個桌子 (註: TXT 誤聽為 卡片) 上面妳幫我寫在上面，這個號碼。	<b>Me:</b> Okay. Okay. Then on this table (Note: TXT misheard as “card”), help me write this number on it.
<b>Interviewee:</b> (寫號碼)	<b>Interviewee:</b> (Writes number)

### 16.1.6 Transcript 2024-12-23 - Taichung (NCHU) - 3MP1P

**Source Files:** \* 2024-12-23 - Taichung (NCHU) - 3MP1P.json \* 2024-12-23 - Taichung (NCHU) - 3MP1P.txt

Traditional Chinese Transcript	English Translation
<p><b>Interviewer:</b> 所以，基本上這個軟體是我論文的一部分，都會幫你，呃，知道你買的東西多環保。然後，我可以錄你的聲音嗎？</p>	<p><b>Interviewer:</b> So, basically this software is part of my thesis, it will help you, uh, know how eco-friendly the things you buy are. And, can I record your audio?</p>
<p><b>Interviewee:</b> 可以啊可以啊。</p>	<p><b>Interviewee:</b> Yes, yes.</p>
<p><b>Interviewer:</b> 好。那你之前有用過 Momo 嗎？</p>	<p><b>Interviewer:</b> Okay. Have you used Momo before?</p>
<p><b>Interviewee:</b> 有。</p>	<p><b>Interviewee:</b> Yes.</p>
<p><b>Interviewer:</b> 那你在 Momo 上有買過什麼？</p>	<p><b>Interviewer:</b> What have you bought on Momo?</p>
<p><b>Interviewee:</b> 欸，有買過那個鞋子，還有那個擴香瓶。</p>	<p><b>Interviewee:</b> Hey, I've bought those shoes, and also that diffuser bottle.</p>
<p><b>Interviewer:</b> 好。那你現在有你想要，想要買什麼嗎？</p>	<p><b>Interviewer:</b> Okay. Is there anything you want, want to buy now?</p>
<p><b>Interviewee:</b> (Searches on Momo) 噢... 可能就買鞋子吧。</p>	<p><b>Interviewee:</b> (Searches on Momo) Um... Maybe just buy shoes.</p>
<p><b>Interviewer:</b> 好，就直接點進去我要商品這樣子嗎？</p>	<p><b>Interviewer:</b> Okay, so just click directly into the product I want like this?</p>
<p><b>Interviewee:</b> (Selects hiking boots)</p>	<p><b>Interviewee:</b> (Selects hiking boots)</p>
<p><b>Interviewer:</b> 這個是那個登山鞋啊。</p>	<p><b>Interviewer:</b> This is that hiking boot.</p>
<p><b>Interviewee:</b> 對。</p>	<p><b>Interviewee:</b> Yes.</p>
<p><b>Interviewer:</b> 所以就是，就是它爬山穿的那個鞋子，然後可以防水這樣子。</p>	<p><b>Interviewer:</b> So it's, it's the kind of shoe worn for hiking, and it's waterproof, like that.</p>
<p><b>Interviewer:</b> 那你之前有買過這個品牌嗎？</p>	<p><b>Interviewer:</b> Have you bought this brand before?</p>
<p><b>Interviewee:</b> 之前...我現在穿這個品牌的，這個鞋子這樣子啊。</p>	<p><b>Interviewee:</b> Before... I'm currently wearing this brand's, this shoe, like this.</p>
<p><b>Interviewer:</b> 對對對對。那剛剛整個網頁上想要什麼新的，最近沒有看過的嘛？</p>	<p><b>Interviewer:</b> Right, right, right, right. So on the whole webpage just now, was there anything new you wanted, that you hadn't seen recently?</p>
<p><b>Interviewee:</b> 你說這個網頁上嗎？ 啊...好像沒有欸。</p>	<p><b>Interviewee:</b> You mean on this webpage? Ah... seems like no.</p>
<p><b>Interviewer:</b> 啊，哪個方式這是剛剛新的嗎？ 對不對？ 啊，哦，這是你剛呢我們載的那個東西嗎？</p>	<p><b>Interviewer:</b> Ah, which way, is this the new one from just now? Right? Ah, oh, is this the thing we just loaded?</p>
<p><b>Interviewer:</b> 對。你覺得這是什麼？</p>	<p><b>Interviewer:</b> Yes. What do you think this is?</p>

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我覺得，呃，他這邊就是會去看一次，會抓我這個商品裡面的一些資訊，然後去查他的那個，這個品牌跟這個產品，它的來源這樣子。然後去看說這個東西它是不是一個環保的商品這樣。	<b>Interviewee:</b> I think, uh, it will look at it once here, it will grab some information from within this product, and then go check its, this brand and this product, its origin, like that. Then go see if this thing is an eco-friendly product.
<b>Interviewer:</b> 那個窗簾是什麼？	<b>Interviewer:</b> What is that overlay/curtain?
<b>Interviewee:</b> 我覺得這個的重點應該是下面這個嘛，就是公司整體的評分是多少啊，一直在高還是不太高。	<b>Interviewee:</b> I think the main point of this should be the part below, right? Which is the company's overall rating, ah, whether it's consistently high or not too high.
<b>Interviewer:</b> 對，它就是看它是高還不高。	<b>Interviewer:</b> Right, it just looks at whether it's high or not high.
<b>Interviewee:</b> 這樣看起來應該是不太高哦。	<b>Interviewee:</b> Looking at it this way, it seems not too high.
<b>Interviewer:</b> 那最下面還有兩個按鈕，想要按嗎？	<b>Interviewer:</b> Then there are two buttons at the very bottom, want to press them?
<b>Interviewee:</b> 還好耶。就是他這邊是看有沒有替代的產品。	<b>Interviewee:</b> It's okay. It's just that here it looks to see if there are alternative products.
<b>Interviewer:</b> 好啊。那上面還有兩個部分(綠色 & 紫色 tabs)。	<b>Interviewer:</b> Okay. Then there are two sections above (green & purple tabs).
<b>Interviewee:</b> (Clicks green tab)	<b>Interviewee:</b> (Clicks green tab)
<b>Interviewer:</b> 那這個是什麼？	<b>Interviewer:</b> What is this one?
<b>Interviewee:</b> 哦，他這邊是在跟我講說哪些牌子它的碳排可能會比較少一點，會比較環保吧。	<b>Interviewee:</b> Oh, here it's telling me which brands might have slightly lower carbon emissions, would be more eco-friendly.
<b>Interviewer:</b> 啊。那這些其他的品牌你有買過嗎？	<b>Interviewer:</b> Ah. Have you bought these other brands?
<b>Interviewee:</b> 沒有啊，這些都沒有看過的品牌。	<b>Interviewee:</b> No, these are all brands I haven't seen before.
<b>Interviewer:</b> 對對。但一切的這個系列會影響你的，你的想法嗎？	<b>Interviewer:</b> Right, right. But does this whole series affect your, your thoughts?
<b>Interviewee:</b> 嗯，還好。因為像鞋子的話，我就主要還是以穿起來要舒服為主啊。	<b>Interviewee:</b> Um, it's okay. Because for shoes, my main focus is still primarily on comfort when wearing them.
<b>Interviewer:</b> 所以除非這些品牌可能有一些那個...	<b>Interviewer:</b> So unless these brands might have some of that...
<b>Interviewee:</b> 有這個，如果他們解釋上有尊一些可能對於這個鞋子好好穿，有沒有我想要的功能的話，那我覺得會比較想要去買這些東西。	<b>Interviewee:</b> Have this, if their explanation includes some possibilities regarding these shoes being comfortable to wear, whether they have the functions I want, then I think I'd be more inclined to buy these things.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 啊。那這一個部分？ (Clicks purple tab)	<b>Interviewer:</b> Ah. What about this section? (Clicks purple tab)
<b>Interviewee:</b> 這是什麼？ 哦，他這邊是說有沒有可以追蹤我買過這個公司的產品這樣子啊。	<b>Interviewee:</b> What is this? Oh, here it's asking if there's a way to track products I've bought from this company, like that.
<b>Interviewer:</b> 啊，那就是按這邊，按一個...	<b>Interviewer:</b> Ah, then just press here, press one...
<b>Interviewee:</b> 好。那我看一下那個產品的產地狀況好了。	<b>Interviewee:</b> Okay. Then I'll take a look at the product's origin situation.
<b>Interviewer:</b> 好。	<b>Interviewer:</b> Okay.
<b>Interviewer:</b> 那這裡還有什麼其他的...	<b>Interviewer:</b> Is there anything else here...
<b>Interviewee:</b> 想要知道嗎？ 我覺得會按這個啊：要怎麼減少亂買。(Clicks '跟 AI 聊聊')	<b>Interviewee:</b> Want to know? I think I'll press this one: How to reduce impulse buying. (Clicks 'Chat with AI')
<b>Interviewer:</b> 他在找...哦。	<b>Interviewer:</b> It's searching... oh.
<b>Interviewee:</b> 那就是在講說要先去設定一個預算嗎，然後要去列一下清單，先確認說自己是不是真的有需要這些東西。其實買之前要去思考一下，然後要可以考慮買二手東西。	<b>Interviewee:</b> So it's saying you should first set a budget, then make a list, first confirm if you really need these things. Actually, before buying, you should think about it, and you can consider buying second-hand things.
<b>Interviewer:</b> 啊，之前沒有想到的可能就是二手購物吧？	<b>Interviewer:</b> Ah, something you didn't think of before might be second-hand shopping?
<b>Interviewee:</b> 啊，對啊。	<b>Interviewee:</b> Ah, right.
<b>Interviewer:</b> 好。那你也可以直接問他，有，有什麼問題想嗎？ 還是沒有？	<b>Interviewer:</b> Okay. You can also ask it directly, are there, are there any questions you want to ask? Or no?
<b>Interviewee:</b> 我想一下哦... (Types question: 有沒有公司有環保跟舒適的產品嗎)	<b>Interviewee:</b> Let me think... (Types question: Are there companies with eco-friendly and comfortable products?)
<b>Interviewer:</b> OK OK。	<b>Interviewer:</b> OK OK.
<b>Interviewee:</b> 哦，有覺得它這邊有丟下不錯建議，因為我就是買鞋子會比較注重是穿起來舒服，那我剛是問說沒有公司有環保跟舒服的產品啊，那時候給我幾個牌子，非常非常好。看看。然後，可能，比呀，可以考慮看看。	<b>Interviewee:</b> Oh, I feel it gave some good suggestions here, because when buying shoes I pay more attention to comfort when wearing them, and I just asked if there are companies with eco-friendly and comfortable products, and it gave me several brands, very very good. Take a look. Then, maybe, compare, I can consider them.
<b>Interviewer:</b> 好啊。	<b>Interviewer:</b> Okay.
<b>Interviewer:</b> 哟。	<b>Interviewer:</b> Oh.
<b>Interviewer:</b> 哟，因為還不錯欸。我的回... 嗯，對答還蠻算蠻流暢的啊。	<b>Interviewer:</b> Oh, because it's quite good. My resp... um, the response is quite, quite fluent.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 對啊。	<b>Interviewee:</b> Yeah.
<b>Interviewer:</b> 好。那這樣差不多可以了。可以不會幫我拍照你覺得最有趣的地方，所以有，有用的地方？	<b>Interviewer:</b> Okay. Then that's about it. Can you help me take a photo of what you think is the most interesting part, so the useful part?
<b>Interviewee:</b> 哦，我覺得就是這個 AI 的，真的，聊天機器人。(Takes photo)	<b>Interviewee:</b> Oh, I think it's this AI, really, the chatbot. (Takes photo)
<b>Interviewer:</b> 好。那個時期啊。那你可以幫我之前回 Momo 那邊，來這裡，這個，好嗎？你可以幫我講出來嗎？	<b>Interviewer:</b> Okay. That stage. Can you help me go back to the Momo page from before, come here, this one, okay? Can you say it for me?
<b>Interviewee:</b> 你說這個 ESG 報告編號：3MP1P。	<b>Interviewee:</b> You mean this ESG report number: 3MP1P.
<b>Interviewer:</b> 好啊。	<b>Interviewer:</b> Okay.
<b>Interviewer:</b> OK。好。那這樣就可以了。等下應該會這邊，那，啊，不是不是。剛剛那個，對。那最下面有一個問卷可以寫這個號碼，剛剛那個號碼。對。然後幫我剪，對。這樣都是另一個。好，謝謝。	<b>Interviewer:</b> OK. Okay. Then that's fine. Later it should be here, then, ah, no no. That one just now, right. Then at the very bottom there's a questionnaire where you can write this number, the number from just now. Right. Then help me cut, right. That's all another one. Okay, thank you.

### 16.1.7 Transcript 2024-12-23 - Taichung (NCHU) - 50R6E

**Source Files:** \* 2024-12-23 - Taichung (NCHU) - 50R6E.json \* 2024-12-23 - Taichung (NCHU) - 50R6E.txt

**Ziran ID Code:** 50R6E

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 所以，呃，基本上這個是我的論文的軟體，那大概幫你，呃，知道你買的產品是多環保。那，呃，這樣的話，我可以錄影你的聲音嗎？	<b>Interviewer:</b> So, uh, basically this is the software for my thesis, it roughly helps you, uh, know how eco-friendly the products you buy are. Then, uh, in that case, can I record your audio?
<b>Interviewee:</b> 嗯嗯。	<b>Interviewee:</b> Mhm.
<b>Interviewer:</b> 可以嗎？	<b>Interviewer:</b> Is that okay?
<b>Interviewee:</b> 哟，我說可以可以。	<b>Interviewee:</b> Oh, I said yes, yes.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好，謝謝。呵呵。好，那你剛剛開 Momo 嗎？之前有用過 Momo 嗎？	<b>Interviewer:</b> Okay, thank you. Hehe. Okay, did you just open Momo? Have you used Momo before?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你用 Momo 基本上你買什麼樣的東西？	<b>Interviewer:</b> What kind of things do you basically buy using Momo?
<b>Interviewee:</b> 家電啊、保養品都有，食物也有買過。	<b>Interviewee:</b> Home appliances, skincare products, I have bought food too.
<b>Interviewer:</b> 那你有什麼特別喜歡的品牌嗎？	<b>Interviewer:</b> Do you have any particularly favorite brands?
<b>Interviewee:</b> 好像沒有。要看什麼產品，不一定。	<b>Interviewee:</b> Seems like no. Depends on the product, not necessarily.
<b>Interviewer:</b> 那 Momo 上，你可以幫我找一個產品，你想要買的嗎？	<b>Interviewer:</b> Then on Momo, can you help me find a product you want to buy?
<b>Interviewee:</b> (Searches) 網路有點慢...我就隨便找一個...我通常都會去看什麼特價的地方...從特價的地方看。哦，看得懂，感覺不錯耶，杯子。	<b>Interviewee:</b> (Searches) The internet is a bit slow... I'll just randomly find one... I usually go look at the special offer sections... look from the special offer section. Oh, I understand this, looks pretty good, cups.
<b>Interviewer:</b> 好。那你剛剛有找到什麼？	<b>Interviewer:</b> Okay. What did you find just now?
<b>Interviewee:</b> Kitty 牛奶。	<b>Interviewee:</b> Kitty milk.
<b>Interviewer:</b> 嗯。那剛剛有什麼新的東西嗎？	<b>Interviewer:</b> Um. Was there anything new just now?
<b>Interviewee:</b> 這個框框。	<b>Interviewee:</b> This frame/box.
<b>Interviewer:</b> 嗯嗯。那這是什麼？這是...	<b>Interviewer:</b> Mhm. What is this? This is...
<b>Interviewee:</b> 就是肉。	<b>Interviewee:</b> It's meat.
<b>Interviewer:</b> 那剛剛那個 AI 幫手有跟你講什麼？	<b>Interviewer:</b> What did the AI assistant tell you just now?
<b>Interviewee:</b> AI 幫手，這個...買東西...他說買東西也是一種投資，我可以幫你分析花的錢是好的還是不好的...公司，然後他有介紹這間公司，然後講到 ESG 的評比分數。	<b>Interviewee:</b> AI assistant, this... buying things... it says buying things is also a type of investment, I can help you analyze if the money spent is good or bad... company, then it introduced this company, and mentioned the ESG rating score.
<b>Interviewer:</b> 那你覺得這個內容有什麼有意思嗎？還是你覺得可以使用嗎？	<b>Interviewer:</b> Do you think there's anything interesting in this content? Or do you think it's usable?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 應該說平常買東西不會特別看ESG評比分數。可是就是覺得字有點...這一段，第一個框框，就是這一段字有點多，就一下子會比較難抓到重點嘛，對我來說。	<b>Interviewee:</b> I should say, normally when buying things I don't specifically look at ESG rating scores. But I just feel the words are a bit... this section, the first frame, this section has a few too many words, it makes it a bit hard to grasp the main point quickly, for me.
<b>Interviewer:</b> 那你之前有買過這個產品嗎？還是這個品牌嗎？	<b>Interviewer:</b> Have you bought this product before? Or this brand?
<b>Interviewee:</b> 我有去這個品牌吃過飯，但我沒有買過他們的產品，可是我有去那邊吃過飯。	<b>Interviewee:</b> I have eaten at this brand's place, but I haven't bought their products, but I have eaten there.
<b>Interviewer:</b> 好。那跟AI幫手，呃，它要說什麼呢？它還要講我做這個AI幫手。它還要講這個品牌的名稱、材料、可持續性、製造工程、集團。	<b>Interviewer:</b> Okay. What about the AI assistant, uh, what does it want to say? It also wants to talk about me making this AI assistant. It also wants to talk about this brand's name, materials, sustainability, manufacturing process, group.
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那有什麼你之前不知道的嗎？	<b>Interviewer:</b> Is there anything you didn't know before?
<b>Interviewee:</b> 應該說，我有點好奇這個可持續性評比還有勞工評比是怎麼來的。嗯哼。對。然後這個我知道，因為我知道他們還沒有上市櫃。他們還沒有上市櫃？我怎麼記得他們有上過？嗯，我記得他們好像有股票代號，還是我記錯了？好好。喔，我蠻好奇他分數怎麼評的。	<b>Interviewee:</b> I should say, I'm a bit curious about how this sustainability rating and labor rating came about. Uh-huh. Right. And this I know, because I know they haven't gone public yet. They haven't gone public? How come I remember they have? Um, I remember they seem to have a stock code, or am I remembering wrong? Okay okay. Oh, I'm quite curious how they rate the score.
<b>Interviewer:</b> 好。那上面還有會按鈕，你想按的嗎？（環保省錢, etc.）	<b>Interviewer:</b> Okay. There are also buttons above, do you want to press any? (Eco-friendly & Save Money, etc.)
<b>Interviewee:</b> (Clicks '環保省錢') 王品集團。我想要環保省錢。嗯。從哪可以增加我的儲蓄？嗯。它是按這個會有反應嗎？嗯，有有有。還是要等一下？	<b>Interviewee:</b> (Clicks '環保省錢') Wang Steak Group. I want to be eco-friendly and save money. Um. From where can I increase my savings? Um. Does clicking this trigger a response? Um, yes yes yes. Or do I need to wait?
<b>Interviewer:</b> 你要計時一下。	<b>Interviewer:</b> You need to time it a bit.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 哦。未來，特別是妳想要考研究所？為什麼他會說特別是我想考研究所？哦，有點好奇。自訂預算，OK。減少目標？凱子？好的。我以為他會跟這個產品有關。所以跟這個牌子沒有什麼關係。哦。	<b>Interviewee:</b> Oh. Future, especially if you want to apply for graduate school? Why would it say especially if I want to apply for graduate school? Oh, a bit curious. Custom budget, OK. Reduce target? Spendthrift? Okay. I thought it would be related to this product. So it has nothing to do with this brand. Oh.
<b>Interviewer:</b> 那有什麼其他的事情想問他嗎？	<b>Interviewer:</b> Is there anything else you want to ask it?
<b>Interviewee:</b> (Doesn't ask)	<b>Interviewee:</b> (Doesn't ask)
<b>Interviewer:</b> 不然看一下環保總碳排。應該可以省錢一下。還是？	<b>Interviewer:</b> Otherwise, take a look at the total carbon footprint. Should be able to save some money. Or?
<b>Interviewee:</b> (Clicks ‘替代品’)	<b>Interviewee:</b> (Clicks ‘替代品’)
<b>Interviewer:</b> 當然可以。那剛剛你覺得他給你回覆有什麼有趣的嗎？什麼有意思嗎？	<b>Interviewer:</b> Of course. Did you find anything interesting in its response just now? Anything meaningful?
<b>Interviewee:</b> 有意思的嗎？好像，我覺得好像還好。但是我知道一些新的品牌。可是我不太想要植物性的肉類比，類比。	<b>Interviewee:</b> Meaningful? Seems, I think it seems okay. But I learned about some new brands. However, I don't really want plant-based meat analogues, analogues.
<b>Interviewer:</b> 好，你就知道一些新品。	<b>Interviewer:</b> Okay, so you know some new products.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Right.
<b>Interviewer:</b> 那可以幫我回到 Momo 那邊？	<b>Interviewer:</b> Can you help me go back to the Momo page?
<b>Interviewee:</b> (Goes back)	<b>Interviewee:</b> (Goes back)
<b>Interviewer:</b> 上面，最上面還有這些部分。(綠色 & 紫色 tab)	<b>Interviewer:</b> Above, at the very top, there are still these sections. (Green & purple tabs)
<b>Interviewee:</b> (Clicks green tab)	<b>Interviewee:</b> (Clicks green tab)
<b>Interviewer:</b> 你覺得這個什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 就是那個應該講在講碳足跡還是什麼的嗎？可是我不知道他的，就是這個條件是跟什麼東西去做相比。就我蠻問號的。對。	<b>Interviewee:</b> It's that... it should be talking about carbon footprint or something? But I don't know its... like, what this condition is being compared to. I'm quite puzzled. Right.
<b>Interviewer:</b> 好。那最後一個部分。(Clicks purple tab) 投資。哦。	<b>Interviewer:</b> Okay. Then the last section. (Clicks purple tab) Investment. Oh.
<b>Interviewee:</b> 這是什麼？就是講這間公司有它的股票代號。	<b>Interviewee:</b> What is this? It just says this company has its stock code.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。OK。那差不多這樣子。可以幫我拍照你覺得最重要？就是剛剛這個內容的重點是什麼？可以幫我拍那個...等一下。你你你幫我填那個，呃，問卷那邊會需要照片。	<b>Interviewer:</b> Okay. OK. Then that's about it. Can you help me take a photo of what you think is most important? Like, what was the main point of the content just now? Can you help me take a picture of that... Wait a minute. You you help me fill out that, uh, the questionnaire part will need the photo.
<b>Interviewee:</b> 哦，那我就拍，選一個拍就好嗎？	<b>Interviewee:</b> Oh, then I'll just take a picture, just pick one to take?
<b>Interviewer:</b> 對。	<b>Interviewer:</b> Right.
<b>Interviewee:</b> 那我拍這個。	<b>Interviewee:</b> Then I'll take this one.
<b>Interviewer:</b> 好。那上面還有一個號碼，還有一個，不是，剛剛，剛剛那個 Momo，Momo 那邊。Momo。對對對。最上面。那你可這樣出來，這個號碼嗎？	<b>Interviewer:</b> Okay. There's a number at the top, also one, no, just now, that Momo one, over at Momo. Momo. Right right right. At the very top. Can you get it out like this, this number?
<b>Interviewee:</b> 50R6E。	<b>Interviewee:</b> 50R6E.
<b>Interviewer:</b> 好。OK。好。那這樣就可以了。等下應該會，這邊。那，啊，不是不是。剛剛那個，對。那最下面有一個問卷可以寫這個號碼，剛剛那個號碼。對。然後幫我剪，對。這樣都是另一個。好，謝謝。	<b>Interviewer:</b> Okay. OK. Okay. Then that's fine. Later it should, here. Then, ah, no no. That one just now, right. Then at the very bottom there's a questionnaire where you can write this number, the number from just now. Right. Then help me cut, right. That's all another one. Okay, thank you.

### 16.1.8 Transcript 2024-12-23 - Taichung (NCHU) - 67LVE

**Source Files:** \* 2024-12-23 - Taichung (NCHU) - 67LVE.json \* 2024-12-23 - Taichung (NCHU) - 67LVE.txt

**Ziran ID Code:** 67LVE

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 所以基本上這個是我的論文的一部分，一個環保的軟體。等一下你可以幫我測試這個，還有，我可以錄你的聲音嗎？	<b>Interviewer:</b> So basically this is part of my thesis, an eco-friendly software. In a moment you can help me test this, and also, can I record your audio?
<b>Interviewee:</b> 呃，可以。	<b>Interviewee:</b> Uh, yes you can.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那你之前有用過 Momo 嗎？	<b>Interviewer:</b> Okay. Have you used Momo before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那你適用什麼網頁買東西？	<b>Interviewer:</b> Okay. What website do you use to buy things?
<b>Interviewee:</b> 啊，你有用過 Shopee 還是類似的？	<b>Interviewee:</b> Ah, have you used Shopee or similar ones?
<b>Interviewer:</b> 蝦皮。	<b>Interviewer:</b> Shopee.
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 好。那，你平常在網路上會買什麼樣的東西？	<b>Interviewer:</b> Okay. So, what kind of things do you usually buy online?
<b>Interviewee:</b> 平常上網沒有固定會買什麼東西，就是可能看生活有缺什麼，就是自己會去買。	<b>Interviewee:</b> Usually when I go online, I don't have a fixed thing I buy, it's more like seeing what's lacking in daily life, then I'll buy it myself.
<b>Interviewer:</b> 那你覺得 Momo... 有你需要的什麼商品嗎？什麼品牌什麼都可以，幫我找。	<b>Interviewer:</b> Then do you think Momo... has any products you need? Any brand, anything is fine, help me search.
<b>Interviewee:</b> (Searches/Navigates)	<b>Interviewee:</b> (Searches/Navigates)
<b>Interviewer:</b> 啊，你可以講一下你剛剛在查什麼？	<b>Interviewer:</b> Ah, can you tell me what you were just searching for?
<b>Interviewee:</b> 我在找彈力帶，運動用的。	<b>Interviewee:</b> I was looking for resistance bands, for exercise.
<b>Interviewer:</b> 那有找到什麼想要買的嗎？	<b>Interviewer:</b> Did you find anything you want to buy?
<b>Interviewee:</b> 不曉得。是想要買這個。	<b>Interviewee:</b> I don't know. I want to buy this one.
<b>Interviewer:</b> 那這是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 那個是健身拉力繩。	<b>Interviewee:</b> That's a fitness resistance rope.
<b>Interviewer:</b> 好。那你之前有買過這個商品嗎？還是這個品牌？	<b>Interviewer:</b> Okay. Have you bought this product before? Or this brand?
<b>Interviewee:</b> 呃，沒有。	<b>Interviewee:</b> Uh, no.
<b>Interviewer:</b> 沒有買過。好。那剛剛旁邊有一個新的東西，你知道這個是什麼嗎？	<b>Interviewer:</b> Haven't bought it. Okay. There was a new thing on the side just now, do you know what this is?
<b>Interviewee:</b> 呃，什麼？	<b>Interviewee:</b> Uh, what?
<b>Interviewer:</b> 好。來。呃，有看到什麼新的嗎？有看到什麼，呃，之前沒有看過的嗎？	<b>Interviewer:</b> Okay. Come on. Uh, did you see anything new? Did you see anything, uh, that you hadn't seen before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 沒有？ 好。那最上面剛剛這個黃色的是什麼？ 黃色的？	<b>Interviewee:</b> No? Okay. What about the yellow one at the top just now? The yellow one?
<b>Interviewee:</b> 這個。嗯。	<b>Interviewee:</b> This one. Um.
<b>Interviewer:</b> 呃，這是...	<b>Interviewer:</b> Uh, this is...
<b>Interviewer:</b> 好。那你是不是覺得它是這個頁面的一部分還是什麼其他的東西？ 它是什麼？	<b>Interviewer:</b> Okay. Do you think it's part of this page or something else? What is it?
<b>Interviewee:</b> 呃，就是網頁的一部分。	<b>Interviewee:</b> Uh, it's part of the webpage.
<b>Interviewer:</b> 好，OK。呃，其實不是。剛剛這個就是我自己的那個App，你剛剛有下載了這個。它剛剛跟你講什麼？ 它的內容是什麼？	<b>Interviewer:</b> Okay, OK. Uh, actually, no. That was my own App just now, you downloaded it. What did it tell you just now? What was its content?
<b>Interviewee:</b> (Reads/Describes)	<b>Interviewee:</b> (Reads/Describes)
<b>Interviewer:</b> 好。你覺得剛剛它跟你講是什麼意思？	<b>Interviewer:</b> Okay. What do you think it meant by what it told you just now?
<b>Interviewee:</b> 那個...幫你分析說買這個商品是不是對你來說是好的。	<b>Interviewee:</b> That... helps you analyze whether buying this product is good for you.
<b>Interviewer:</b> 對。就是花這個錢對你來說值不值得。那你覺得它的重點是什麼？ 它的重點？	<b>Interviewer:</b> Right. Like, whether spending this money is worth it for you. What do you think is its key point? Its key point?
<b>Interviewee:</b> 噢...重點...他說他覺得，他覺得這個商品是缺乏環保認證的。	<b>Interviewee:</b> Um... key point... It said it thinks, it thinks this product lacks environmental certification.
<b>Interviewer:</b> 好。對。這是建議購買其他類型的。嗯。最下面還有兩個按鈕呢，你想要按嗎？ (尋找替代品& 跟 AI 聊聊)	<b>Interviewer:</b> Okay. Right. This suggests buying other types. Um. There are two more buttons at the very bottom, do you want to press them? (Find Alternatives & Chat with AI)
<b>Interviewee:</b> (Clicks '尋找替代品')	<b>Interviewee:</b> (Clicks 'Find Alternatives')
<b>Interviewer:</b> 那剛剛它有跟你講什麼？	<b>Interviewer:</b> What did it tell you just now?
<b>Interviewee:</b> (Reads/Describes)	<b>Interviewee:</b> (Reads/Describes)
<b>Interviewer:</b> 對你來說這個，這個有什麼意義嗎？	<b>Interviewer:</b> Does this, does this have any meaning for you?
<b>Interviewee:</b> 我可能會想選購之類的啊。	<b>Interviewee:</b> I might consider purchasing [one of these] or something.
<b>Interviewer:</b> 那你還有什麼問題想要問它嗎？ (指'跟 AI 聊聊'按鈕)	<b>Interviewer:</b> Do you have any other questions you want to ask it? (Points to 'Chat with AI' button)
<b>Interviewee:</b> (Doesn't click/ask)	<b>Interviewee:</b> (Doesn't click/ask)
<b>Interviewer:</b> 好。那這裡還有兩個部分。(綠色 & 紫色 tab)	<b>Interviewer:</b> Okay. There are two more sections here. (Green & purple tabs)
<b>Interviewee:</b> (Clicks green tab)	<b>Interviewee:</b> (Clicks green tab)

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 最下面，不是這裡，這裡，你覺得是什麼？	<b>Interviewer:</b> At the very bottom, not here, here, what do you think this is?
<b>Interviewee:</b> 哦，分析說買哪一類的可以減少碳排放。	<b>Interviewee:</b> Oh, analyzing which type to buy can reduce carbon emissions.
<b>Interviewer:</b> 好。那最後一個。	<b>Interviewer:</b> Okay. Then the last one.
<b>Interviewee:</b> (Clicks purple tab)	<b>Interviewee:</b> (Clicks purple tab)
<b>Interviewer:</b> 那一個找不到。好。那這樣大概可以了。那可以幫我拍照，你覺得最重點是什麼？就是拍照拍照。呃，剛剛，來，我跟你講這個部分。第一個，可以幫我拍照嗎？還是那個 screenshot 也可以。	<b>Interviewer:</b> That one can't be found. Okay. Then that's roughly enough. Can you help me take a photo, what do you think is the most important point? Just take a photo, take a photo. Uh, just now, come, I'll tell you this part. First, can you help me take a photo? Or a screenshot is also okay.
<b>Interviewee:</b> (Takes photo/screenshot)	<b>Interviewee:</b> (Takes photo/screenshot)
<b>Interviewer:</b> 剛剛它的上面有一個號碼，你可以幫我講出來？	<b>Interviewer:</b> There was a number on top of it just now, can you say it for me?
<b>Interviewee:</b> 67LVE。	<b>Interviewee:</b> 67LVE.
<b>Interviewer:</b> 好。那你可以幫我寫在這個卡片上...	<b>Interviewer:</b> Okay. Can you help me write it on this card...

### 16.1.9 Transcript 2024-12-25 - Taichung (NCHU) - 2ITG0

**Source Files:** \* 2024-12-25 - Taichung (NCHU) - 2ITG0.json \* 2024-12-25 - Taichung (NCHU) - 2ITG0.txt

**Ziran ID Code:** 2ITG0

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 基本上這個是我的論文的一部分，一個環保的 App。你同意我錄影你的聲音嗎？	<b>Interviewer:</b> Basically, this is part of my thesis, an eco-friendly App. Do you agree to let me record your audio?
<b>Interviewee:</b> 同意。	<b>Interviewee:</b> Agreed.
<b>Interviewer:</b> 好。那，呃，你之前有用過 Momo 嗎？	<b>Interviewer:</b> Okay. Then, uh, have you used Momo before?
<b>Interviewee:</b> 呃，之前 Momo 比較沒有，比較常用蝦皮。	<b>Interviewee:</b> Uh, previously not much Momo, I use Shopee more often.
<b>Interviewer:</b> 好。那你蝦皮上有買過什麼類型的東西？	<b>Interviewer:</b> Okay. What types of things have you bought on Shopee?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃，有買食物，比如說，呃，麥片。	<b>Interviewee:</b> Uh, I've bought food, for example, uh, cereal.
<b>Interviewer:</b> 好。那現在你想要買什麼嗎？	<b>Interviewer:</b> Okay. Is there anything you want to buy now?
<b>Interviewee:</b> 我現在想要買藍牙耳機。	<b>Interviewee:</b> I want to buy Bluetooth headphones now.
<b>Interviewer:</b> 好。那你幫我找一下。	<b>Interviewer:</b> Okay. Can you help me search for it?
<b>Interviewee:</b> (Searches>Selects product)	<b>Interviewee:</b> (Searches>Selects product)
<b>Interviewer:</b> 好，我選的是這個。你最近有買過這個品牌嗎？Sony的？	<b>Interviewer:</b> Okay, I chose this one. Have you bought this brand recently? Sony?
<b>Interviewee:</b> 我沒買過，但是我知道它好像還蠻有名的。	<b>Interviewee:</b> I haven't bought it, but I know it seems quite famous.
<b>Interviewer:</b> 那耳機不是很多嗎？為什麼選這個呢？	<b>Interviewer:</b> Aren't there many headphones? Why choose this one?
<b>Interviewee:</b> 因為它可以有降噪的功能，我主要是看到它降噪。	<b>Interviewee:</b> Because it has a noise-canceling function, I mainly saw its noise canceling.
<b>Interviewer:</b> 然後我是點了...然後我是看這個。好。那，它（App）有跟你講什麼？	<b>Interviewer:</b> Then I clicked... then I looked at this. Okay. So, what did it (the App) tell you?
<b>Interviewee:</b> 它有跟我說，欸，它有跟我說Sony的那個公司，然後跟我說一些Sony的資料。	<b>Interviewee:</b> It told me, hey, it told me about the Sony company, and told me some information about Sony.
<b>Interviewer:</b> 對，就是公司的資料。那對你來說，哪一個部分比較重要的？	<b>Interviewer:</b> Right, company information. So for you, which part is more important?
<b>Interviewee:</b> 欸，應該是生產國家，對，或者は它的材料，就看有沒有一些，呃，有毒的嘛，或者是對身體不好的一些材料。	<b>Interviewee:</b> Hey, it should be the country of production, yes, or its materials, just to see if there are any, uh, toxic ones, or some materials that are bad for the body.
<b>Interviewer:</b> 對。好。那最下面有兩個按鈕，就是，你有，你想要按嗎？還是不想要也可以？	<b>Interviewer:</b> Right. Okay. Then there are two buttons at the very bottom, so, do you, do you want to press one? Or it's okay if you don't want to?
<b>Interviewee:</b> 應該是要替代的那個。 (Clicks '尋找替代品')	<b>Interviewee:</b> It should be the alternative one. (Clicks 'Find Alternatives')
<b>Interviewer:</b> 這裡大概有跟你講什麼？	<b>Interviewer:</b> What does it roughly tell you here?
<b>Interviewee:</b> 它跟我講了，呃，Sony、蘋果、三星跟Bose，這是各種評比。嗯，這個應該是比較有用的。	<b>Interviewee:</b> It told me, uh, Sony, Apple, Samsung, and Bose, these are various comparisons. Um, this should be more useful.
<b>Interviewer:</b> 噢，實用的。那你有什麼問題想要自己問他嗎？(指'跟AI聊聊'按鈕)	<b>Interviewer:</b> Um, practical. Do you have any questions you want to ask it yourself? (Points to 'Chat with AI' button)

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 欸，我可以...這個，我看一下...啊，應該是說這個吧：我買的產品對我有沒有有害的物質？(Clicks ‘跟 AI 聊聊’ & Types question)	<b>Interviewee:</b> Hey, can I... this one, let me see... Ah, it should be this one: Does the product I'm buying contain any harmful substances for me? (Clicks ‘Chat with AI’ & Types question)
<b>Interviewer:</b> 好好好。我現在去上網...就直接點嗎？	<b>Interviewer:</b> Okay okay okay. I'll go online now... just click directly?
<b>Interviewer:</b> 嗯。哦，好。OK，這個部分還沒有做好，因為這個是一個 Draft。	<b>Interviewer:</b> Um. Oh, okay. OK, this part isn't finished yet, because this is a Draft.
<b>Interviewee:</b> 哦，OK。	<b>Interviewee:</b> Oh, OK.
<b>Interviewer:</b> 好。那有其他的問題想問嗎？	<b>Interviewer:</b> Okay. Are there any other questions you want to ask?
<b>Interviewee:</b> 呃，沒有。	<b>Interviewee:</b> Uh, no.
<b>Interviewer:</b> 好。那你幫我回那個 Momo 那邊。好。最上面有，還有，還有一個，還有兩個部分（綠色& 紫色 tab），幫我看一下。	<b>Interviewer:</b> Okay. Can you go back to the Momo page for me? Okay. At the very top, there is, also, also one, also two sections (green & purple tabs), help me take a look.
<b>Interviewee:</b> (Clicks green tab)	<b>Interviewee:</b> (Clicks green tab)
<b>Interviewer:</b> 好。那你覺得這個是什麼？	<b>Interviewer:</b> Okay. What do you think this is?
<b>Interviewee:</b> 呃，它應該是在講，買這個東西能幫助你儲存更多錢跟環保吧。可能可以拯救地球，然後看能不能永續，永續性。	<b>Interviewee:</b> Uh, it should be saying that buying this thing can help you save more money and be environmentally friendly. Maybe it can save the earth, and see if it can be sustainable, sustainability.
<b>Interviewer:</b> 那這些其他的牌子，你有，你知道這些品牌嗎？有聽說嗎？	<b>Interviewer:</b> What about these other brands, do you, do you know these brands? Have you heard of them?
<b>Interviewee:</b> 這其他的好像不知道。其他品牌沒有聽過。	<b>Interviewee:</b> These other ones, I don't seem to know. Haven't heard of the other brands.
<b>Interviewer:</b> OK。那你覺得會影響你的決定嗎？就是，還是已經決定好了你要買什麼？	<b>Interviewer:</b> OK. Do you think it will affect your decision? Like, or have you already decided what you want to buy?
<b>Interviewee:</b> 可能不會，應該已經決定了。	<b>Interviewee:</b> Probably not, I should have already decided.
<b>Interviewer:</b> 好。好。你第三個部分呢？(Clicks purple tab)	<b>Interviewer:</b> Okay. Okay. What about the third section? (Clicks purple tab)
<b>Interviewee:</b> 這是什麼？投資的部分。就可以看，呃，看它的那個股價，嗯，然後還有就是看它在各國的一些股票價格。	<b>Interviewee:</b> What is this? The investment part. You can see, uh, see its stock price, um, and also see its stock prices in various countries.
<b>Interviewer:</b> 噢。那你之前有買過股票嗎？	<b>Interviewer:</b> Um. Have you bought stocks before?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃，好像沒有。	<b>Interviewee:</b> Uh, seems like no.
<b>Interviewer:</b> 好。對。那最下面這個內容是什麼？	<b>Interviewer:</b> Okay. Right. What is the content at the very bottom?
<b>Interviewee:</b> 就是它會分析說 Sony 在這世界上的股價，大概的發展是什麼，未來的發展。	<b>Interviewee:</b> It analyzes Sony's stock price in the world, what the general trend is, the future trend.
<b>Interviewer:</b> 嗯嗯。好啊。嗯，好。那這樣一個這樣就可以了。OK。那就是最上面還有一個代碼。嗯，剛剛那個代碼可能...好，你幫我講出來。	<b>Interviewer:</b> Mhm. Okay. Um, okay. Then this is enough like this. OK. So there's a code at the very top. Um, that code just now maybe... okay, can you say it for me?
<b>Interviewee:</b> 好。2ITG0。	<b>Interviewee:</b> Okay. 2ITG0.
<b>Interviewer:</b> OK。好。那你幫我拍照，你覺得最重要的部分是什麼？	<b>Interviewer:</b> OK. Okay. Can you take a photo for me, what do you think is the most important part?
<b>Interviewee:</b> 最重要的部分，我覺得是這個資料的部分。(Takes photo)	<b>Interviewee:</b> The most important part, I think it's this data section. (Takes photo)
<b>Interviewer:</b> OK。好。那麻煩你再次填這個問卷嗎？因為就要，就是那個照片，這樣子。	<b>Interviewer:</b> OK. Okay. Could I trouble you to fill out this questionnaire again? Because I need, just that photo, like that.
<b>Interviewee:</b> OK OK。謝謝。	<b>Interviewee:</b> OK OK. Thank you.

### 16.1.10 Transcript 2024-12-25 - Taichung (NCHU) - 3G1RL

**Source Files:** \* 2024-12-25 - Taichung (NCHU) - 3G1RL.json \* 2024-12-25 - Taichung (NCHU) - 3G1RL.txt

**Ziran ID Code:** 3G1RL

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 基本上，呃，它是我的論文的一部分，它是一個，呃，環保的 App。嗯，那我要先問你，你同意我錄音這個聲音嗎？	<b>Interviewer:</b> Basically, uh, this is part of my thesis, it's an, uh, eco-friendly App. Um, first I want to ask, do you agree to let me record this audio?
<b>Interviewee:</b> 呃，同意。	<b>Interviewee:</b> Uh, yes.
<b>Interviewer:</b> 好。那，呃，你之前有有用過 Momo 嗎？	<b>Interviewer:</b> Okay. Then, uh, have you used Momo before?
<b>Interviewee:</b> 呃，有。	<b>Interviewee:</b> Um, yes.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你是比較喜歡 Momo 還是蝦皮還是其他的平台？	<b>Interviewer:</b> Do you prefer Momo, Shopee, or other platforms?
<b>Interviewee:</b> 嗯，比較常用蝦皮。	<b>Interviewee:</b> Um, I use Shopee more often.
<b>Interviewer:</b> OK。那你平常在網路上有買過什麼類型的東西？	<b>Interviewer:</b> OK. What types of things have you bought online usually?
<b>Interviewee:</b> 嗯，我用 Momo 有買過音響。	<b>Interviewee:</b> Um, I've used Momo to buy speakers.
<b>Interviewer:</b> 好。那你現在有什麼你想要買的嗎？	<b>Interviewer:</b> Okay. Is there anything you want to buy right now?
<b>Interviewee:</b> 嗯，一些電影...	<b>Interviewee:</b> Um, some movies...
<b>Interviewer:</b> 好，Momo 想要嗎？可以幫我找一下嗎？ Momo...	<b>Interviewer:</b> Okay, do you want [to search on] Momo? Can you help me look it up? Momo...
<b>Interviewee:</b> 呃，Momo 有... Momo 有吃的吧。可是我不知道 Momo 上面有沒有...我看一下我的 Momo 有什麼...	<b>Interviewee:</b> Uh, Momo has... Momo probably has food. But I don't know if Momo has [movies]... Let me check what my Momo has...
<b>Interviewee:</b> 哟，他剛好挑那個...我要直接買什麼？隨便東西都可以嗎？	<b>Interviewee:</b> Oh, it happened to pick that... What should I buy directly? Is anything okay?
<b>Interviewer:</b> 都可以。	<b>Interviewer:</b> Anything is fine.
<b>Interviewee:</b> 那不然我就點鞋子。	<b>Interviewee:</b> Then I'll just click on shoes.
<b>Interviewer:</b> 你手機有 Momo 的 App 嗎？	<b>Interviewer:</b> Do you have the Momo app on your phone?
<b>Interviewee:</b> 有。這個也可以嗎？不行...剛好有一個，好，我知道了。這個要怎麼退出...	<b>Interviewee:</b> Yes. Is this one okay too? No...刚好 there's one, okay, I know. How do I exit this...
<b>Interviewer:</b> 這個是他 (Momo) 的廣告。	<b>Interviewer:</b> This is its (Momo's) advertisement.
<b>Interviewee:</b> 沒有我要的。Timberland。	<b>Interviewee:</b> Not what I want. Timberland.
<b>Interviewee:</b> 沒有，那不然你就...好，就找 Timberland 就好。但是...	<b>Interviewee:</b> No, then you just... okay, just search for Timberland. But...
<b>Interviewer:</b> 剛剛 App 有這個嗎？有。你看一下這個... 哟，但是它沒有寫那個 boat shoes。 哟，它是英文的。呃，沒關係。啊不然就我先隨便點一個那個吧。	<b>Interviewer:</b> Did the app have this just now? Yes. Look at this... oh, but it doesn't say "boat shoes". Oh, it's in English. Uh, it doesn't matter. Or I can just randomly click one.
<b>Interviewer:</b> 啊，但是你喜歡的是這個嗎？	<b>Interviewer:</b> Ah, but is this the one you like?
<b>Interviewee:</b> Yeah。那就找這個，好好好。	<b>Interviewee:</b> Yeah. Then let's look for this one, okay okay okay.
<b>Interviewee:</b> 就... 哟，帆船鞋。	<b>Interviewee:</b> It's... oh, boat shoes.
<b>Interviewee:</b> 我不知道有這個中文字，帆船鞋。為什麼沒有... 有有有，這個。好。	<b>Interviewee:</b> I didn't know this Chinese word existed, boat shoes. Why isn't there... yes yes yes, this one. Okay.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你剛剛為什麼選這個？	<b>Interviewer:</b> Why did you choose this one just now?
<b>Interviewee:</b> 因為這個我已經看這雙鞋子看很久了。	<b>Interviewee:</b> Because I've been looking at this pair of shoes for a long time.
<b>Interviewer:</b> 那你之前有買過這個品牌嗎？	<b>Interviewer:</b> Have you bought this brand before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那你為什麼是看...？	<b>Interviewer:</b> Then why were you looking...?
<b>Interviewee:</b> 就是，嗯，就是網路上也有別人穿，然後我覺得看起來很好看。	<b>Interviewee:</b> It's just, um, other people wear them online too, and I think they look really good.
<b>Interviewer:</b> 好。那剛剛你開那個、那個網頁，有看到什麼新的東西嗎？	<b>Interviewer:</b> Okay. When you opened that, that webpage just now, did you see anything new?
<b>Interviewee:</b> 就是他剛一開始頁面的一些特惠活動，Dyson。	<b>Interviewee:</b> Just some special offers on the initial page, Dyson.
<b>Interviewer:</b> 好。鞋子。好，那這裡呢？這裡，喔這個，這是什麼？這是剛剛那個？	<b>Interviewer:</b> Okay. Shoes. Okay, what about here? Here, oh this, what is this? Is this the one you just had?
<b>Interviewee:</b> 哟，你下載...我剛下載，你剛下載的那個綠綠綠，喔。	<b>Interviewee:</b> Oh, you download... I just downloaded, the green green green one you just downloaded, oh.
<b>Interviewer:</b> 好，那你覺得綠綠是什麼？	<b>Interviewer:</b> Okay, what do you think the green thing is?
<b>Interviewee:</b> 嗯...給你看就是它的更詳細的訊息，所以讓你不回買到假的。	<b>Interviewee:</b> Um... showing you its more detailed information, so you won't buy a fake.
<b>Interviewer:</b> 好。那你覺得這個內容裡面的重點是什麼？嗯...喔，環保。	<b>Interviewer:</b> Okay. What do you think is the key point of this content? Um... oh, eco-friendly.
<b>Interviewee:</b> 這個公司...總體評分 45...所以是在看你這個產品的環保程度？	<b>Interviewee:</b> This company... overall rating 45... so is it looking at the eco-friendliness level of this product?
<b>Interviewer:</b> 嗯，你覺得是高的還是低的？	<b>Interviewer:</b> Um, do you think it's high or low?
<b>Interviewee:</b> 低。看起來應該是低，45，這應該是低。	<b>Interviewee:</b> Low. It looks like it should be low, 45, this should be low.
<b>Interviewer:</b> 嗯。所以，喔，所以這個就是你的那個...是是是。OK。	<b>Interviewer:</b> Um. So, oh, so this is your thing... yes yes yes. OK.
<b>Interviewer:</b> 那第二個部分那邊，就是綠色的部分。	<b>Interviewer:</b> Then the second part there, the green section.
<b>Interviewee:</b> 就是，嗯...減少碳排量 38%。這也是...	<b>Interviewee:</b> It's, um... reduces carbon emissions by 38%. This is also...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 哦，這是推薦我可以買哪一個品牌。	<b>Interviewee:</b> Oh, this recommends which brand I can buy.
<b>Interviewer:</b> 嗯。那其他的品牌你有買過嗎？還是...	<b>Interviewer:</b> Um. Have you bought the other brands? Or...
<b>Interviewee:</b> 有，這個(Timberland)這個有。哦，OK。其他我沒有。	<b>Interviewee:</b> Yes, this one (Timberland), this one I have. Oh, OK. The others, no.
<b>Interviewer:</b> 那你為什麼會買Patagonia？	<b>Interviewer:</b> Then why would you buy Patagonia?
<b>Interviewee:</b> 因為我很喜歡買那個，那種二手的東西，然後他們的，他們的東西很多在二手店都有。哦，原來。	<b>Interviewee:</b> Because I really like buying that, that kind of second-hand stuff, and their, a lot of their stuff is available in second-hand stores. Oh, I see.
<b>Interviewer:</b> 好，第三個。	<b>Interviewer:</b> Okay, the third one.
<b>Interviewee:</b> 這是...？	<b>Interviewee:</b> This is...?
<b>Interviewer:</b> 你覺得是什麼？	<b>Interviewer:</b> What do you think it is?
<b>Interviewee:</b> 推薦我可以投資哪些其他的公司。	<b>Interviewee:</b> Recommending which other companies I can invest in.
<b>Interviewee:</b> 所以，哦，他是推薦我類似Timberland的公司，哦，可以投資是嗎？	<b>Interviewee:</b> So, oh, it's recommending companies similar to Timberland to me, oh, that I can invest in, is that right?
<b>Interviewee:</b> 股票。哦，他還有這個，直接在那邊看那個股票。	<b>Interviewee:</b> Stocks. Oh, it also has this, directly look at the stocks there.
<b>Interviewer:</b> 嗯，酷喔。那你覺得你，你最近有買過股票嗎？	<b>Interviewer:</b> Um, cool. So do you think, have you bought stocks recently?
<b>Interviewee:</b> 嗯...嗯...嗯。	<b>Interviewee:</b> Um... um... um.
<b>Interviewer:</b> 好好好。那你幫我回第一個部分，這個，對。	<b>Interviewer:</b> Okay okay okay. Can you go back to the first section for me, this one, right.
<b>Interviewer:</b> 然後最下面有兩個按鈕，你想按，還是你不想按也可以？	<b>Interviewer:</b> Then at the very bottom there are two buttons, do you want to press one, or it's okay if you don't want to?
<b>Interviewee:</b> (Clicks '尋找替代品') 嗯，那這裡呢？它是跟你講什麼？	<b>Interviewee:</b> (Clicks 'Find Alternatives') Um, what about here? What is it telling you?
<b>Interviewee:</b> 哟，這就是一些更多(替代品)。	<b>Interviewee:</b> Oh, these are just some more (alternatives).
<b>Interviewer:</b> 酷喔。那你有，你有自己的問題你想問嗎？也可以自己打字。(指'跟AI聊聊'按鈕)	<b>Interviewer:</b> Cool. Do you have, do you have your own questions you want to ask? You can also type them yourself. (Points to 'Chat with AI' button)
<b>Interviewee:</b> (Clicks '跟AI聊聊') 嗯，自己的問題...我看一下這個有什麼...	<b>Interviewee:</b> (Clicks 'Chat with AI') Um, my own questions... Let me see what this has...
<b>Interviewee:</b> (思考) 嗯...嗯...	<b>Interviewee:</b> (Thinking) Um... um...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃...那個，剛剛那個叫什麼？環保評分嗎？(Types question)	<b>Interviewee:</b> Uh... that, what was that called just now? Eco-rating? (Types question)
<b>Interviewee:</b> 好像要看上面喔...已經有了...	<b>Interviewee:</b> Seems like I need to look above... it's already there...
<b>Interviewee:</b> 在搜什麼？評分很高。喔，蠻準的啊。	<b>Interviewee:</b> What is it searching for? The rating is very high. Oh, quite accurate.
<b>Interviewer:</b> 好。所以這就是像一個環保的，呃，像 ChatGPT 那種，你可以問他任何東西。	<b>Interviewer:</b> Okay. So this is like an eco-friendly, uh, like ChatGPT type of thing, you can ask it anything.
<b>Interviewee:</b> 嗯，基本上是這個，對。酷喔。這全部都是你做的？	<b>Interviewee:</b> Um, basically it's this, right. Cool. You made all of this?
<b>Interviewer:</b> 啊對。好。呃，還有什麼要測試嗎？呃，你可以幫我回那個 Momo 那邊。	<b>Interviewer:</b> Ah yes. Okay. Uh, is there anything else to test? Uh, can you help me go back to the Momo page?
<b>Interviewee:</b> OK。	<b>Interviewee:</b> OK.
<b>Interviewer:</b> 好。那它的上面有一個代碼，你看這個，你可以幫我講出來嗎？這個綠色的號碼。	<b>Interviewer:</b> Okay. There's a code at the top, look at this, can you say it for me? This green number.
<b>Interviewee:</b> 3G1RL。	<b>Interviewee:</b> 3G1RL.
<b>Interviewer:</b> 好。那，呃，你覺得最重要的部分，可以幫我拍照嗎？最重要，對對對，你覺得最有用的，有用的資料是什麼？	<b>Interviewer:</b> Okay. Then, uh, the part you think is most important, can you take a photo for me? Most important, yes yes yes, what do you think is the most useful, useful information?
<b>Interviewee:</b> OK。	<b>Interviewee:</b> OK.
<b>Interviewee:</b> (Takes photo) 嗯，就用手機幫他拍。	<b>Interviewee:</b> (Takes photo) Um, just use the phone to take a picture of it.
<b>Interviewer:</b> 呃，如果你等一下要用，你要用手機填那個問卷可以嗎？	<b>Interviewer:</b> Uh, if you need to use it later, can you use your phone to fill out the questionnaire?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那剛剛那個，呃，你有那個 QR 的那個網站，對。欸，你弄好了。	<b>Interviewer:</b> Then that one just now, uh, you have that QR code website, right. Hey, you've set it up.
<b>Interviewee:</b> 但是你還沒有測試好啊？沒關係，可以，好像弄好之後再測試。因為我有點這個啦...我也用這個。是要先填這個？對對對。	<b>Interviewee:</b> But you haven't finished testing yet? It's okay, we can, seems like we can test after setting it up. Because I have this thing... I also use this. Do I need to fill this out first? Yes yes yes.
<b>Interviewer:</b> 剛剛這個代碼，那代碼我也是看那個上面那個。	<b>Interviewer:</b> This code just now, that code, I also saw it on the top there.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 喔你有，你有。好。但是我還是要，就是，我要觀察一下你在幹嘛，太快了吧。	<b>Interviewee:</b> Oh you have it, you have it. Okay. But I still need to, like, observe what you're doing, it's too fast.
<b>Interviewer:</b> 好好。那我好了，我先填問卷。好，謝謝。	<b>Interviewer:</b> Okay okay. I'm done, I'll fill out the questionnaire first. Okay, thank you.

### 16.1.11 Transcript 2024-12-25 - Taichung (NCHU) - 5REHE

**Source Files:** \* 2024-12-25 - Taichung (NCHU) - 5REHE.json \* 2024-12-25 - Taichung (NCHU) - 5REHE.txt

**Ziran ID Code:** 5REHE

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好，那我首先跟你講，這個是我的論文的一部分，一個環保的 App。那你同意我錄影你的聲音嗎？	<b>Me:</b> Okay, let me first tell you, this is part of my thesis, an environmental protection App. Do you agree to let me record your voice?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Me:</b> 好。那我問你，你之前有買過 Momo 上的東西 (註: JSON 誤聽為短期) 嗎？	<b>Me:</b> Okay. Let me ask you, have you bought things (Note: JSON misheard as "short-term") on Momo before?
<b>Interviewee:</b> 最近呃...有不小心，有不小心訂，但是我沒有用那個，然後後來就取消。	<b>Interviewee:</b> Recently uh... I accidentally, accidentally ordered, but I didn't use that one, and then canceled it later.
<b>Me:</b> 好。那其他的平台呢？	<b>Me:</b> Okay. What about other platforms?
<b>Interviewee:</b> 其他的平台？最近，呃，我有買一個...我買一個積木的花。	<b>Interviewee:</b> Other platforms? Recently, uh, I bought one... I bought a flower made of building blocks.
<b>Me:</b> 好。那你現在有想要買什麼嗎？	<b>Me:</b> Okay. Is there anything you want to buy now?
<b>Interviewee:</b> 最近？呃...最近想要買什麼？可能我想買一雙鞋子。	<b>Interviewee:</b> Recently? Uh... What do I want to buy recently? Maybe I want to buy a pair of shoes.
<b>Me:</b> 都可以。鞋子。好。那你幫我找。	<b>Me:</b> Anything is fine. Shoes. Okay. Help me search.
<b>Interviewee:</b> (搜尋鞋子) ...一些鞋子...	<b>Interviewee:</b> (Searching for shoes)... Some shoes...
<b>Me:</b> 呃...沒有？那你剛剛想要買什麼？	<b>Me:</b> Uh... no? What did you want to buy just now?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我想要買一雙，就是它有一個...欸不是啦，我查錯了。是一雙 Adidas 的 Hello Kitty 的鞋子。	<b>Interviewee:</b> I wanted to buy a pair, it's just that it has a... Hey no, I searched wrong. It's a pair of Adidas Hello Kitty shoes.
<b>Me:</b> 對。(等待搜尋結果) 跑掉了...查不到？ 沒有。這裡沒有？ 有其他的 Hello Kitty 的鞋子嗎？ 有可能已經賣完了。	<b>Me:</b> Right. (Waiting for search results) It ran away... Can't find it? No. Not here? Are there other Hello Kitty shoes? Maybe they're already sold out.
<b>Interviewee:</b> 好好。那我要找別的嗎？	<b>Interviewee:</b> Okay okay. Should I look for something else then?
<b>Me:</b> 嗯，好。	<b>Me:</b> Hmm, okay.
<b>Interviewee:</b> 嗯...喔，我想買這個。	<b>Interviewee:</b> Hmm... Oh, I want to buy this one.
<b>Me:</b> 好。那這是什麼品牌？	<b>Me:</b> Okay. What brand is this?
<b>Interviewee:</b> Asics 的。	<b>Interviewee:</b> Asics.
<b>Me:</b> 所以你之前有買過這個嗎？ 這個品牌？	<b>Me:</b> So have you bought this before? This brand?
<b>Interviewee:</b> 有，我有買過一雙，只是它顏色不一樣，是黃色。	<b>Interviewee:</b> Yes, I've bought a pair, just the color is different, it was yellow.
<b>Me:</b> 好。就是 Asics 和這個就是他們有一個聯名？	<b>Me:</b> Okay. So Asics and this one, they have a collaboration?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Me:</b> 好。你好像蠻了解鞋子。	<b>Me:</b> Okay. You seem to know shoes quite well.
<b>Interviewee:</b> 呃，還好，一點點而已。	<b>Interviewee:</b> Uh, it's okay, just a little bit.
<b>Me:</b> 好。那你剛剛有看到什麼新的東西嗎？ 之前沒有看過的？	<b>Me:</b> Okay. Did you see anything new just now? Something you hadn't seen before?
<b>Interviewee:</b> 你說我在找這個的時候？ 哎...呃...就是，就是有後來點進來也多這個。然後其他沒有看到什麼新的。	<b>Interviewee:</b> You mean when I was searching for this? Hmm... uh... just, just later clicked in and there was this added. Then didn't see anything else new.
<b>Me:</b> 啊你是說這個軟體嗎？	<b>Me:</b> Ah, you mean this software?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那這個軟體是什麼？	<b>Me:</b> What is this software?
<b>Interviewee:</b> 我看一下。嗯...它就是在分析我想要買的這個產品，它的一些介紹，然後還有環保，環保的。還有這個... 呃...這個是什麼？ 這個是...嗯，這應該是可能是像股票的東西。	<b>Interviewee:</b> Let me see. Hmm... It's analyzing the product I want to buy, some of its introductions, and also environmental protection, environmental protection related. And also this... uh... What is this? This is... hmm, this should probably be something like stocks.
<b>Me:</b> 啊。那對你來說，哪一個部分最重要的？	<b>Me:</b> Ah. Then for you, which part is the most important?
<b>Interviewee:</b> 我覺得，呃，我覺得這個介紹的比較重要。	<b>Interviewee:</b> I think, uh, I think this introduction is more important.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 啊。那這裡，這個內容裡面的重點是什麼？	<b>Me:</b> Ah. Then here, what's the main point inside this content?
<b>Interviewee:</b> 嗯...他在講應該是就是這雙鞋製作的時候的一些，它的用料或者是它的環保問題比較嚴重的汙染問題。	<b>Interviewee:</b> Hmm... It's talking about probably, during the production of this pair of shoes, some of its materials or its environmental issues, the more serious pollution problems.
<b>Me:</b> 好。那你自己的看法呢？這裡有什麼可以使用的嗎？	<b>Me:</b> Okay. What about your own view? Is there anything here that can be used?
<b>Interviewee:</b> 嗯...就是它有這個「材料可續性、可持續性」，就是他會跟你講說這雙鞋，呃，這材質的，的那個可續、可持續性，就是你會比較了解，就是如果你買了這雙鞋之後，他能，他可能對環境不太好，這樣。	<b>Interviewee:</b> Hmm... It has this "Material Sustainability, Sustainability", meaning it will tell you about this pair of shoes, uh, this material's, its sustainability, sustainability, so you'll understand better, like if you buy this pair of shoes, it can, it might not be good for the environment, like that.
<b>Me:</b> 嗯。那最下面還有兩個按鈕 (註: TXT 誤聽為 按針) 可以幫我按一個嗎？如果想要。	<b>Me:</b> Hmm. Then at the very bottom there are two buttons (Note: TXT misheard as "needles"). Can you press one for me? If you want to.
<b>Interviewee:</b> (按下按鈕)	<b>Interviewee:</b> (Presses button)
<b>Me:</b> 那這是什麼呢？	<b>Me:</b> What is this then?
<b>Interviewee:</b> 就是他，他跟一些其他的品脾做比較，然後他跟你講一些相較於這個品牌來講，比較更環保的其他品牌。	<b>Interviewee:</b> It's, it compares with some other brands, and then it tells you some other brands that, compared to this brand, are relatively more environmentally friendly.
<b>Me:</b> 那其他的品脾你有買過嗎？	<b>Me:</b> Have you bought these other brands?
<b>Interviewee:</b> 欸，沒有耶。	<b>Interviewee:</b> Hey, no.
<b>Me:</b> 對。那你這裡有什麼問題想要問他嗎？什麼都可以，也可以直接去打字。	<b>Me:</b> Right. Do you have any questions you want to ask it here? Anything is fine, you can also type directly.
<b>Interviewee:</b> (思考) 那...	<b>Interviewee:</b> (Thinking) Then...
<b>Me:</b> 這個部分還沒有做好。還有其他的嗎？這個你剛剛是有完成...	<b>Me:</b> This part isn't done well yet. Anything else? This one you just completed...
<b>Interviewee:</b> Product materials ?	<b>Interviewee:</b> Product materials?
<b>Me:</b> 對。	<b>Me:</b> Yes.
<b>Interviewee:</b> 啊，第一個是這個，第二個是這個，第二個是什麼？	<b>Interviewee:</b> Ah, the first is this, the second is this, what's the second?
<b>Me:</b> 之前買過 Leaders ? 啊。Levi's ? 啊。好，這個都是假的，因為他不知道你是誰喔。	<b>Me:</b> Bought Leaders before? Hmm. Levi's? Hmm. Okay, these are all fake, because it doesn't know who you are.
<b>Interviewee:</b> 對啊。	<b>Interviewee:</b> Yeah.
<b>Me:</b> 沒關係。但我還是有買過 Levi's 。	<b>Me:</b> Doesn't matter. But I have bought Levi's before.
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Hmm.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 但是這可以幫你記得你之前有買過。	<b>Me:</b> But this can help you remember what you've bought before.
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Hmm.
<b>Me:</b> 好。那還有其他的問題嗎？	<b>Me:</b> Okay. Are there any other questions?
<b>Interviewee:</b> 應該就沒有。	<b>Interviewee:</b> Probably no more.
<b>Me:</b> 好。那你幫我回那個 Momo 那邊。對。那它在上面還有那個...剛剛這個第二個部分喔。那你覺得，呃，看一下這些你有買過 (註: TXT 誤聽為賣過) 嗎？其他的品牌？	<b>Me:</b> Okay. Help me go back to that Momo page. Right. Then on top it still has that... the second part from just now. Oh. What do you think, uh, take a look, have you bought (Note: TXT misheard as "sold") these? Other brands?
<b>Interviewee:</b> No。	<b>Interviewee:</b> No.
<b>Me:</b> 好，都沒有買過 (註: TXT 誤聽為賣過)。那你覺得看到這個資料會影響你嗎？有什麼影響？	<b>Me:</b> Okay, haven't bought (Note: TXT misheard as "sold") any. Do you think seeing this data will affect you? What kind of impact?
<b>Interviewee:</b> 嗯...應該不會有什麼影響。	<b>Interviewee:</b> Hmm... probably won't have much impact.
<b>Me:</b> 好啊。那這樣就可以了。你幫我講出來說這是什麼號碼。這個。哦。	<b>Me:</b> Okay. That's fine then. Help me say out loud what number this is. This one. Oh.
<b>Interviewee:</b> 好。你幫我講出來？	<b>Interviewee:</b> Okay. You help me say it out loud?
<b>Me:</b> 呃...你說我的代碼？	<b>Me:</b> Uh... you mean my code?
<b>Interviewee:</b> 對。呃...5REHE。	<b>Interviewee:</b> Yes. Uh... 5REHE.
<b>Me:</b> 好好，謝謝。	<b>Me:</b> Okay okay, thank you.

### 16.1.12 Transcript 2024-12-25 - Taichung (NCHU) - 80W9Z

**Source Files:** \* 2024-12-25 - Taichung (NCHU) - 80W9Z.json \* 2024-12-25 - Taichung (NCHU) - 80W9Z.txt

**Ziran ID Code:** 80W9Z

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 所以基本上這個是我的論文的一部分，它是一個環保的 App。那我也可以問你，你同意我錄影這個聲音嗎？	<b>Interviewer:</b> So basically, this is part of my thesis, it's an eco-friendly App. Can I also ask, do you agree to let me record this audio?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那這樣的話，我想問你，你平常有用過 Momo 嗎？	<b>Interviewer:</b> Okay. In that case, I'd like to ask, do you usually use Momo?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我平常有滑過，沒有用過。	<b>Interviewee:</b> I usually browse it, but haven't used it [to buy].
<b>Interviewer:</b> 那你在 Momo 上有買過什麼類型的東西？	<b>Interviewer:</b> What types of things have you bought on Momo?
<b>Interviewee:</b> 沒有用過。	<b>Interviewee:</b> Haven't used it [to buy].
<b>Interviewer:</b> 那你現在有什麼東西你想要買嗎？	<b>Interviewer:</b> Is there anything you want to buy right now?
<b>Interviewee:</b> 我前兩天還在想要買舒肥機。	<b>Interviewee:</b> The other day I was thinking about buying a sous vide machine.
<b>Interviewer:</b> 啊，那 Momo 上可以找得到嗎？	<b>Interviewer:</b> Ah, can you find it on Momo?
<b>Interviewee:</b> (Clicks/Navigates)	<b>Interviewee:</b> (Clicks/Navigates)
<b>Interviewer:</b> 這邊好像網路有點慢慢的... 嗯，你先選一個。	<b>Interviewer:</b> The internet seems a bit slow here... Um, choose one first.
<b>Interviewee:</b> (Navigates) 要不然我就點鞋子。	<b>Interviewee:</b> (Navigates) Otherwise, I'll just click on shoes.
<b>Interviewer:</b> 好，Adidas。那這個...	<b>Interviewer:</b> Okay, Adidas. Then this...
<b>Interviewer:</b> 好，那你覺得這個畫面的是什麼東西？你覺得這是什麼？	<b>Interviewer:</b> Okay, what do you think this screen is showing? What do you think this is?
<b>Interviewee:</b> 呃...就是基於這個產品，然後還有它的介紹跟它的評分。	<b>Interviewee:</b> Uh... it's based on this product, and then there's its introduction and its rating.
<b>Interviewer:</b> 那你覺得這個內容裡面，有什麼重要的資料嗎？	<b>Interviewer:</b> What important information do you think is in this content?
<b>Interviewee:</b> 對我來講說，比較重要的會是它是哪邊製造的，然後它的過程，製造是什麼樣子，然後以及它材料跟它的評分。它怎麼做的，它對我來講會是一個考量的標準。	<b>Interviewee:</b> For me, what's more important would be where it's manufactured, then its process, what the manufacturing is like, and also its materials and its rating. How it's made, that would be a standard for consideration for me.
<b>Interviewer:</b> 那你之前有買過這個品牌嗎？	<b>Interviewer:</b> Have you bought this brand before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 這個產品？	<b>Interviewer:</b> This product?
<b>Interviewee:</b> 沒有買過。	<b>Interviewee:</b> Haven't bought it.
<b>Interviewee:</b> 所以說我還在比價那邊。我自己個人會覺得說，如果他要再買的話，他可能可以再多一點像是它的價格的部分，它價格可以去跟其他的品牌或其他產品去做比價，或是有一個評分，或是什麼樣的說法。	<b>Interviewee:</b> So I'm still in the price comparison stage. Personally, I feel that if I were to buy it, maybe there could be a bit more, like regarding the price part, its price could be compared with other brands or other products, or have a rating, or some kind of description.
<b>Interviewer:</b> 那它的上面還有三個按鈕。你先看第一個（黃色）。	<b>Interviewer:</b> Then there are three buttons at the top. Look at the first one first (yellow).

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好，那你覺得這個內容裡面的重點是什麼？	<b>Interviewer:</b> Okay, what do you think is the key point of this content?
<b>Interviewee:</b> (Reads/Describes) 嗯...給你看就是它的更詳細的訊息，所以不會買到假的。	<b>Interviewee:</b> (Reads/Describes) Um... showing you its more detailed information, so you won't buy a fake.
<b>Interviewer:</b> 好。那第二個（綠色）呢？	<b>Interviewer:</b> Okay. What about the second one (green)?
<b>Interviewee:</b> 環保。	<b>Interviewee:</b> Eco-friendly.
<b>Interviewee:</b> 這個公司...總體評分 45...所以是在看你這個產品的環保程度啊？	<b>Interviewee:</b> This company... overall rating 45... so is it looking at the eco-friendliness level of this product?
<b>Interviewer:</b> 嗯嗯。	<b>Interviewer:</b> Mhm.
<b>Interviewee:</b> (Reads) ...減少碳排量 38%...這也是...	<b>Interviewee:</b> (Reads) ...reduces carbon emissions by 38%... this is also...
<b>Interviewee:</b> 哦，這是推薦我可以買哪一個品牌。	<b>Interviewee:</b> Oh, this recommends which brand I could buy.
<b>Interviewer:</b> 嗯。其他的品牌你有買過嗎？還是...？	<b>Interviewer:</b> Um. Have you bought the other brands? Or...?
<b>Interviewee:</b> 這個(Adidas)有。OK。其他我沒有。	<b>Interviewee:</b> This one (Adidas), yes. OK. The others, no.
<b>Interviewer:</b> 那你為什麼還是會買(Adidas)？	<b>Interviewer:</b> Then why would you still buy (Adidas)?
<b>Interviewee:</b> 因為我會買那種二手啊。這個東西...他們的...他們的東西很多在二手...	<b>Interviewee:</b> Because I buy second-hand stuff. This thing... their... a lot of their stuff is available second-hand...
<b>Interviewer:</b> 好，那第三個部分呢？	<b>Interviewer:</b> Okay, what about the third section?
<b>Interviewee:</b> (Clicks) 這是...？	<b>Interviewee:</b> (Clicks) This is...?
<b>Interviewer:</b> 你覺得是什麼？	<b>Interviewer:</b> What do you think it is?
<b>Interviewee:</b> 推薦我可以投資哪些其他的公司。	<b>Interviewee:</b> Recommending which other companies I can invest in.
<b>Interviewee:</b> 股票...哦，它還有這個...這邊看那個股票。	<b>Interviewee:</b> Stocks... oh, it also has this... look at the stocks here.
<b>Interviewer:</b> 嗯。那你最近有買過股票嗎？	<b>Interviewer:</b> Um. Have you bought stocks recently?
<b>Interviewee:</b> 嗯...沒有。	<b>Interviewee:</b> Um... no.
<b>Interviewer:</b> 好。	<b>Interviewer:</b> Okay.
<b>Interviewer:</b> 好，那你下面有看到兩個按鈕嗎？(尋找替代品 & 跟 AI 聊聊)	<b>Interviewer:</b> Okay, do you see the two buttons below? (Find Alternatives & Chat with AI)
<b>Interviewee:</b> (Clicks '跟 AI 聊聊')	<b>Interviewee:</b> (Clicks 'Chat with AI')
<b>Interviewer:</b> 嗯。你可以問它問題。你要問什麼問題都可以，你可以直接打字。	<b>Interviewer:</b> Um. You can ask it questions. You can ask any question, you can just type.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 任何問題都可以？	<b>Interviewee:</b> Any question?
<b>Interviewer:</b> 任何問題都可以。	<b>Interviewer:</b> Any question is fine.
<b>Interviewee:</b> (Types question)	<b>Interviewee:</b> (Types question)
<b>Interviewer:</b> 好，那你對它來說，它的回答、它的重點是什麼？	<b>Interviewer:</b> Okay, for you, its answer, what's its key point?
<b>Interviewee:</b> 我覺得它可能就是...它那邊的方法的建議是我覺得不錯，但它可以有更多的，像是可以舉例的部分。因為它可能...我剛剛看這邊的話，它可能不太知道說要從哪邊着手。或許可能可以找更多的範例，就是，我覺得。	<b>Interviewee:</b> I think maybe... the method suggestions there are good, I think, but it could have more, like parts with examples. Because maybe... looking here just now, it might not quite know where to start. Maybe it could find more examples, that's what I think.
<b>Interviewer:</b> 對，好。嗯。那這邊也有一些(建議的)問題，你有很想要問其他的事情嗎？還是還好？	<b>Interviewer:</b> Right, okay. Um. There are also some (suggested) questions here, is there anything else you really want to ask? Or is it okay?
<b>Interviewee:</b> 還好。	<b>Interviewee:</b> It's okay.
<b>Interviewer:</b> 那你覺得它跟 ChatGPT 的差異是什麼？	<b>Interviewer:</b> What do you think is the difference between it and ChatGPT?
<b>Interviewee:</b> (思考) ...它可能在專業的部分會帶有更多的解釋？那它在日常生活上... (思考)	<b>Interviewee:</b> (Thinking)... Maybe in the professional aspects, it will have more explanations? And in daily life... (Thinking)
<b>Interviewer:</b> 比較會是它會在更多專業上的考量，不是偏生活。但是比較關心環保，然後它嵌進在那個 Momo 的裡面。	<b>Interviewer:</b> It's more likely that it has more professional considerations, not leaning towards daily life. But it's more concerned with environmental protection, and it's embedded within Momo.
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Mhm.
<b>Interviewer:</b> 嗯，對。	<b>Interviewer:</b> Um, right.
<b>Interviewer:</b> 好，那你覺得（對你來說）最重要的部分，你可以幫我拍照嗎？用你的手機。	<b>Interviewer:</b> Okay, what you feel is the most important part (for you), can you take a photo for me? Use your phone.
<b>Interviewee:</b> 拍照？	<b>Interviewee:</b> Take a photo?
<b>Interviewer:</b> 對，拍這個畫面。就是你覺得最重要的部分。	<b>Interviewer:</b> Yes, take a photo of this screen. The part you feel is most important.
<b>Interviewee:</b> 嗯... (Takes Photo) 環保評分。	<b>Interviewee:</b> Um... (Takes Photo) The environmental rating.
<b>Interviewer:</b> 環保評分？好。	<b>Interviewer:</b> The environmental rating? Okay.
<b>Interviewer:</b> 好。那它這上面有一個號碼，你可以幫我講出來嗎？這個綠色的號碼。	<b>Interviewer:</b> Okay. There's a number at the top here, can you say it for me? This green number.
<b>Interviewee:</b> 80W9Z。	<b>Interviewee:</b> 80W9Z.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好，你可以幫我寫在這個卡片上...對...好。那這樣差不多可以了，謝謝。	<b>Interviewer:</b> Okay, can you help me write it on this card... yes... okay. Then that's about it, thank you.
<b>Interviewee:</b> 謝謝。	<b>Interviewee:</b> Thank you.

### 16.1.13 Transcript 2025-01-10 - Tainan (TNNUA) - 6R02U

**Source Files:** \* 2025-01-10 - Tainan (TNNUA) - 6R02U.json \* 2025-01-10 - Tainan (TNNUA) - 6R02U.txt

**Ziran ID Code:** 6R02U

Traditional Chinese Transcript	English Translation
<b>Me:</b> 我先介紹 (註: JSON 誤聽為 牽車身)一下，所以基本上這個是 (註: JSON 誤聽為 誰利率) 我的論文的一部分，環保軟體。那我們等下 (註: JSON 誤聽為 在下) 會測試這個 (註: TXT 誤聽為 是是) App。我可以錄你的聲音嗎？	<b>Me:</b> Let me introduce (Note: JSON misheard as “pull car body”) first. So basically this is (Note: JSON misheard as “whose interest rate”) part of my thesis, an environmental protection software. Then later (Note: JSON misheard as “below”) we will test this (Note: TXT misheard “shi shi” - yes yes) App. Can I record your voice?
<b>Interviewee:</b> 好啊，可以，可以。	<b>Interviewee:</b> Sure, yes, yes.
<b>Me:</b> 好。呃...那我先問，妳之前有用過 Momo 嗎？	<b>Me:</b> Okay. Uh... let me ask first, have you used Momo before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 那另外一個平台？ 還有沒有？ (註: JSON 誤聽為 實際可以賣)	<b>Me:</b> What about other platforms? Are there any others? (Note: JSON misheard as “actually can sell”)
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Me:</b> 啟？ 就蝦皮？ (註: JSON 誤聽為 叫別魚) 好。那你平常 (註: JSON 誤聽為 盯上才) 網路上會買什麼類型的東西？	<b>Me:</b> Huh? Just Shopee? (Note: JSON misheard as “called other fish”) Okay. What type of things do you usually (Note: JSON misheard as “only after noticing”) buy online?
<b>Interviewee:</b> 啊...衣服、鞋子。	<b>Interviewee:</b> Ah... clothes, shoes.
<b>Me:</b> 那 Momo 上你想要買什麼？	<b>Me:</b> What do you want to buy on Momo?
<b>Interviewee:</b> (Thinking) ...存錢筒。	<b>Interviewee:</b> (Thinking) ...Piggy bank.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那你可以幫我找一下你想要買的嗎？（等待搜尋）...某某商品...嗯...必須是中文的話...你要中文還是...中文。好了。拼音？中文？拼音？拼音？對。好。那你剛剛在找什麼？	<b>Me:</b> Okay. Can you help me find what you want to buy? (Waiting for search)... Momo product... hmm... if it has to be Chinese... do you want Chinese or... Chinese. Okay. Pinyin? Chinese? Pinyin? Pinyin? Right. Okay. What were you searching for just now?
<b>Interviewee:</b> 金錢筒。	<b>Interviewee:</b> Money bank.
<b>Me:</b> 金錢筒，有找到了？	<b>Me:</b> Money bank, found it?
<b>Interviewee:</b> 找到了。	<b>Interviewee:</b> Found it.
<b>Me:</b> 好。那你剛剛選擇哪一個？	<b>Me:</b> Okay. Which one did you choose just now?
<b>Interviewee:</b> 選擇這一個。	<b>Interviewee:</b> Chose this one.
<b>Me:</b> 這一個是什麼？	<b>Me:</b> What is this one?
<b>Interviewee:</b> 這是智能的。	<b>Interviewee:</b> This is a smart one.
<b>Me:</b> 好。那之前有買過嗎？	<b>Me:</b> Okay. Have you bought it before?
<b>Interviewee:</b> 沒有，但是有買過類似的東西。	<b>Interviewee:</b> No, but I've bought similar things.
<b>Me:</b> 好。那你有聽說過這個品牌嗎？	<b>Me:</b> Okay. Have you heard of this brand before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 沒有？ 好。那呃，這個剛好，這個網頁上有，有，有...你覺得什麼重要的資料嗎？ 重要的？ 重要？ 你覺得OK？ 這個很重要？ 知道嗎？ 知道？ 比如什麼？	<b>Me:</b> No? Okay. Then uh, this just happens, on this webpage, there is, there is, there is... do you think there's any important information? Important? Important? You think it's OK? This is very important? Know it? Know it? Like what?
<b>Interviewee:</b> 可能，你說這個東西為什麼很重要嗎？	<b>Interviewee:</b> Maybe, are you asking why this thing is very important?
<b>Me:</b> 不是，我是說那個剛剛不是有很多資料嗎？ 所以就要寫很多資料。然後首先你會看什麼？ 可能不知道價格還是看顏色還是看什麼？	<b>Me:</b> No, I mean, wasn't there a lot of information just now? So you need to write a lot of information. Then what would you look at first? Maybe you don't know the price, or look at the color, or look at what?
<b>Interviewee:</b> 可能看...可能看好不好看。	<b>Interviewee:</b> Maybe look... maybe look if it looks good.
<b>Me:</b> 好。那還有什麼嗎？	<b>Me:</b> Okay. Anything else?
<b>Interviewee:</b> 然後有沒有辦法幫我真的存到錢？ 會不會很容易打開？	<b>Interviewee:</b> And whether it can really help me save money? Will it be easy to open?
<b>Me:</b> 好。那剛剛旁邊有，可能換色的部分，那個換色的部分裡面，可以幫我看一下到底你想什麼？	<b>Me:</b> Okay. Then beside it just now, maybe the color-changing part, inside that color-changing part, can you help me see what exactly you're thinking?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> (查看插件) 好像都不知道這個品牌。對，他是說這個什麼，CTSTAR 是屬於消費品牌，中型企業，然後沒有，沒有看過很大的環保整理。然後這個產品是用塑膠做的，對環境會有影響。CEO 不詳。	<b>Interviewee:</b> (Looking at plugin) Seems like I don't know this brand at all. Right, it says this what, CTSTAR belongs to consumer brands, a medium-sized enterprise, and then no, haven't seen major environmental consolidation. Then this product is made of plastic, will have an impact on the environment. CEO unknown.
<b>Me:</b> CEO 不知道是什麼？	<b>Me:</b> CEO unknown is what?
<b>Interviewee:</b> 老闆。	<b>Interviewee:</b> The boss.
<b>Me:</b> CEO，老闆不知道是誰。但是因為他跟你對話是這些品牌的...可能是覺得這個是衣服，所以他不懂是什麼產品。那這樣的話，你可以幫我找另外一個產品嗎？	<b>Me:</b> CEO, the boss is unknown. But because it's conversing with you about these brands... maybe it thinks this is clothes, so it doesn't understand what product it is. In that case, can you help me find another product?
<b>Interviewee:</b> (搜尋 Nike 鞋)	<b>Interviewee:</b> (Searches for Nike shoes)
<b>Me:</b> 你剛剛在找什麼？	<b>Me:</b> What were you searching for just now?
<b>Interviewee:</b> 找 Nike。	<b>Interviewee:</b> Looking for Nike.
<b>Me:</b> 這件你有買過嗎？	<b>Me:</b> Have you bought this item?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 在這邊買過？	<b>Me:</b> Bought it here?
<b>Interviewee:</b> 在門市鞋子。	<b>Interviewee:</b> At the store shoes.
<b>Me:</b> 這不是在網路上買的？	<b>Me:</b> This wasn't bought online?
<b>Interviewee:</b> 不是。	<b>Interviewee:</b> No.
<b>Me:</b> 那有找到你喜歡的嗎？	<b>Me:</b> Did you find one you like?
<b>Interviewee:</b> 這雙好了。	<b>Interviewee:</b> This pair is okay.
<b>Me:</b> 好。這是什麼樣的？這是？為什麼喜歡這個？	<b>Me:</b> Okay. What kind is this? This is? Why do you like this one?
<b>Interviewee:</b> 看起來蠻好看的。	<b>Interviewee:</b> Looks quite nice.
<b>Me:</b> 好。然後剛剛那個黃色的裡面有什麼，什麼你想要知道嗎？	<b>Me:</b> Okay. Then inside that yellow part just now, is there anything, anything you want to know?
<b>Interviewee:</b> 他說是美國的運動品牌。嗯。但是在生產的時候碳足跡和用水量受到批評。他的老闆是 John Donahoe。呃，不是...他怎麼講？好。然後他在台灣製造？它在台灣有那個製造的地方？嗯。但是它的措施不太夠。使用聚酯纖維材料可能會，會有汙染問題。好，塑料汙染問題。然後建議消費者慎重考慮品牌，尤其是 Dunk 系列。	<b>Interviewee:</b> It says it's an American sports brand. Hmm. But during production, its carbon footprint and water usage were criticized. Its boss is John Donahoe. Uh, no... how does he put it? Okay. Then it's made in Taiwan? It has manufacturing sites in Taiwan? Hmm. But its measures are insufficient. Using polyester fiber materials might, might cause pollution problems. Okay, plastic pollution problems. Then it advises consumers to carefully consider the brand, especially the Dunk series.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 那你看到這個，這個系列的，你還是想要買嗎？	<b>Me:</b> Seeing this, this series, do you still want to buy it?
<b>Interviewee:</b> 嗯...會想想一下，去看別的。嗯。那如果真的很喜歡才會買這個。	<b>Interviewee:</b> Hmm... I'll think about it, look at others. Hmm. Then if I really like it, I'll buy this one.
<b>Me:</b> 好。那旁邊還有另外一個部分可以幫忙按喔？	<b>Me:</b> Okay. Then beside it, there's another part you can help press?
<b>Interviewee:</b> 可以幫忙按喔？還有？這是什麼？這個？嗯，它說至少減少碳排放量 30%，他叫我說可以看看別的品牌。	<b>Interviewee:</b> Can help press? Also? What's this? This one? Hmm, it says reduce carbon emissions by at least 30%, it tells me I can look at other brands.
<b>Me:</b> 那這些品牌你知道嗎？有看過嗎？	<b>Me:</b> Do you know these brands? Have you seen them?
<b>Interviewee:</b> 沒有，沒有看過這些。	<b>Interviewee:</b> No, haven't seen these.
<b>Me:</b> 那想要看嗎？好，這裡沒辦法看。我去問你有沒有想要看。剛剛才看什麼？不是看錯了。這個品牌你之前沒有看過？	<b>Me:</b> Want to look? Okay, can't look here. Let me ask if you want to look. What did you just see? Didn't see wrong. This brand, you haven't seen it before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 好。那...（看另一品牌）都已經爛了啊？有、有、有，這一個。	<b>Me:</b> Okay. Then... (Looking at another brand) It's already rotten? Yes, yes, yes, this one.
<b>Interviewee:</b> 那你覺得什麼樣？嗯，覺得比較貴喔。那可能鞋子比較小，是女生的鞋？	<b>Interviewee:</b> What do you think? Hmm, feels more expensive. Oh. Then maybe the shoes are smaller, are they women's shoes?
<b>Me:</b> 好。那他的那個外表呢？外表就是喜歡不喜歡？	<b>Me:</b> Okay. What about its appearance? Appearance, like or dislike?
<b>Interviewee:</b> 他看起來怎麼樣？不會特別想買。嗯。然後，但是他說是巴西的運動品牌。嗯。但他（這裡）說他的生產聚酯纖維使用很可疑。嗯。是隸屬於 FMCG 類別。嗯。他說對於尋求更高環保的標準的消費者，建議考慮其他這三個品牌。	<b>Interviewee:</b> How does it look? Wouldn't particularly want to buy. Hmm. Then, but it says it's a Brazilian sports brand. Hmm. But it (here) says its production's polyester fiber use is very suspicious. Hmm. Belongs to the FMCG category. Hmm. It says for consumers seeking higher environmental standards, it's recommended to consider these other three brands.
<b>Me:</b> 那你有，你有，你看到這個覺得怎麼樣？	<b>Me:</b> Then you have, you have, what do you think seeing this?
<b>Interviewee:</b> 覺得說我應該回去買 Nike。	<b>Interviewee:</b> Feel like I should go back and buy Nike.
<b>Me:</b> 好啊。那你可（以）回回回 Nike 那邊這樣子。	<b>Me:</b> Okay. Then you can go back back back to the Nike page like that.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那，嗯，等一下。好。所以它的最下面還有...啊，不是，那個最下面那個第三個按鈕，你覺得這是什麼？這是...這可能是投資 Nike 的東西吧？啊。	<b>Me:</b> Okay. Then, hmm, wait a moment. Okay. So at its very bottom there's still... ah, no, that bottom one, the third button, what do you think this is? This is... this might be things for investing in Nike, right? Ah.
<b>Me:</b> 你有最近有投資過嗎？	<b>Me:</b> Have you invested recently?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 那你看這個投資的部分，嗯，下面有寫一些東西。這個，呃，是什麼？	<b>Me:</b> Then you look at this investment part, hmm, below it writes some things. This, uh, what is it?
<b>Interviewee:</b> 他說他的，他的投資的狀況有下跌，從 82 美金掉到 71 美金。他說反映出市場對該品牌的信心有所下降。嗯。他說他是一個全球知名的運動品牌。但是好多問題，長期以來備受關注。	<b>Interviewee:</b> It says its, its investment situation has declined, dropping from \$82 USD to \$71 USD. It says this reflects a decrease in market confidence in the brand. Hmm. It says it's a globally renowned sports brand. But many issues, long-term attention received.
<b>Me:</b> 那你有，有，有...有想要投資嗎？還是想要思考同考慮投資嗎？	<b>Me:</b> Then do you have, have, have... want to invest? Or want to think about the same consider investing?
<b>Interviewee:</b> 應該還不會。	<b>Interviewee:</b> Probably not yet.
<b>Me:</b> 好。那你可以幫我回另外一個就是...這個，這個這個。啊，最下面這些兩個按鈕，有有想要按一個嗎？	<b>Me:</b> Okay. Can you help me go back to the other one, just... this, this, this one. Ah, these two buttons at the very bottom, do you, do you want to press one?
<b>Interviewee:</b> 還好。	<b>Interviewee:</b> It's okay.
<b>Me:</b> 好。那如果不想按也可以。好。嗯。那這是最上面那個號碼，幫我寫啊。	<b>Me:</b> Okay. If you don't want to press, that's also okay. Okay. Hmm. Then this is the very top number, help me write it down.
<b>Interviewee:</b> 最上面的號碼？ 啊，在這裡。	<b>Interviewee:</b> The very top number? Ah, it's here.
<b>Me:</b> 謝謝。但是要寫號碼還是...	<b>Me:</b> Thank you. But should I write the number or...
<b>Interviewee:</b> 這個號碼就夠了。	<b>Interviewee:</b> This number is enough.
<b>Me:</b> 6R02U-1。	<b>Me:</b> 6R02U-1.
<b>Interviewee:</b> (寫號碼)	<b>Interviewee:</b> (Writes number)
<b>Me:</b> 好了？ 好。那對你來說，剛剛你看到的內容，最重要的部分在哪裡？	<b>Me:</b> Done? Okay. Then for you, in the content you saw just now, where is the most important part?
<b>Interviewee:</b> 可能是那個告訴我們它的環保不環保的問題。	<b>Interviewee:</b> Maybe the part that tells us whether it's environmentally friendly or not.
<b>Me:</b> 好。那你現在有空嗎？ 可以幫我掃那個 QR 和填那個問卷嗎？	<b>Me:</b> Okay. Are you free now? Can you help me scan that QR code and fill out that questionnaire?
<b>Interviewee:</b> 好啊。	<b>Interviewee:</b> Sure.

### 16.1.14 Transcript 2025-01-10 - Tainan (TNNUA) - 6R02U

**Source Files:** \* 2025-01-10 - Tainan (TNNUA) - 6R02U.json \* 2025-01-10 - Tainan (TNNUA) - 6R02U.txt

**Ziran ID Code:** 6R02U

Traditional Chinese Transcript	English Translation
<b>Me:</b> 我先測試一下。所以基本上這個是綠綠 (註: 應為這個是), 我的論文的一部分, 環保軟體。那我們等一下有測試這個 App。我可以錄影你的聲音嗎？	<b>Me:</b> Let me test first. So basically this is Green Green (Note: Should be “This is”), part of my thesis, an environmental protection software. Then later we will test this App. Can I record your voice?
<b>Interviewee:</b> 嗯。好啊。可以，可以。	<b>Interviewee:</b> Hmm. Sure. Yes, yes.
<b>Me:</b> 好。那我先問你，你有用過 Momo 嗎？	<b>Me:</b> Okay. Let me ask you first, have you used Momo?
<b>Interviewee:</b> 我沒有。	<b>Interviewee:</b> I haven’t.
<b>Me:</b> 那另外一個是什麼？	<b>Me:</b> What about the other one?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Me:</b> 蝦皮。用蝦皮比較多？ 啊你呢？有用過蝦皮還是另外一個？	<b>Me:</b> Shopee. Use Shopee more? And you? Have you used Shopee or the other one?
<b>Interviewee:</b> 用蝦皮，也有用過。	<b>Interviewee:</b> Use Shopee, have used it too.
<b>Me:</b> 還有另外一個平台還有？ 呃...	<b>Me:</b> Are there other platforms as well? Uh...
<b>Interviewee:</b> 沒有耶，只有蝦皮。	<b>Interviewee:</b> No, only Shopee.
<b>Me:</b> 好。那你平常在網路上會買什麼類型的東西？	<b>Me:</b> Okay. What type of things do you usually buy online?
<b>Interviewee:</b> 材料。	<b>Interviewee:</b> Materials.
<b>Me:</b> 材料？ 藝術材料？	<b>Me:</b> Materials? Art materials?
<b>Interviewee:</b> 對，就是可能什麼電線啊什麼的。	<b>Interviewee:</b> Yes, like maybe wires or something.
<b>Me:</b> 你呢？	<b>Me:</b> And you?
<b>Interviewee:</b> 我應該也是，有時候會買衣服什麼的。	<b>Interviewee:</b> I probably too, sometimes buy clothes or something.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 那你在蝦皮 (註: TXT 誤聽為 shopee) 想買東西，你有東西你沒有遇到嗎？就是想買但是找不到？有找不到的東西嗎？就是想買但是網路上沒有？	<b>Me:</b> Then on Shopee (Note: TXT used “shopee”), when you want to buy things, have you encountered items you couldn’t find? Like, wanted to buy but couldn’t find? Are there things you can’t find? Like, want to buy but they’re not online?
<b>Interviewee:</b> 有。比如材料？有些材料也是沒辦法在網路上找到。	<b>Interviewee:</b> Yes. Like materials? Some materials also cannot be found online.
<b>Me:</b> 那OK，我們現在要試試這個 Momo。如果開Momo，你有什麼東西想買嗎？	<b>Me:</b> Then OK, we now need to try this Momo. If you open Momo, is there anything you want to buy?
<b>Interviewee:</b> 銅板。	<b>Interviewee:</b> Copper plate.
<b>Me:</b> 那你可以幫我自己寫一下嗎？這是拼音嗎？還是，這是英文嗎？但是可以用拼音還是注音都可以。	<b>Me:</b> Can you help me write it yourself? Is this Pinyin? Or, is this English? But you can use either Pinyin or Zhuyin.
<b>Interviewee:</b> 注音。	<b>Interviewee:</b> Zhuyin.
<b>Me:</b> 注音？有些有點不一樣嗎？嗯。再轉...欸，那個卡住了嗎？(網路問題)...有嗎？	<b>Me:</b> Zhuyin? Some are a bit different? Hmm. Turning again... Hey, is that stuck? (Network issue)... Is it there?
<b>Interviewee:</b> (搜尋「銅板」)...沒有機身？同？同？同心圓的(註: TXT 誤聽為新關)? 不是，「銅」。這是「ㄉㄨㄥˇㄉㄨㄥˇ」喔？「ㄉㄨㄥˇㄉㄨㄥˇ」...	<b>Interviewee:</b> (Searching “tong ban” - copper plate)... No fuselage? Tong? Tong? Concentric circle's (Note: TXT misheard as “new pass”)? No, “tong”. This is “tóng” oh? “Tóng”...
<b>Me:</b> 那你自己比較喜歡拼音還是中文還是什麼？	<b>Me:</b> Which do you prefer yourself, Pinyin or Chinese or what?
<b>Interviewee:</b> 我喜歡拼音欸。(發現打錯字) 這是我知道的，來...好像錯了，不是錯了啦，是打「銅」吧。Sorry sorry，對不起。「銅」...哪裡？	<b>Interviewee:</b> I like Pinyin. (Realizes typo) This I know, come... seems wrong, no it's not wrong, should type “tóng”. Sorry sorry, excuse me. “Tóng”... where?
<b>Me:</b> 六(ㄌㄧㄡˋ)？	<b>Me:</b> Six (liù)?
<b>Interviewee:</b> 愛河(ㄞˋㄏㄜˊ)。很簡單。	<b>Interviewee:</b> Love River (ài hé). Very simple.
<b>Me:</b> 沒有？沒有找到？嗯。你剛剛，剛剛只想要買什麼那個嗎？銅板？	<b>Me:</b> No? Didn't find it? Hmm. You just, just wanted to buy what, that one? Copper plate?
<b>Interviewee:</b> 銅板。	<b>Interviewee:</b> Copper plate.
<b>Me:</b> 好。那銅板之外，還有其他的東西(註: TXT 誤聽為車型)想買嗎？還是一個品牌嗎？你喜歡的品牌？	<b>Me:</b> Okay. Besides copper plate, are there other things (Note: TXT misheard as “car model”) you want to buy? Or a brand? A brand you like?
<b>Interviewee:</b> 你來。我沒有喜歡的品牌。	<b>Interviewee:</b> You pick. I don't have a favorite brand.
<b>Me:</b> 噢。這是你的助理？喜歡品牌？	<b>Me:</b> Hmm. This is your assistant? Likes brands?
<b>Interviewee:</b> 我不知道耶。	<b>Interviewee:</b> I don't know.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 呃...那選...那選...啊，這英文。好。那幫我選一個。	<b>Me:</b> Uh... then choose... then choose... Ah, this is English. Okay. Then help me choose one.
<b>Interviewee:</b> 我隨便選。	<b>Interviewee:</b> I'll choose randomly.
<b>Me:</b> 嗯。對，你喜歡的。(商品頁面顯示銷售一空) 哎，銷售一空，它賣完了。	<b>Me:</b> Hmm. Right, one you like. (Product page shows sold out) Hey, sold out, it's sold out.
<b>Interviewee:</b> 賣完了？	<b>Interviewee:</b> Sold out?
<b>Me:</b> 好。那你之前有買過這個產品嗎？還是這個品牌嗎？	<b>Me:</b> Okay. Have you bought this product before? Or this brand?
<b>Interviewee:</b> 有，這個品牌。	<b>Interviewee:</b> Yes, this brand.
<b>Me:</b> 這個品牌？但是？	<b>Me:</b> This brand? But?
<b>Interviewee:</b> 通常是在實體店面買，但又有一次是在網路上買。	<b>Interviewee:</b> Usually buy at the physical store, but there was one time I bought it online.
<b>Me:</b> 哦。那剛剛那個，這個網頁上面有看到什麼有興趣的嗎？	<b>Me:</b> Oh. Then just now, on this webpage, did you see anything interesting?
<b>Interviewee:</b> 穎...有有啦，我剛剛沒有仔細逛，但是應該是有。	<b>Interviewee:</b> Uh... yes yes, I didn't browse carefully just now, but there should be.
<b>Me:</b> 有？比如？	<b>Me:</b> Yes? For example?
<b>Interviewee:</b> 呃...應該像...像剛剛這個。	<b>Interviewee:</b> Uh... probably like... like that one just now.
<b>Me:</b> 好。那你看一下這個產品。(指示開啟插件)	<b>Me:</b> Okay. Then take a look at this product. (Instructs to open plugin)
<b>Interviewee:</b> OK。	<b>Interviewee:</b> OK.
<b>Me:</b> 你也可以選一個啊。下一個好了。	<b>Me:</b> You can also choose one. Ah. Next one is fine.
<b>Me:</b> 那你剛剛選什麼？為什麼選這個？	<b>Me:</b> What did you choose just now? Why choose this one?
<b>Interviewee:</b> 嗯... (選了外套)	<b>Interviewee:</b> Hmm... (Chose a jacket)
<b>Me:</b> 啊。然後選這個？	<b>Me:</b> Ah. Then chose this one?
<b>Interviewee:</b> 人。	<b>Interviewee:</b> Person.
<b>Me:</b> 那剛剛旁邊有一個黃色的部分是什麼？	<b>Me:</b> Then beside it just now, there was a yellow section, what is that?
<b>Interviewee:</b> 哦，幫你分析嗎？	<b>Interviewee:</b> Oh, helps you analyze?
<b>Me:</b> 嗯。大概幫你分析什麼？	<b>Me:</b> Hmm. Roughly analyzes what for you?
<b>Interviewee:</b> 就是...值不值得花錢。然後還有分析這個品牌的特性。	<b>Interviewee:</b> Like... whether it's worth spending money on. And also analyzes the characteristics of this brand.
<b>Me:</b> 嗯。那你覺得這個，這個重點(註: JSON 誤聽為終點)在哪裡？	<b>Me:</b> Hmm. What do you think is the point (Note: JSON misheard as "end point") here?
<b>Interviewee:</b> 是告訴你說這個...可能它的材質不好，那你可能不清楚，但這裡寫得很清楚。	<b>Interviewee:</b> It tells you that this... maybe its material is not good, and you might not know clearly, but it's written very clearly here.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 嗯。那你看到這個的之後 (註: JSON 誤聽為的車好)，還是想要買這個產品嗎？	<b>Me:</b> Hmm. After seeing this (Note: JSON misheard as “this car good”), do you still want to buy this product?
<b>Interviewee:</b> 嗯...他有說到環保的部分嗎？就是說這個是聚酯纖維？	<b>Interviewee:</b> Hmm... Did it mention the environmental protection part? Like saying this is polyester fiber?
<b>Me:</b> 他說什麼聚酯纖維好像不是環保的材質。好。這裡有說。	<b>Me:</b> What polyester fiber it says seems not to be an environmentally friendly material. Okay. It says here.
<b>Interviewee:</b> 就是有提醒你說這個東西聚酯纖維還有什麼？這個是化學汙染？好，那我覺得我會再慎重考慮一下。就是因為我買東西本來就不是我看到然後馬上會買，我會想很久。好。那這個給我一個，多一個參考的。	<b>Interviewee:</b> It reminds you that this thing, polyester fiber, and what else? This is chemical pollution? Okay, then I think I will reconsider carefully. Because when I buy things, I don't just buy immediately upon seeing them, I think for a long time. Okay. Then this gives me one, one more reference.
<b>Me:</b> 啊，上面還有兩個按鈕。	<b>Me:</b> Ah, there are two more buttons above.
<b>Interviewee:</b> (點擊按鈕) 這個是什麼？	<b>Interviewee:</b> (Clicks button) What is this?
<b>Me:</b> 「減少」。	<b>Me:</b> “Reduce”.
<b>Interviewee:</b> 就說如果你不買這個嘛？是這樣的意思？就是說這個東西所會製造的碳排放量。這些會製造地球的...	<b>Interviewee:</b> Meaning if you don't buy this? Is that the meaning? Meaning the carbon emissions this thing will produce. These will produce the Earth's...
<b>Me:</b> 對，這是它的數值嗎？嗯。	<b>Me:</b> Right, is this its numerical value? Hmm.
<b>Interviewee:</b> 那這些其他的品牌你有買過 (註: JSON 誤聽為賣光) 嗎？還是有聽聽過說嘛？	<b>Interviewee:</b> Then these other brands, have you bought (Note: JSON misheard as “sold out”) them? Or have you heard of them?
<b>Me:</b> 呃...聽說過。呃...這是什麼？嗯...我以為我英文不好。這個是什麼？Patagonia？	<b>Me:</b> Uh... heard of them. Uh... What's this? Hmm... I thought my English was bad. What's this? Patagonia?
<b>Interviewee:</b> Patagonia 是什麼？我好像沒有，沒有注意那個。	<b>Interviewee:</b> What is Patagonia? I don't seem to have, haven't noticed that one.
<b>Me:</b> OK。登山的那個？	<b>Me:</b> OK. The hiking one?
<b>Interviewee:</b> 登山品牌？哦，好，有。	<b>Interviewee:</b> Hiking brand? Oh, okay, yes.
<b>Me:</b> 那，我可能要看他的 logo。	<b>Me:</b> Then, I might need to see its logo.
<b>Interviewee:</b> 我看你要查一下。	<b>Interviewee:</b> I see you need to look it up.
<b>Me:</b> 好。那哦，我知道。哦。	<b>Me:</b> Okay. Then oh, I know. Oh.
<b>Me:</b> 好。那最後一個部分呢？這是什麼？	<b>Me:</b> Okay. What about the last section? What is this?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 最終你買過其他產品的公司？就是說這個？這個是指什麼？我這個有點不懂。	<b>Interviewee:</b> Finally, the company whose other products you've bought? Meaning this? What does this refer to? I don't quite understand this one.
<b>Me:</b> 好啊，沒問題。嗯。所以下面還有兩個按鈕，你想要按一個互相聊也可以。	<b>Me:</b> Okay, no problem. Hmm. So below there are still two buttons, do you want to press one to chat with each other, that's also okay.
<b>Interviewee:</b> 我試試看看。	<b>Interviewee:</b> Let me try and see.
<b>Me:</b> (Participant clicks button) 還有什麼？	<b>Me:</b> (Participant clicks button) What else?
<b>Interviewee:</b> 「持續」...哦，它給你其他替代的品牌。然後告訴你說這些品牌是比較有，有對環保有幫助的啊。那這個是一個 AI 幫手，也可以自己問問題。	<b>Interviewee:</b> "Sustainable"... Oh, it gives you other alternative brands. Then tells you these brands are more, have, are helpful to environmental protection. Ah. Then this is an AI assistant, you can also ask questions yourself.
<b>Me:</b> 嗯。那有什麼問題想要問嗎？	<b>Me:</b> Hmm. Do you have any questions you want to ask?
<b>Interviewee:</b> 嗯...沒有。	<b>Interviewee:</b> Hmm... No.
<b>Me:</b> 想？也可以自己打字 (註: JSON 誤聽為 搭車)。	<b>Me:</b> Think? You can also type yourself (Note: JSON misheard as "take car").
<b>Interviewee:</b> 嗯。但我，我想問就是那個品牌...就是它跳出來的那幾個，它推薦的。但是會不會就是，就是變成只固定那幾個品牌？就是畢竟我覺得在做環保的品牌線現在有越來越多，但是還是比較是少數啊。那這樣子會不會就是每次我只要搜尋(註: TXT 誤聽為 取)什麼，然後跳出來的都是一樣的，一樣的？會有這個問題喔。	<b>Interviewee:</b> Hmm. But I, I want to ask about that brand... like those few that popped up, the ones it recommended. But will it, will it become fixed to only those few brands? Because after all, I feel that the line of environmentally friendly brands is increasing now, but it's still relatively a minority. Ah. Then in that case, will it be that every time I just search (Note: TXT misheard as "take") for something, the ones that pop up are all the same, the same? There might be this issue.
<b>Me:</b> 好。	<b>Me:</b> Okay.
<b>Me:</b> 好。那這樣就可以了。手機，你可以使用你的手機掃描這個 QR。那下面有一個問卷。那這個測試代碼要就是這些，所以如果你測試一個產品就可以了。但是你因為你測試三個產品，可以寫三個。好。好。謝謝。	<b>Me:</b> Okay. That's fine then. Phone, you can use your phone to scan this QR. Then below there's a questionnaire. And this test code is just these, so if you tested one product, that's fine. But since you tested three products, you can write three. Okay. Okay. Thank you.
<b>Me:</b> 呃，那你可 (以) 幫我簽名 (註: JSON 誤聽為 其實) 那個卡片上？寫這個號碼？	<b>Me:</b> Uh, then can you help me sign (Note: JSON misheard as "actually") that card? Write this number?
<b>Interviewee:</b> 哟好。	<b>Interviewee:</b> Oh okay.
<b>Me:</b> 6R02U-2。	<b>Me:</b> 6R02U-2.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> (寫號碼) 好。	<b>Interviewee:</b> (Writes number) Okay.

### 16.1.15 Transcript 2025-02-12 - Pingtung (NPUST) - BY11X

**Source Files:** \* 2025-02-12 - Pingtung (NPUST) - BY11X.json \* 2025-02-12 - Pingtung (NPUST) - BY11X.txt

**Ziran ID Code:** BY11X

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我可以錄影這個對話嗎？	<b>Interviewer:</b> Can I record this conversation?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 好。那我...我是建功大學創意設計所的碩士班的學生。這個是我的論文的一部分，我的 app。那等一下我會問你一些問題，你可以幫我解釋我的 app 嗎？	<b>Interviewer:</b> Okay. So I... I'm a master's student from the Institute of Creative Design at Jian Gong University. This is part of my thesis, my app. Then later I will ask you some questions, can you help me explain my app?
<b>Interviewee:</b> 嗯，可以。	<b>Interviewee:</b> Um, yes.
<b>Interviewer:</b> 好，那我們開始了。你已經有下載那個軟體嗎？	<b>Interviewer:</b> Okay, let's start. Have you already downloaded the software?
<b>Interviewee:</b> 有。在這裡。	<b>Interviewee:</b> Yes. It's here.
<b>Interviewer:</b> 好。那你可幫我開 momo ？那 momo 你之前有用過嗎？	<b>Interviewer:</b> Okay. Can you help me open momo? Have you used momo before?
<b>Interviewee:</b> 呃...有，我用過。	<b>Interviewee:</b> Uh... yes, I've used it.
<b>Interviewer:</b> 那你平常會網路上買東西嗎？	<b>Interviewer:</b> Do you usually buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 是比較適用 momo 還是其他的平台？	<b>Interviewer:</b> Do you prefer using momo or other platforms?
<b>Interviewee:</b> 其他的平台。	<b>Interviewee:</b> Other platforms.
<b>Interviewer:</b> 比如像...	<b>Interviewer:</b> Such as...
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 好。那還有其他的嗎？	<b>Interviewer:</b> Okay. Are there any others?
<b>Interviewee:</b> 嗯...應該是蝦皮比較居多。	<b>Interviewee:</b> Um... probably mostly Shopee.
<b>Interviewer:</b> 好。那 Shopee 上你平常會買什麼樣的東西？	<b>Interviewer:</b> Okay. What kind of things do you usually buy on Shopee?
<b>Interviewee:</b> 買日常用品或衣服。	<b>Interviewee:</b> Buy daily necessities or clothes.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那那個 momo 上你上次買了什麼呢？	<b>Interviewer:</b> Okay. What about on momo, what did you buy last time?
<b>Interviewee:</b> momo 上我好像買了...忘記我買什麼，但應該也是日常用品。	<b>Interviewee:</b> On momo, I think I bought... I forgot what I bought, but it should also be daily necessities.
<b>Interviewer:</b> 好。那你現在有什麼想買的嗎？	<b>Interviewer:</b> Okay. Is there anything you want to buy now?
<b>Interviewee:</b> 我現在...呃...可以直接往下看？	<b>Interviewee:</b> Right now... uh... can I just scroll down?
<b>Interviewer:</b> 可以啊可以啊。也可以直接打字。	<b>Interviewer:</b> Yes, yes. You can also type directly.
<b>Interviewee:</b> 啊...快鍋。嗯。好。	<b>Interviewee:</b> Ah... quick pot [pressure cooker]. Um. Okay.
<b>Interviewer:</b> (Waits) 這是什麼？	<b>Interviewer:</b> (Waits) What is this?
<b>Interviewee:</b> 呃，快煮鍋。這是一個鍋子，然後可以直接插電。	<b>Interviewee:</b> Uh, quick-cook pot. This is a pot, and you can plug it in directly.
<b>Interviewer:</b> 好。嗯，比較小型的。那你要特別想要買一個品牌嗎？還是...	<b>Interviewer:</b> Okay. Um, a smaller type. Do you particularly want to buy a specific brand? Or...
<b>Interviewee:</b> 噢...比較喜歡的品牌應該是這個。	<b>Interviewee:</b> Um... the brand I prefer is probably this one.
<b>Interviewer:</b> 這哪一個？	<b>Interviewer:</b> Which one is this?
<b>Interviewee:</b> 富麗森。	<b>Interviewee:</b> Fujimori.
<b>Interviewer:</b> 噢。那為什麼你比較喜歡這個？	<b>Interviewer:</b> Um. Why do you prefer this one?
<b>Interviewee:</b> 因為...呃...之前有人...之前有看別人買，然後很推薦這個品牌的快煮鍋。	<b>Interviewee:</b> Because... uh... someone before... I saw someone else buy it before, and they highly recommended this brand's quick-cook pot.
<b>Interviewer:</b> 好。那幫我按這個。	<b>Interviewer:</b> Okay. Help me press this one.
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 所以其他人，你認識其他人有...有...有買過？但是你自己沒有買過這個品牌？	<b>Interviewer:</b> So other people, you know others who have... have... bought it? But you yourself haven't bought this brand?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那這個網頁上你覺得對你來說，最重要的點是什麼？	<b>Interviewer:</b> Okay. On this webpage, what do you think is the most important point for you?
<b>Interviewee:</b> 噢...它的圖片跟商品介紹內容。	<b>Interviewee:</b> Um... its pictures and the product description content.
<b>Interviewer:</b> 好。	<b>Interviewer:</b> Okay.
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那價格呢？	<b>Interviewer:</b> What about the price?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 價格也是一個考量點。	<b>Interviewee:</b> Price is also a consideration point.
<b>Interviewer:</b> 那你可以幫我看一下下面？這裡它說什麼？	<b>Interviewer:</b> Can you help me look below? What does it say here?
<b>Interviewee:</b> 這裡...「基本上買東西也是一種投資喔！我可以幫你分析你花的錢是支持好公司還是不好的公司。」這個也要唸嗎？	<b>Interviewee:</b> Here... "Basically, buying things is also a form of investment! I can help you analyze whether the money you spend supports good companies or bad companies." Do I need to read this too?
<b>Interviewer:</b> 不要唸，就是你自己說的，它的重點是什麼？	<b>Interviewer:</b> Don't read it, just tell me in your own words, what's its main point?
<b>Interviewee:</b> 重點...他幫我分析，他幫我就是快速的介紹這個品牌的...應該是說這個東西的用途，然後還有...嗯...他的材料和他的產地，然後還有 ESG 還有永續性的評級。哦。	<b>Interviewee:</b> Main point... it helps me analyze, it helps me quickly introduce this brand's... should say this thing's uses, and also... um... its materials and its origin, and also ESG and sustainability ratings. Oh.
<b>Interviewer:</b> 那對你來說這裡有什麼你有興趣的嗎？	<b>Interviewer:</b> Then for you, is there anything here you're interested in?
<b>Interviewee:</b> 在這個框框嗎？	<b>Interviewee:</b> In this box?
<b>Interviewer:</b> 嗯。	<b>Interviewer:</b> Um.
<b>Interviewee:</b> 我覺得我有興趣的是它的這個材料、永續性評估。	<b>Interviewee:</b> I think what interests me are its materials, sustainability assessment.
<b>Interviewer:</b> 嗯。為什麼？	<b>Interviewer:</b> Um. Why?
<b>Interviewee:</b> 因為...呃...好像有一些材質如果不好用的話，可能會有塑化劑或什麼的。然後他這邊有幫我列出來，所以代表說這個產品他沒有。然後如果他用來煮食物的話，應該不會有什麼就是危害人體的東西。	<b>Interviewee:</b> Because... uh... it seems some materials, if they are not good quality [implying safety], might contain plasticizers or something. And it listed them for me here, so it means this product doesn't have them. And if it's used to cook food, it probably won't have anything harmful to the human body.
<b>Interviewer:</b> 嗯嗯。那你會相信這個資料嗎？	<b>Interviewer:</b> Mhm. Would you believe this information?
<b>Interviewee:</b> 嗯...我會相信。	<b>Interviewee:</b> Um... I would believe it.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?
<b>Interviewee:</b> 因為我覺得他...這是 AI 對不對？它這個是應該是...你有點類似像 ChatGPT 喔？就是有大數據的統整出來的。	<b>Interviewee:</b> Because I think it... this is AI, right? This one is probably... you're a bit like ChatGPT, oh? Like, it's consolidated from big data.
<b>Interviewer:</b> 好。那你可以幫我開那個第二個部分？最上面。	<b>Interviewer:</b> Okay. Can you help me open the second section? At the very top.
<b>Interviewee:</b> 最上面？這個？	<b>Interviewee:</b> The very top? This one?
<b>Interviewer:</b> 儲蓄式？那這是什麼？	<b>Interviewer:</b> The savings type? What is this?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 「透過購買更多環保商品可以...嗯...哦，減少碳排放量。」所以這是其他品牌的名稱？ �恩。哦，他給我的建議嗎？	<b>Interviewee:</b> "By purchasing more environmentally friendly products, you can... um... oh, reduce carbon emissions." So these are names of other brands? Um. Oh, are these its recommendations for me?
<b>Interviewer:</b> 你覺得呢？	<b>Interviewer:</b> What do you think?
<b>Interviewee:</b> 我覺得應該是他給我其他品牌的建議。然後第一個是綠色生活，我好像有聽...咦，等一下等一下，至少已經是選擇科技品牌，至少他們還有放品牌名稱。	<b>Interviewee:</b> I think it's probably giving me recommendations for other brands. And the first one is Green Living, I think I've heard... eh, wait wait, at least it's choosing tech brands, at least they still put the brand names.
<b>Interviewer:</b> 嗯。這些品牌你最近有看過嗎？	<b>Interviewer:</b> Um. Have you seen these brands recently?
<b>Interviewee:</b> 綠色生活好像有聽過，但其他...一二三四五...其他四項我沒有聽過。	<b>Interviewee:</b> Green Living seems familiar, but the others... one two three four five... the other four I haven't heard of.
<b>Interviewer:</b> 那你覺得這些企業會影響你嗎？ 就是你的選擇？	<b>Interviewer:</b> Do you think these companies would influence you? Like, your choice?
<b>Interviewee:</b> 會，但是我還是會搜尋一下。	<b>Interviewee:</b> Yes, but I would still search them up.
<b>Interviewer:</b> 嗯。嗯。好。那你想要多other他指導嗎呢？	<b>Interviewer:</b> Um. Um. Okay. Do you want more guidance on other things?
<b>Interviewee:</b> 用 momo 再繼續找其他商品嗎？ 還是？	<b>Interviewee:</b> Use momo to continue looking for other products? Or?
<b>Interviewer:</b> 嗯嗯，其他的，其他。所以可以再選其他商品？	<b>Interviewer:</b> Mhm, others, other things. So you can choose other products again?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那你可以幫我開另外一個？ 另外一個。Yeah，就是對。看一下。	<b>Interviewer:</b> Then can you help me open another one? Another one. Yeah, just right. Take a look.
<b>Interviewee:</b> 好。(Opens new tab/page) 好了。	<b>Interviewee:</b> Okay. (Opens new tab/page) Done.
<b>Interviewer:</b> 好。那你可打字？	<b>Interviewer:</b> Okay. Can you type?
<b>Interviewee:</b> 我看一下。回主頁。嗯。想一下...我應該想要買美妝用品。這一個。(Selects product)	<b>Interviewee:</b> Let me see. Back to homepage. Um. Let me think... I probably want to buy beauty products. This one. (Selects product)
<b>Interviewer:</b> 嗯。你現在在打什麼？	<b>Interviewer:</b> Um. What are you typing now?
<b>Interviewee:</b> 嗯...這個是算乳液，然後我現在想要選...選這個。這個是算是臉上的乳液。	<b>Interviewee:</b> Um... this is considered a lotion, and now I want to choose... choose this one. This is considered a face lotion.
<b>Interviewer:</b> 嗯。好。那這個網頁上你覺得有什麼你有興趣的嗎？	<b>Interviewer:</b> Um. Okay. On this webpage, do you think there's anything you're interested in?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 噢...有興趣的喔...這是他的品牌，我之前就用過，所以我覺得還不錯。然後吸引我的應該是他這個買二送五。	<b>Interviewee:</b> Um... interested in... oh... this is its brand, I've used it before, so I think it's quite good. Then what attracts me is probably this "buy two get five free".
<b>Interviewer:</b> 哦。好。嗯。那那個黃色的部分裡面呢？ 黃色的裡面，他有說什麼重要的嗎？	<b>Interviewer:</b> Oh. Okay. Um. What about inside that yellow section? Inside the yellow part, did it say anything important?
<b>Interviewee:</b> 哦，他也是先大概講一下他的...這個我購買商品的品牌小介紹，然後還有...呃...他在哪一個國家，然後他的工廠在哪裡，然後使用的材料，還有可持續性或是一些勞工問題的評分。	<b>Interviewee:</b> Oh, it also first roughly talks about its... this brand of the product I'm buying, a small introduction, and also... uh... which country it's in, and where its factory is, then the materials used, and sustainability or some labor issue ratings.
<b>Interviewer:</b> 那有什麼你驚訝的部分嗎？你之前不知道的？	<b>Interviewer:</b> Is there anything surprising to you? That you didn't know before?
<b>Interviewee:</b> 這個...我不知道股票代碼。	<b>Interviewee:</b> This... I don't know the stock code.
<b>Interviewer:</b> 好好。那幫我看那個最上面的，就是那個投資的部分？	<b>Interviewer:</b> Okay okay. Help me look at the very top one, the investment section?
<b>Interviewee:</b> 投資？	<b>Interviewee:</b> Investment?
<b>Interviewer:</b> 對。那你之前有投資過嗎？	<b>Interviewer:</b> Yes. Have you invested before?
<b>Interviewee:</b> 呃...我沒有。	<b>Interviewee:</b> Uh... I haven't.
<b>Interviewer:</b> 好。那，看到這個有興趣嗎？	<b>Interviewer:</b> Okay. Seeing this, are you interested?
<b>Interviewee:</b> 哟...我之前有看過，但是他現在 AI 幫我列出來的這兩個我不知道。EL？	<b>Interviewee:</b> Oh... I've seen it before, but these two that the AI listed for me now, I don't know them. EL?
<b>Interviewer:</b> 嗯。所以你是覺得這是什麼？	<b>Interviewer:</b> Um. So what do you think this is?
<b>Interviewee:</b> 他寫代號，應該是就是這間公司的代號，然後底下應該就是他列出來的股票的圖表。	<b>Interviewee:</b> It writes code, it should be the code for this company, and below should be the stock charts it listed.
<b>Interviewer:</b> 那你看到這個有想要買這個股票嗎？	<b>Interviewer:</b> Seeing this, do you feel like buying this stock?
<b>Interviewee:</b> 我想一下...我看一下...(Looks at chart)...我可能不會買，因為它的波動有點太大了。	<b>Interviewee:</b> Let me think... let me see... (Looks at chart)... I probably wouldn't buy, because its volatility is a bit too high.
<b>Interviewer:</b> 好。OK。那你可幫我 screenshot 這些部分嗎？ 你覺得重要的部分。	<b>Interviewer:</b> Okay. OK. Can you help me screenshot these parts? The parts you think are important.
<b>Interviewee:</b> 嗯。(Takes screenshot) 這個產品要...要入鏡嗎？	<b>Interviewee:</b> Um. (Takes screenshot) Does the product need to... be in the shot?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 還是...對對，就是全部你覺得重要的。	<b>Interviewer:</b> Or... yes yes, just everything you think is important.
<b>Interviewee:</b> 可以直接選這裡？ 嘿，但是我可能要先保存它一下。	<b>Interviewee:</b> Can I select directly here? Eh, but I might need to save it first.
<b>Interviewer:</b> 讓它消失。	<b>Interviewer:</b> Let it disappear.
<b>Interviewee:</b> (Takes another screenshot) 還有...嗯...	<b>Interviewee:</b> (Takes another screenshot) Also... um...
<b>Interviewer:</b> 剛剛那個另外一個產品也可以喔。	<b>Interviewer:</b> The other product from just now is also okay.
<b>Interviewee:</b> 好。嗯。(Takes screenshot) 這個...這邊加一張。好了。然後拍到的產品...這一個。	<b>Interviewee:</b> Okay. Um. (Takes screenshot) This one... add one here. Done. Then the product photographed... this one.
<b>Interviewer:</b> 那為什麼你選這些部分？	<b>Interviewer:</b> Why did you choose these parts?
<b>Interviewee:</b> 啊...欸？ 為什麼選這兩個產品嗎？	<b>Interviewee:</b> Um... eh? Why choose these two products?
<b>Interviewer:</b> 不是，就是你剛剛那個 screenshot，為什麼 screenshot 這個部分？	<b>Interviewer:</b> No, just the screenshot you took, why screenshot this part?
<b>Interviewee:</b> 啊...因為它有列出就是...就是重點，嗯，然後讓我在選擇可以依據它顯示的東西做一下判斷。	<b>Interviewee:</b> Uh... because it listed... just... the key points, um, and then it lets me make a judgment based on the things it displays when choosing.
<b>Interviewer:</b> 好。那最後面的部分，你可以幫我回那個第一個？ 然後最下面有兩個按鈕，你想要按一個嗎？	<b>Interviewer:</b> Okay. Then the last part, can you help me go back to the first one? Then at the very bottom, there are two buttons, do you want to press one?
<b>Interviewee:</b> 尋找替代商品...查看...嗯...這個。	<b>Interviewee:</b> Find Alternative Products... View... um... this one.
<b>Interviewer:</b> 好好。為什麼按這個呢？	<b>Interviewer:</b> Okay okay. Why press this one?
<b>Interviewee:</b> 因為它好像說這是...他還有其他推薦的品牌？ 所以我選擇了...嗯，這個。	<b>Interviewee:</b> Because it seems to say this is... it has other recommended brands? So I chose... um, this one.
<b>Interviewer:</b> 那他剛剛跟你說什麼？	<b>Interviewer:</b> What did it tell you just now?
<b>Interviewee:</b> 啊...他這邊點開來說我們的...哦，它的替代品牌的比較。他有列出來除了我選的富麗森以外，他還有列其他...一二三...其他三種的品牌。	<b>Interviewee:</b> Um... here it opens up saying our... oh, a comparison of its alternative brands. It listed besides the Fujimori I chose, it also listed others... one two three... three other kinds of brands.
<b>Interviewer:</b> 那這些你有聽說過嗎？	<b>Interviewer:</b> Have you heard of these?
<b>Interviewee:</b> 有。飛利浦我有聽過，但印象好像也有，但是這個...不是。	<b>Interviewee:</b> Yes. Philips I've heard of, but impression also seems familiar, but this one... no.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你覺得這些品牌怎麼樣？	<b>Interviewer:</b> What do you think of these brands?
<b>Interviewee:</b> 嗯...這個品牌，我記得飛利浦的品牌我記得還不錯，但是它好像用在其他電器商品。對。然後印象...我忘記是哪一個商品。	<b>Interviewee:</b> Um... this brand, I remember the Philips brand, I remember it's quite good, but it seems to be used in other electrical appliances. Yes. Then Impression... I forgot which product it was.
<b>Interviewer:</b> 嗯。好。嗯，OK。那你還有什麼問題你想要問 AI 嗎？	<b>Interviewer:</b> Um. Okay. Um, OK. Do you have any other questions you want to ask the AI?
<b>Interviewee:</b> 目前沒有。	<b>Interviewee:</b> Not at the moment.
<b>Interviewer:</b> 好。那就這樣就可以了。OK，謝謝。	<b>Interviewer:</b> Okay. Then this is fine. OK, thank you.

### 16.1.16 Transcript 2025-02-12 - Pingtung (NPUST) - CO2N2

**Source Files:** \* 2025-02-12 - Pingtung (NPUST) - CO2N2.json \* 2025-02-12 - Pingtung (NPUST) - CO2N2.txt

**Ziran ID Code:** CO2N2

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 你同意我錄音我們的對話嗎？	<b>Interviewer:</b> Do you agree to let me record our conversation?
<b>Interviewee:</b> 可以同意。	<b>Interviewee:</b> Yes, I agree.
<b>Interviewer:</b> 好。那基本上我是臺南應用科大設計系的碩班的學生。這個是我的論文的 app，那我要給你介紹這個 app，好，問你一些問題，可以嗎？	<b>Interviewer:</b> Okay. Basically, I am a master's student from the Department of Design at Tainan University of Technology. This is the app for my thesis. I want to introduce this app to you, okay, and ask you some questions, is that okay?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。呃，你先幫我開那個 momo。你之前有用過 momo 嗎？	<b>Interviewer:</b> Okay. Uh, first help me open that momo. Have you used momo before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 啊。那其他的可以買東西的平台嗎？例如是 Shopee？	<b>Interviewer:</b> Ah. What about other platforms for buying things? For example, Shopee?
<b>Interviewee:</b> Shopee 有。	<b>Interviewee:</b> Shopee, yes.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那 Shopee 的周圍還有其他嗎？還是 Shopee 而已？	<b>Interviewer:</b> Okay. Besides Shopee, are there others? Or just Shopee?
<b>Interviewee:</b> 嗯，Shopee 而已。	<b>Interviewee:</b> Um, just Shopee.
<b>Interviewer:</b> 好。那你 Shopee 商品上會買什麼？什麼樣的東西？	<b>Interviewer:</b> Okay. What do you buy on Shopee? What kind of things?
<b>Interviewee:</b> 嗯...貓咪寵物的用品。	<b>Interviewee:</b> Um... cat pet supplies.
<b>Interviewer:</b> 好。那我們這次使用 momo 一下。那你目前有什麼你想要買的嗎？	<b>Interviewer:</b> Okay. Let's use momo this time. Is there anything you currently want to buy?
<b>Interviewee:</b> 嗯...好，貓砂。	<b>Interviewee:</b> Um... okay, cat litter.
<b>Interviewer:</b> 可以啊。我什麼都可以打嗎？	<b>Interviewer:</b> Yes, you can. Can I type anything?
<b>Interviewee:</b> 你可以直接打。對。	<b>Interviewee:</b> You can type directly. Yes.
<b>Interviewer:</b> (Types) 好。	<b>Interviewer:</b> (Types) Okay.
<b>Interviewee:</b> (Browses)	<b>Interviewee:</b> (Browses)
<b>Interviewer:</b> 你有找到嗎？嗯。貓砂...哪一個？	<b>Interviewer:</b> Did you find it? Um. Cat litter... which one?
<b>Interviewee:</b> 這裡？你有想要買這種的嗎？	<b>Interviewee:</b> Here? Do you want to buy this type?
<b>Interviewer:</b> 這個。好。	<b>Interviewer:</b> This one. Okay.
<b>Interviewer:</b> 那是哪一個？	<b>Interviewer:</b> Which one is that?
<b>Interviewee:</b> 我要點嗎？	<b>Interviewee:</b> Should I click?
<b>Interviewer:</b> 嗯。	<b>Interviewer:</b> Um.
<b>Interviewee:</b> 好。(Clicks)	<b>Interviewee:</b> Okay. (Clicks)
<b>Interviewer:</b> 好。你可以講出來這是什麼？	<b>Interviewer:</b> Okay. Can you say what this is?
<b>Interviewee:</b> 這個是混合貓砂。	<b>Interviewee:</b> This is mixed cat litter.
<b>Interviewer:</b> 那這個品牌你有買過嗎？	<b>Interviewer:</b> Have you bought this brand before?
<b>Interviewee:</b> 嗯...沒有。很像我買的，但是沒有買過。	<b>Interviewee:</b> Um... no. It looks like the one I buy, but I haven't bought this one.
<b>Interviewer:</b> 好。那這個網頁上面，你覺得哪一個部分最重要的？對你來說。	<b>Interviewer:</b> Okay. On this webpage, which part do you think is most important? For you.
<b>Interviewee:</b> 最重要？圖片。	<b>Interviewee:</b> Most important? Pictures.
<b>Interviewer:</b> 圖片。為什麼？	<b>Interviewer:</b> Pictures. Why?
<b>Interviewee:</b> 因為我可以最直接看到我要買的商品。	<b>Interviewee:</b> Because I can most directly see the product I want to buy.
<b>Interviewer:</b> 好。那還有其他的嗎？	<b>Interviewer:</b> Okay. Are there others?
<b>Interviewee:</b> 嗯...你要參考一下？價格。	<b>Interviewee:</b> Um... need to refer to it? Price.
<b>Interviewer:</b> 好。那第三個你覺得重要的是什麼？	<b>Interviewer:</b> Okay. What's the third thing you think is important?
<b>Interviewee:</b> 成分。	<b>Interviewee:</b> Ingredients.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 成分、材料。好。那這裡這個成分它說什麼？	<b>Interviewer:</b> Ingredients, materials. Okay. What do the ingredients here say?
<b>Interviewee:</b> 這個成...成分是豆渣、澱粉、膨潤土、咖啡渣、礦砂等等。	<b>Interviewee:</b> This ingre... ingredients are soybean residue, starch, bentonite, coffee grounds, mineral sand, etc.
<b>Interviewer:</b> 那你覺得這個可以嗎？	<b>Interviewer:</b> Do you think this is okay?
<b>Interviewee:</b> 嗯...跟我平常用的不太一樣。	<b>Interviewee:</b> Um... it's a bit different from what I usually use.
<b>Interviewer:</b> 哦？為什麼不一樣？	<b>Interviewer:</b> Oh? Why is it different?
<b>Interviewee:</b> 嗯...我的成分比較簡單，這個加了很多不同的東西。	<b>Interviewee:</b> Um... mine has simpler ingredients, this one adds many different things.
<b>Interviewer:</b> 啊。那你可以看下面一點嗎？還有什麼其他的有趣的嗎？有興趣的嗎？	<b>Interviewer:</b> Ah. Can you look down a bit? Is there anything else interesting? Anything you're interested in?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那你覺得剛剛那個黃色的，它是這個網頁的一部分嗎？	<b>Interviewer:</b> Okay. That yellow part just now, do you think it's part of this webpage?
<b>Interviewee:</b> 看起來不是。	<b>Interviewee:</b> Doesn't look like it.
<b>Interviewer:</b> 好。為什麼？	<b>Interviewer:</b> Okay. Why?
<b>Interviewee:</b> 因為這裡是白色的，這個黃色，然後有特別的框框。	<b>Interviewee:</b> Because here it's white, this is yellow, and it has a special frame.
<b>Interviewer:</b> 好。那最上面，你可以看一下有三個不一樣的部分？	<b>Interviewer:</b> Okay. At the very top, can you take a look, there are three different sections?
<b>Interviewee:</b> (Looks)	<b>Interviewee:</b> (Looks)
<b>Interviewer:</b> 可以幫我按第二個？	<b>Interviewer:</b> Can you help me press the second one?
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 你覺得這是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 它的材料跟環保的關係。	<b>Interviewee:</b> Its materials and the relationship with environmental protection.
<b>Interviewer:</b> 啊。其他的品牌你有買過嗎？你有聽說過嗎？	<b>Interviewer:</b> Ah. Have you bought the other brands? Have you heard of them?
<b>Interviewee:</b> 沒有。其實我才養貓耶，兩三個月。	<b>Interviewee:</b> No. Actually, I just got a cat, only two or three months ago.
<b>Interviewer:</b> 啊。那你對這些品牌有興趣嗎？	<b>Interviewer:</b> Ah. Are you interested in these brands?
<b>Interviewee:</b> 這個...因為看不懂...感覺不一樣。	<b>Interviewee:</b> This one... because I don't understand... feels different.
<b>Interviewer:</b> 你講出來是哪一個？	<b>Interviewer:</b> Which one are you pointing out?
<b>Interviewee:</b> OK，應該是 EcoCat。	<b>Interviewee:</b> OK, should be EcoCat.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那最上面的第三個部分？	<b>Interviewer:</b> Okay. Then the third section at the top?
<b>Interviewee:</b> 投資？	<b>Interviewee:</b> Investment?
<b>Interviewer:</b> 你覺得這是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 哦，這是有關這個商品的公司。	<b>Interviewee:</b> Oh, this is about the company of this product.
<b>Interviewer:</b> 嗯。它說什麼？	<b>Interviewer:</b> Um. What does it say?
<b>Interviewee:</b> 它說它有代號，還有國家跟公司的名稱。	<b>Interviewee:</b> It says it has a code, and the country and company name.
<b>Interviewer:</b> 那這個會影響你的想法嗎？	<b>Interviewer:</b> Would this affect your thoughts?
<b>Interviewee:</b> 可能會。	<b>Interviewee:</b> Maybe.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?
<b>Interviewee:</b> 因為有些人不買中國的東西，所以有些人會因為這個公司有不好的事情，他就會影響他要不要買。	<b>Interviewee:</b> Because some people don't buy things from China, so some people, because this company has had bad incidents, it will affect whether they buy or not.
<b>Interviewer:</b> 哟，好。那... OK。所以這個商品是從中國來的？	<b>Interviewer:</b> Oh, okay. So... OK. So this product is from China?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那...好。那你可以幫我回第一個部分那邊嗎？這個？那最上面有一個號碼，可以幫我寫這個號碼在卡片上？	<b>Interviewer:</b> Okay. Then... okay. Can you help me go back to the first section there? This one? Then at the very top, there's a number, can you help me write this number on the card?
<b>Interviewee:</b> 這裡啊？就是這個號碼？	<b>Interviewee:</b> Here? Just this number?
<b>Interviewer:</b> 那你可以幫我講出來嗎？	<b>Interviewer:</b> Can you help me say it out loud?
<b>Interviewee:</b> C-O-Z-N-2。	<b>Interviewee:</b> C-O-Z-N-2.
<b>Interviewer:</b> 好。這個都是匿名的，所以這樣我可以知道。好。那你可以幫我取下面一點嗎？好。所以下面有...有兩個案子？你可以幫我按一下按鈕？對。	<b>Interviewer:</b> Okay. This is all anonymous, so this way I can know. Okay. Can you help me go down a bit? Okay. So below there are... there are two cases? Can you help me press the button? Yes.
<b>Interviewee:</b> (Clicks button) 然後這裡還有什麼？	<b>Interviewee:</b> (Clicks button) Then what else is here?
<b>Interviewer:</b> 嗯。	<b>Interviewer:</b> Um.
<b>Interviewee:</b> 啊...我點進來之後，它就幫我顯示出我的商品，嗯，品牌，然後它就給我其他建議的品牌。不同的。	<b>Interviewee:</b> Ah... after I clicked in, it showed me my product, um, the brand, and then it gave me other recommended brands. Different ones.
<b>Interviewer:</b> 哟，那這些你有看過嗎？之前有看過嗎？	<b>Interviewer:</b> Oh, have you seen these before? Have you seen them previously?
<b>Interviewee:</b> 沒有。就不同的成分，也不同的牌子。	<b>Interviewee:</b> No. Just different ingredients, and different brands.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你還有什麼其他的問題，你想要問他嗎？這個AI？	<b>Interviewer:</b> Do you have any other questions you want to ask it? This AI?
<b>Interviewee:</b> 嗯...可以點這個嗎？	<b>Interviewee:</b> Um... can I click this?
<b>Interviewer:</b> 你可以點，還是也可以直接直接打字。	<b>Interviewer:</b> You can click, or you can also directly type.
<b>Interviewee:</b> 啊...我怎麼減少亂買？ (Clicks button, scrolls)	<b>Interviewee:</b> Ah... How do I reduce impulse buying? (Clicks button, scrolls)
<b>Interviewer:</b> 你要去上面一點吧？哦，有。有。有。有了。	<b>Interviewer:</b> You need to go up a bit? Oh, yes yes. Yes. Oh, got it.
<b>Interviewee:</b> (Scrolls up) 點兩次了。嗯。	<b>Interviewee:</b> (Scrolls up) Clicked twice. Um.
<b>Interviewer:</b> 他就會給你一些建議。	<b>Interviewer:</b> It will give you some suggestions.
<b>Interviewee:</b> 制定預算、列清單、三思而後行。	<b>Interviewee:</b> Set a budget, make a list, think twice before acting.
<b>Interviewer:</b> 那你覺得這裡面的重點是什麼？	<b>Interviewer:</b> What do you think is the main point in here?
<b>Interviewee:</b> 嗯...他會針對我的問題回答。	<b>Interviewee:</b> Um... it answers my question specifically.
<b>Interviewer:</b> 嗯。然後你說他的回答的重點嗎？	<b>Interviewer:</b> Um. And you're saying the main point of its answer?
<b>Interviewee:</b> 對。嗯...要想好自己到底要的是什麼。	<b>Interviewee:</b> Yes. Um... need to think clearly about what one really wants.
<b>Interviewer:</b> 好。OK。你還有其他的問題嗎？	<b>Interviewer:</b> Okay. OK. Do you have any other questions?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那這樣這樣可以了。好，謝謝你。謝謝。好嗎？	<b>Interviewer:</b> Okay. Then this is fine. Okay, thank you. Thank you. Okay?
<b>Interviewee:</b> (Nods)	<b>Interviewee:</b> (Nods)

### 16.1.17 Transcript 2025-03-05 - Tainan (NCKU) - ARXBP

**Source Files:** \* 2025-03-05 - Tainan (NCKU) - ARXBP.json \* 2025-03-05 - Tainan (NCKU) - ARXBP.txt

**Ziran ID Code:** ARXBP

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我現在要問你，可不可以錄音？	<b>Interviewer:</b> I want to ask you now, is it okay to record?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 這個...所以我...我是成功大學專業設計所的...設計...呃...的碩士生，然後我要問...我可以錄影這個對話嗎？	<b>Interviewer:</b> This... So I... I'm a master's student from the Professional Design Institute at National Cheng Kung University... design... uh... Then I want to ask... Can I record this conversation?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那你以前有下載那個軟體嗎？	<b>Interviewer:</b> Okay. Have you downloaded the software before?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你可以幫我開 momo 嗎？	<b>Interviewer:</b> Can you help me open momo?
<b>Interviewee:</b> (Opens momo)	<b>Interviewee:</b> (Opens momo)
<b>Interviewer:</b> 你之前有用過 momo 嗎？	<b>Interviewer:</b> Have you used momo before?
<b>Interviewee:</b> 沒有。momo 是購物網站嗎？	<b>Interviewee:</b> No. Is momo a shopping website?
<b>Interviewer:</b> 感覺網路真的很慢嗎？	<b>Interviewer:</b> Does the internet feel really slow?
<b>Interviewee:</b> 沒有開網頁。哦，有，我今天才用。	<b>Interviewee:</b> Haven't opened the webpage. Oh, yes, I just used it today.
<b>Interviewer:</b> 那你會在網路上買東西嗎？	<b>Interviewer:</b> Do you buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你是用什麼平台呢？	<b>Interviewer:</b> What platforms do you use?
<b>Interviewee:</b> 嗯...會用這個，然後也會用 PChome。	<b>Interviewee:</b> Um... I use this one, and I also use PChome.
<b>Interviewer:</b> 啊，所以你有用過 momo ?	<b>Interviewer:</b> Ah, so you have used momo?
<b>Interviewee:</b> 對，有用過 momo 。	<b>Interviewee:</b> Yes, I've used momo.
<b>Interviewer:</b> 那比如 Shopee 呢？	<b>Interviewer:</b> What about Shopee?
<b>Interviewee:</b> 有，會。	<b>Interviewee:</b> Yes, I do.
<b>Interviewer:</b> 啊。所以還有其他的嗎？	<b>Interviewer:</b> Ah. So are there others?
<b>Interviewee:</b> 嗯...屈臣氏、寶雅。	<b>Interviewee:</b> Um... Watsons, POYA.
<b>Interviewer:</b> 啊，很多。	<b>Interviewer:</b> Ah, many.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> OK。那國外的呢？ 國外的平台？	<b>Interviewer:</b> OK. What about foreign ones? Foreign platforms?
<b>Interviewee:</b> 嗯...有用過 Coupang ? 是國外的？ Coupang 是韓國的吧？ 嗯。	<b>Interviewee:</b> Um... Have I used Coupang? Is it foreign? Coupang is Korean, right? Um.
<b>Interviewer:</b> 對。有用過 Coupang ?	<b>Interviewer:</b> Yes. Have you used Coupang?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那 momo 上你平常會買什麼樣的東西？	<b>Interviewer:</b> Then on momo, what kind of things do you usually buy?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃...都會耶。呃...生活用品或是保養品。	<b>Interviewee:</b> Uh... I buy everything. Uh... daily necessities or skincare products.
<b>Interviewer:</b> 好。那你現在想要買什麼嗎？	<b>Interviewer:</b> Okay. Is there anything you want to buy now?
<b>Interviewee:</b> 我現在想要買...我想要買防曬。	<b>Interviewee:</b> Right now I want to buy... I want to buy sunscreen.
<b>Interviewer:</b> 好。那你搜尋。可以。	<b>Interviewer:</b> Okay. Then search. You can.
<b>Interviewee:</b> (Searches) 網路真的...很慢...慢慢的。	<b>Interviewee:</b> (Searches) The internet is really... slow... slow.
<b>Interviewer:</b> 好。你可以幫我選一個？ 選一個。	<b>Interviewer:</b> Okay. Can you help me choose one? Choose one.
<b>Interviewee:</b> 對。(Selects product)	<b>Interviewee:</b> Yes. (Selects product)
<b>Interviewer:</b> 為什麼選這個？	<b>Interviewer:</b> Why choose this one?
<b>Interviewee:</b> 嗯...因為我之前有用過。	<b>Interviewee:</b> Um... because I've used it before.
<b>Interviewer:</b> 嗯。你能給介紹是什麼樣的產品？	<b>Interviewer:</b> Um. Can you introduce what kind of product it is?
<b>Interviewee:</b> 它是一個防曬乳，然後它就可以讓你的皮膚看起來比較漂亮。	<b>Interviewee:</b> It's a sunscreen lotion, and it can just make your skin look nicer.
<b>Interviewer:</b> 嗯。對。那所以你之前有用過同一個品牌？	<b>Interviewer:</b> Um. Yes. So you've used the same brand before?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你開這個網頁，這裡你覺得哪一個部分比較重要？ 哪一個部分比較重要？	<b>Interviewer:</b> Then you open this webpage, here, which part do you think is more important? Which part is more important?
<b>Interviewee:</b> 我...應該是...哦，他還沒有開...要等一下...對。通常是就會看價錢。	<b>Interviewee:</b> I... probably... oh, it hasn't loaded yet... need to wait... yes. Usually, I would look at the price.
<b>Interviewer:</b> 看價錢。所以現在為什麼...啊，他是說開慢慢的還沒有開？ 還是這邊有...這邊有網路可以連嗎？	<b>Interviewer:</b> Look at the price. So why now... ah, is it saying it's loading slowly and hasn't opened? Or is there... is there internet here that can connect?
<b>Interviewee:</b> 有有有。	<b>Interviewee:</b> Yes yes yes.
<b>Interviewer:</b> 學校的？ 還是可以用...	<b>Interviewer:</b> The school's? Or can use...
<b>Interviewee:</b> 我的？	<b>Interviewee:</b> Mine?
<b>Interviewer:</b> 你學校的可以使用嗎？	<b>Interviewer:</b> Can you use the school's?
<b>Interviewee:</b> 我不确定。	<b>Interviewee:</b> I'm not sure.
<b>Interviewer:</b> 平常也會有這個問題嗎？	<b>Interviewer:</b> Do you usually have this problem too?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 材質？	<b>Interviewer:</b> Material?
<b>Interviewee:</b> (Connects to hotspot)	<b>Interviewee:</b> (Connects to hotspot)

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 這樣是不是花很多時間就是等網路？	<b>Interviewer:</b> Doesn't this waste a lot of time just waiting for the internet?
<b>Interviewee:</b> 對。現在他...現在學校的網路直接不見了喔。	<b>Interviewee:</b> Yes. Now it... now the school's internet just disappeared.
<b>Interviewer:</b> 好。還是我...我可以連我...	<b>Interviewer:</b> Okay. Or I... can I connect my...
<b>Interviewee:</b> 我可以開我的。	<b>Interviewee:</b> I can turn on mine.
<b>Interviewer:</b> 等我一下。(Connects to hotspot)看一下，有那個 iPhone 嗎？那個 XR 這個？對。好。密碼是這個。	<b>Interviewer:</b> Wait a moment. (Connects to hotspot) Take a look, is there that iPhone? That XR one? Yes. Okay. The password is this.
<b>Interviewee:</b> (Connects)	<b>Interviewee:</b> (Connects)
<b>Interviewer:</b> 那會快一點？	<b>Interviewer:</b> Will it be faster then?
<b>Interviewee:</b> 好。有有有。	<b>Interviewee:</b> Okay. Yes yes yes.
<b>Interviewer:</b> 好。那再一次...好。欸，還是慢慢的。嗯。好，那OK。那剛剛我有問你，你記得這裡哪一個部分比較重要？你剛剛說是價錢？	<b>Interviewer:</b> Okay. Then one more time... okay. Eh, still slow. Um. Okay, then OK. Then just now I asked you, do you remember which part here is more important? You just said price?
<b>Interviewee:</b> 價錢。	<b>Interviewee:</b> Price.
<b>Interviewer:</b> 還有其他的嗎？	<b>Interviewer:</b> Anything else?
<b>Interviewee:</b> 我會看商品描述，就是他會寫介紹這個商品。	<b>Interviewee:</b> I look at the product description, like it will write an introduction to this product.
<b>Interviewer:</b> 那第三個重要的地方是什麼？	<b>Interviewer:</b> Then what's the third important place?
<b>Interviewee:</b> 第三個重要的地方...我應該會看評價。	<b>Interviewee:</b> The third important place... I would probably look at reviews.
<b>Interviewer:</b> OK。對。那圖片呢？	<b>Interviewer:</b> OK. Yes. What about pictures?
<b>Interviewee:</b> 圖片...也會。嗯，就是它在商品描述這邊裡面就會有很多圖片。	<b>Interviewee:</b> Pictures... also yes. Um, just within the product description section here, there will be many pictures.
<b>Interviewer:</b> 哦。好。那你可以幫我去上面？那剛剛有一個新的都...跑出來了嗎？有什麼新的你之前沒有看過嗎？	<b>Interviewer:</b> Oh. Okay. Can you help me go up? Then just now was there anything new that... popped out? Anything new you haven't seen before?
<b>Interviewee:</b> 這...這一塊？	<b>Interviewee:</b> This... this block?
<b>Interviewer:</b> 那你覺得這是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 噢...很像一個 AI？然後很像一個小幫手？	<b>Interviewee:</b> Um... looks like an AI? And looks like a little helper?
<b>Interviewer:</b> AI 小幫手。那他在說什麼？	<b>Interviewer:</b> AI little helper. What is it saying?
<b>Interviewee:</b> 他在介紹這一間公司。對，他介紹這間公司它的生產...	<b>Interviewee:</b> It's introducing this company. Yes, it introduces this company's production...

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你覺得這裡介紹裡面的重點是什麼？	<b>Interviewer:</b> Then what do you think is the main point inside this introduction?
<b>Interviewee:</b> 重點應該是跟環境有關的，因為他很多寫永續、環境問題、永續性評級、ESG 評級。對。應該就是主要在講這間公司...等一下，因為聽起來有點大聲，你可以再講一次嗎？	<b>Interviewee:</b> The main point should be related to the environment, because it writes a lot about sustainability, environmental issues, sustainability rating, ESG rating. Yes. It should mainly be talking about this company... wait, because it sounds a bit loud, can you say it again?
<b>Interviewer:</b> 好。	<b>Interviewer:</b> Okay.
<b>Interviewee:</b> 我怕剛剛沒有錄音到。好。我覺得他這個描述感覺比較多著重在這間公司它在環境上的影響。	<b>Interviewee:</b> I was afraid it didn't record just now. Okay. I think this description seems to focus more on this company's impact on the environment.
<b>Interviewer:</b> 好。那你覺得對你來說最重要的點是什麼？	<b>Interviewer:</b> Okay. Then what do you think is the most important point for you?
<b>Interviewee:</b> 嗯...最重要...我應該會先看它有沒有負面的，就是對環境有沒有負面的影響。有的話就不會考慮啊。如果就是不確定的話，那我就會以這個產品的功能為主。	<b>Interviewee:</b> Um... most important... I would probably first see if it has negatives, like if it has a negative impact on the environment. If it does, I won't consider it. If it's just uncertain, then I'll focus on the product's functionality.
<b>Interviewer:</b> 那你覺得這裡內容裡面有什麼對你來說是新的嗎？你之前不知道的？	<b>Interviewer:</b> Then in the content here, is there anything new for you? That you didn't know before?
<b>Interviewee:</b> 嗯...新的...我覺得應該一樣，是什麼材料、永續性、環境問題、歷史，然後還有就是他這些...呃...還有勞工問題評級，這些分數還有描述是之前不會知道的事情。	<b>Interviewee:</b> Um... new... I think it should be the same, what materials, sustainability, environmental issues, history, and also these... uh... also labor issue ratings, these scores and descriptions are things I wouldn't have known before.
<b>Interviewer:</b> 嗯。那有什麼讓你驚訝的嗎？	<b>Interviewer:</b> Um. Was there anything that surprised you?
<b>Interviewee:</b> 好像...沒有耶。	<b>Interviewee:</b> Seems... no.
<b>Interviewer:</b> 好。對。那你可以幫我去上面啊，第二個部分？	<b>Interviewer:</b> Okay. Yes. Can you help me go up, ah, the second section?
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 第二個，儲蓄。你覺得這是什麼？	<b>Interviewer:</b> The second one, Savings. What do you think this is?
<b>Interviewee:</b> 可以購買？可以...	<b>Interviewee:</b> Can purchase? Can...
<b>Interviewer:</b> 是我還會使用它？	<b>Interviewer:</b> Will I still use it?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 因為它那麼便宜？ 哦，OK。我們要不要去樓上？ 我覺得今天上一天就可以了。這是其他牌子？ 其他品牌對環境的影響？	<b>Interviewee:</b> Because it's so cheap? Oh, OK. Should we go upstairs? I think one day today is enough. Are these other brands? Other brands' impact on the environment?
<b>Interviewer:</b> 那你之前有聽說這些品牌嗎？	<b>Interviewer:</b> Have you heard of these brands before?
<b>Interviewee:</b> 有一些有。	<b>Interviewee:</b> Some of them, yes.
<b>Interviewer:</b> 有買過嗎？	<b>Interviewer:</b> Have you bought them?
<b>Interviewee:</b> 有買過第一個，All Good。	<b>Interviewee:</b> Have bought the first one, All Good.
<b>Interviewer:</b> OK。那你會考慮買其他的嗎？ 還是你還是覺得你剛剛選的是最好的？	<b>Interviewer:</b> OK. Would you consider buying others? Or do you still feel the one you chose just now is the best?
<b>Interviewee:</b> 你說我一開始點進來的嗎？	<b>Interviewee:</b> You mean the one I clicked into initially?
<b>Interviewer:</b> 對對對。還是你在...可以也可以考慮其他的？	<b>Interviewer:</b> Yes yes yes. Or are you... you can also consider others?
<b>Interviewee:</b> 我覺得會考慮耶，就是會考慮。因為像他就友特別講說 All Good 他有使用天然的成分，對，但原本的牌子沒有特別寫。	<b>Interviewee:</b> I think I would consider, yes, would consider. Because like it specifically mentioned that All Good uses natural ingredients, yes, but the original brand didn't specifically write that.
<b>Interviewer:</b> 好。那你幫我看第三個部分。	<b>Interviewer:</b> Okay. Help me look at the third section.
<b>Interviewee:</b> 好。(Clicks)	<b>Interviewee:</b> Okay. (Clicks)
<b>Interviewer:</b> 你覺得這個是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 呃...他的股票代碼？	<b>Interviewee:</b> Uh... its stock code?
<b>Interviewer:</b> 那你之前有買過股票嗎？	<b>Interviewer:</b> Have you bought stocks before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 沒有買過股票？ 那你當初有興趣嗎？	<b>Interviewer:</b> Never bought stocks? Are you interested then?
<b>Interviewee:</b> 嗯...會。	<b>Interviewee:</b> Um... yes.
<b>Interviewer:</b> 那如果你是用這個品牌，你會考慮買這個品牌的股票嗎？	<b>Interviewer:</b> Then if you use this brand, would you consider buying this brand's stock?
<b>Interviewee:</b> 還是...應該不會。對，只會用它的產品，但不會買它的股票。	<b>Interviewee:</b> Or... probably not. Yes, will only use its products, but won't buy its stock.
<b>Interviewer:</b> OK。那你可以幫我回那個第一個部分？ 第一個？ 最下面有兩個按鈕。你要按一個嗎？	<b>Interviewer:</b> OK. Can you help me go back to the first section? First one? At the very bottom there are two buttons. Do you want to press one?
<b>Interviewee:</b> (Clicks “Good tradition” button)	<b>Interviewee:</b> (Clicks “Good tradition” button)

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那這裡的話，你還是可以問那個 AI 其他的問題。你有什麼問題想要問他嗎？	<b>Interviewer:</b> Then here, you can still ask the AI other questions. Do you have any questions you want to ask it?
<b>Interviewee:</b> 嗯...我們錄影兩分鐘就可以結束了？	<b>Interviewee:</b> Um... we can finish recording in two minutes?
<b>Interviewer:</b> (Laughs) 嗯。	<b>Interviewer:</b> (Laughs) Um.
<b>Interviewee:</b> 好像不會，我目前暫時沒有特別有什麼問題我想。	<b>Interviewee:</b> Seems not, I currently don't have any particular questions I think.
<b>Interviewer:</b> 好。那你覺得他剛剛跟你講的是什麼？	<b>Interviewer:</b> Okay. What do you think it told you just now?
<b>Interviewee:</b> 呃...他在比較不同品牌他的特點。	<b>Interviewee:</b> Uh... it's comparing the features of different brands.
<b>Interviewer:</b> 好。那你可回那個原本的地方？ 然後按第二個按鈕？	<b>Interviewer:</b> Okay. Can you go back to the original place? Then press the second button?
<b>Interviewee:</b> (Clicks second button)	<b>Interviewee:</b> (Clicks second button)
<b>Interviewer:</b> 等等回答一下。嗯。呃，最上面最上面。哦，對。他剛剛說什麼？	<b>Interviewer:</b> Wait for the answer. Um. Uh, the very top, very top. Oh, right. What did it say just now?
<b>Interviewee:</b> 它在說這個牌子，它在社會上的影響。然後還有這個產品的來源跟生產過程的內容。	<b>Interviewee:</b> It's talking about this brand, its social impact. And also the origin and production process content of this product.
<b>Interviewer:</b> 那你想要看嗎？	<b>Interviewer:</b> Do you want to see it?
<b>Interviewee:</b> 嗯...會，會想看。	<b>Interviewee:</b> Um... yes, would want to see.
<b>Interviewer:</b> 那你可以跟大家說 OK。	<b>Interviewer:</b> Then you can tell everyone OK. [Likely instructing how to interact with the AI prompt]
<b>Interviewee:</b> (Interacts with AI) 好。	<b>Interviewee:</b> (Interacts with AI) Okay.
<b>Interviewer:</b> 這個是假的。好。那你可以幫我回那個原本的地方？ 然後最上面有一個號碼，一個代碼，你幫我講出來。	<b>Interviewer:</b> This is fake. Okay. Can you help me go back to the original place? Then at the very top there's a number, a code, help me say it out loud.
<b>Interviewee:</b> 好。ARXBP。	<b>Interviewee:</b> Okay. ARXBP.
<b>Interviewer:</b> 好。ARXBP。OK。然後你可以...現在還是有空，也可以幫我掃這個QR。然後有一個問卷，問卷都有問你這個號碼。你就幫我點這邊就結束了。謝謝。	<b>Interviewer:</b> Okay. ARXBP. OK. Then you can... still have time now, you can also help me scan this QR code. Then there's a questionnaire, the questionnaire asks for this number. Just help me tap here and we're done. Thank you.

### 16.1.18 Transcript 2025-03-06 - Chiayi (CCU) - 1S2SE

**Source Files:** \* 2025-03-06 - Chiayi (CCU) - 1S2SE.json \* 2025-03-06 - Chiayi (CCU) - 1S2SE.txt

**Ziran ID Code:** 1S2SE

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我先問你，呃，我可以錄你這個對話嗎？	<b>Interviewer:</b> Let me ask first, uh, can I record this conversation?
<b>Interviewee:</b> 嗯，可以。	<b>Interviewee:</b> Um, yes you can.
<b>Interviewer:</b> 好。那我要介紹一下，我是成功大學創意設計所的學生，然後這個是我的論文的一部分。嗯，那我們等一下會測試這個 App，然後晚一點你可以幫我填那個問卷。那第一個問題是，你呃...你平常會在網路上買東西嗎？	<b>Interviewer:</b> Okay. Then I want to introduce myself, I'm a student from the Institute of Creative Design at Cheng Kung University, and this is part of my thesis. Um, so we'll be testing this app in a moment, and later you can help me fill out the questionnaire. So the first question is, uh... do you usually buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你基本上使用什麼平台？	<b>Interviewer:</b> What platforms do you basically use?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 蝦皮，還有其他的嗎？	<b>Interviewer:</b> Shopee, are there any others?
<b>Interviewee:</b> �恩...就只有蝦皮。	<b>Interviewee:</b> Um... only Shopee.
<b>Interviewer:</b> OK。那你適用蝦皮的 App 還是網頁？	<b>Interviewer:</b> OK. Do you use the Shopee app or the website?
<b>Interviewee:</b> 我用 App。	<b>Interviewee:</b> I use the app.
<b>Interviewer:</b> OK。那 Momo 你有使用過嗎？	<b>Interviewer:</b> OK. Have you used Momo?
<b>Interviewee:</b> 有滑過，但是沒有買過。	<b>Interviewee:</b> I've browsed it, but never bought anything.
<b>Interviewer:</b> 好。那你平常會買什麼？買什麼樣的東西？	<b>Interviewer:</b> Okay. So what do you usually buy? What kind of things?
<b>Interviewee:</b> 買衣服，然後化妝品之類的。	<b>Interviewee:</b> Clothes, and cosmetics, things like that.
<b>Interviewer:</b> 那現在...如果要在這個 App 上測試，有什麼想要買的嗎？你也可以直接打字搜尋。	<b>Interviewer:</b> So now... if you were to test on this app, is there anything you'd want to buy? You can also just type to search.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我應該還是會買美妝相關的化妝品之類的東西。	<b>Interviewee:</b> I'd probably still buy beauty-related items, cosmetics, things like that.
<b>Interviewer:</b> 好。那如果...有你喜歡的品牌嗎？	<b>Interviewer:</b> Okay. So... are there any brands you like?
<b>Interviewee:</b> 嗯...什麼品牌好像沒有特別，沒有特別喜歡的。	<b>Interviewee:</b> Um... no particular brand really, no special favorite.
<b>Interviewer:</b> 那你剛剛想要挑什麼品牌？	<b>Interviewer:</b> Then what brand did you want to pick just now?
<b>Interviewee:</b> 嗯...這一個吧。	<b>Interviewee:</b> Um... this one, I guess.
<b>Interviewer:</b> 這一個？ 那可以幫我講出來嗎？	<b>Interviewer:</b> This one? Can you say it for me?
<b>Interviewee:</b> Maybelline 的。	<b>Interviewee:</b> Maybelline.
<b>Interviewer:</b> OK。看一下這一個。好，找到了嗎？	<b>Interviewer:</b> OK. Let's look at this one. Okay, found it?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Mhm.
<b>Interviewer:</b> 那你可以幫我選一個產品嗎？	<b>Interviewer:</b> Can you select a product for me?
<b>Interviewee:</b> (Selects product)	<b>Interviewee:</b> (Selects product)
<b>Interviewer:</b> 那你為什麼選這個產品？	<b>Interviewer:</b> Why did you choose this product?
<b>Interviewee:</b> 因為它的評價還不錯。	<b>Interviewee:</b> Because its reviews are quite good.
<b>Interviewer:</b> 你有試用過？	<b>Interviewer:</b> Have you tried it?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那這個網頁上，你覺得最重要的地方是什麼？	<b>Interviewer:</b> On this webpage, what do you think is the most important part?
<b>Interviewee:</b> 最重要的地方是評價吧。	<b>Interviewee:</b> The most important part is probably the reviews.
<b>Interviewer:</b> 好。評價說什麼？	<b>Interviewer:</b> Okay. What do the reviews say?
<b>Interviewee:</b> 就是好像都還不錯。	<b>Interviewee:</b> Just that they seem pretty good.
<b>Interviewer:</b> 好。那第二個重要的部分是什麼？	<b>Interviewer:</b> Okay. What's the second most important part?
<b>Interviewee:</b> (Silence)	<b>Interviewee:</b> (Silence)
<b>Interviewer:</b> 第二個？ 你可以幫我講大聲一點喔。	<b>Interviewer:</b> The second one? Can you speak a bit louder for me?
<b>Interviewee:</b> 好。嗯，退換貨。	<b>Interviewee:</b> Okay. Um, returns and exchanges.
<b>Interviewer:</b> 好，為什麼？	<b>Interviewer:</b> Okay, why?
<b>Interviewee:</b> 因為如果使用不好用的話，就可以知道怎麼去退它或者是換它。	<b>Interviewee:</b> Because if it's not good to use, then I know how to return or exchange it.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那第三個重要的部分是什麼？	<b>Interviewer:</b> What's the third most important part?
<b>Interviewee:</b> 重要的就是有沒有折扣。	<b>Interviewee:</b> What's important is whether there's a discount.
<b>Interviewer:</b> 好。那照片呢？ 照片？	<b>Interviewer:</b> Okay. What about the photos? The photos?
<b>Interviewee:</b> 照片我很少特別去看啊。	<b>Interviewee:</b> I rarely look specifically at the photos.
<b>Interviewer:</b> 價格呢？	<b>Interviewer:</b> What about the price?
<b>Interviewee:</b> 啊，價格...	<b>Interviewee:</b> Ah, the price...
<b>Interviewer:</b> 它價格多少？	<b>Interviewer:</b> What's its price?
<b>Interviewee:</b> 價格，嗯，這裡 399。	<b>Interviewee:</b> The price, um, here it's 399.
<b>Interviewer:</b> OK。嗯，你可以幫我看一下那個黃色的那個部分，你覺得這是什麼？	<b>Interviewer:</b> OK. Um, can you take a look at that yellow section for me, what do you think that is?
<b>Interviewee:</b> 它的資訊。	<b>Interviewee:</b> Its information.
<b>Interviewer:</b> 那這個資訊的裡面，最重要的是什麼？ 它的重點是什麼？	<b>Interviewer:</b> Within this information, what's most important? What's its key point?
<b>Interviewee:</b> 重點...這邊嗎？	<b>Interviewee:</b> The key point... here?
<b>Interviewer:</b> 嗯，什麼都可以，什麼都可以。對你來說？	<b>Interviewer:</b> Um, anything is fine, anything. For you?
<b>Interviewee:</b> 應該就是這裡吧？ 它的資訊從哪裡來的？ 什麼之類的。	<b>Interviewee:</b> Probably here? Where its information comes from? Things like that.
<b>Interviewer:</b> 那有什麼你之前不知道的嗎？	<b>Interviewer:</b> Is there anything you didn't know before?
<b>Interviewee:</b> 噛...	<b>Interviewee:</b> Um...
<b>Interviewer:</b> 有什麼你之前不知道的，對你來說是一個新的資訊？	<b>Interviewer:</b> Anything you didn't know before, that's new information for you?
<b>Interviewee:</b> 哦，它是中國來的哦？ 我現在才知道哦。	<b>Interviewee:</b> Oh, it's from China? I only just found that out.
<b>Interviewer:</b> 所以會影響你嗎？	<b>Interviewer:</b> So does that affect you?
<b>Interviewee:</b> 不會耶。嗯，我覺得還好。	<b>Interviewee:</b> Not really. Um, I think it's fine.
<b>Interviewer:</b> 好。那最上面還有兩個部分，你可以幫我按嗎？	<b>Interviewer:</b> Okay. There are two more sections at the very top, can you click them for me?
<b>Interviewee:</b> 噏。(Clicks) 這個...	<b>Interviewee:</b> Um. (Clicks) This...
<b>Interviewer:</b> 是什麼？	<b>Interviewer:</b> What is it?
<b>Interviewee:</b> (Clicks second part) 這個是什麼？ 你覺得這個是什麼？	<b>Interviewee:</b> (Clicks second part) What is this? What do you think this is?
<b>Interviewer:</b> 這個是它的包裝嗎？ 還是什麼？ 你覺得呢？	<b>Interviewer:</b> Is this its packaging? Or what? What do you think?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 環保產品？ 所以是說它包裝會比較環保嗎？ 是嗎？	<b>Interviewee:</b> Eco-friendly product? So does that mean its packaging is more environmentally friendly? Is that it?
<b>Interviewer:</b> 那這些上面的品牌你有買過嗎？	<b>Interviewer:</b> Have you bought these brands listed above?
<b>Interviewee:</b> 沒有耶。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 有聽說過嗎？	<b>Interviewer:</b> Have you heard of them?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那上面還有第三個部分。	<b>Interviewer:</b> Okay. There's still the third section above.
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 這個是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 投資這些品牌。	<b>Interviewee:</b> Invest in these brands.
<b>Interviewer:</b> 之前有投資過嗎？	<b>Interviewer:</b> Have you invested before?
<b>Interviewee:</b> 我沒有投資過東西。	<b>Interviewee:</b> I haven't invested in things.
<b>Interviewer:</b> 那看到這個，你有興趣嗎？	<b>Interviewer:</b> Seeing this, are you interested?
<b>Interviewee:</b> 沒有耶。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那最下面，你覺得它在說什麼？	<b>Interviewer:</b> Okay. At the very bottom, what do you think it's talking about?
<b>Interviewee:</b> 最下面...股價？ 是因為它用的原料，所以它股價是變動的？	<b>Interviewee:</b> The very bottom... stock price? Is it because of the raw materials it uses, so its stock price fluctuates?
<b>Interviewer:</b> 你覺得？ 嗯，好，沒問題。那你可以幫我「回」那個第一個部分嗎？	<b>Interviewer:</b> You think? Um, okay, no problem. Can you help me go "back" to that first section?
<b>Interviewee:</b> 嗯。(Goes back)	<b>Interviewee:</b> Um. (Goes back)
<b>Interviewer:</b> 對。然後最下面有兩個按鈕，你現在要按一個嗎？	<b>Interviewer:</b> Right. Then at the very bottom there are two buttons, do you want to press one now?
<b>Interviewee:</b> 嗯。(Clicks button)	<b>Interviewee:</b> Um. (Clicks button)
<b>Interviewer:</b> 你剛剛按什麼？ 按這個？ 你可以幫我講出來。	<b>Interviewer:</b> What did you just press? This one? Can you say it out loud for me.
<b>Interviewee:</b> 我按尋找替代產品。	<b>Interviewee:</b> I pressed "Find Alternative Products".
<b>Interviewer:</b> 好。那它剛剛有跟你講什麼？	<b>Interviewer:</b> Okay. What did it tell you just now?
<b>Interviewee:</b> 它跟我說這個品牌的化學成分需警惕，然後它提了三個品牌，說這些比較天然，比較可以去使用。	<b>Interviewee:</b> It told me to be cautious about the chemical ingredients of this brand, and then it mentioned three brands, saying these are more natural and better to use.
<b>Interviewer:</b> 那你會考慮買這些嗎？ 還是你覺得...	<b>Interviewer:</b> Would you consider buying these then? Or do you think...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我應該會想要去看看這些品牌賣什麼。	<b>Interviewee:</b> I'd probably want to go check out what these brands sell.
<b>Interviewer:</b> 為什麼？ 你記得這些品牌嗎？	<b>Interviewer:</b> Why? Do you remember these brands?
<b>Interviewee:</b> 我不知道，但可以查。	<b>Interviewee:</b> I don't know them, but I can look them up.
<b>Interviewer:</b> 那你有什麼問題想要問它嗎？	<b>Interviewer:</b> Do you have any questions you want to ask it?
<b>Interviewee:</b> 問它嗎？ 就是...就是它是哪裡化學成分需要警惕嗎？	<b>Interviewee:</b> Ask it? Like... like which chemical ingredients specifically require caution?
<b>Interviewer:</b> 那你可以幫我打字。	<b>Interviewer:</b> You can type that for me.
<b>Interviewee:</b> (Types question) 這樣子？	<b>Interviewee:</b> (Types question) Like this?
<b>Interviewer:</b> 去上面一點。好像要按那個(send button)...	<b>Interviewer:</b> Go up a bit. Seems you need to press that (send button)...
<b>Interviewee:</b> (Sends question)	<b>Interviewee:</b> (Sends question)
<b>Interviewer:</b> 你覺得它剛剛說的對你來說有用嗎？ 它的回答怎麼樣？	<b>Interviewer:</b> Do you think what it just said was useful for you? How was its answer?
<b>Interviewee:</b> 還...它有跟我說哪個部分比較需要警惕，但是因為沒有相關的知識，所以其實你就是看看而已。	<b>Interviewee:</b> Well... it did tell me which part needs caution, but because I don't have related knowledge, it's really just something to look at.
<b>Interviewer:</b> 嗯。那還有其他的問題你想要問嗎？	<b>Interviewer:</b> Um. Are there any other questions you want to ask?
<b>Interviewee:</b> 沒有耶。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那你幫我回一下吧。	<b>Interviewer:</b> Okay. Can you go back for me then.
<b>Interviewee:</b> (Goes back)	<b>Interviewee:</b> (Goes back)
<b>Interviewer:</b> 對。然後還有第二個按鈕，你想要按嗎？ 還是如果不想按也可以。	<b>Interviewer:</b> Right. And there's the second button, do you want to press it? Or it's okay if you don't want to.
<b>Interviewee:</b> 那不用。	<b>Interviewee:</b> Then no need.
<b>Interviewer:</b> 好。然後，嗯，你可以幫我拍照，你覺得對你來說最重要的部分？	<b>Interviewer:</b> Okay. Then, um, can you take a photo for me, of what you think is the most important part for you?
<b>Interviewee:</b> 拍照？	<b>Interviewee:</b> Take a photo?
<b>Interviewer:</b> 對，用你的手機拍照。我剛剛第一個說的嗎？ 就是你覺得這些內容在裡面都可以，你覺得最重要。	<b>Interviewer:</b> Yes, use your phone to take a photo. Was it the first one I mentioned? Just, whatever content inside you feel is most important.
<b>Interviewee:</b> (Takes photo)	<b>Interviewee:</b> (Takes photo)
<b>Interviewer:</b> 最上面有一個代碼。	<b>Interviewer:</b> At the very top, there's a code.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Right.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 你看那個綠色的號碼、代碼。	<b>Interviewer:</b> Look at that green number, the code.
<b>Interviewee:</b> 這個？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 你可以幫我講出來？	<b>Interviewer:</b> Can you say it out loud for me?
<b>Interviewee:</b> 嗯，1S2SE。	<b>Interviewee:</b> Um, 1S2SE.
<b>Interviewer:</b> 好，你可以幫我在這個卡片上寫這個代碼。隨便點...對，這裡這裡。好。畫面...？	<b>Interviewer:</b> Okay, can you help me write this code on this card. Anywhere... yes, here, here. Okay. The screen...?
<b>Interviewee:</b> (Writes code)	<b>Interviewee:</b> (Writes code)
<b>Interviewer:</b> 好吧，畫面。好好，那這樣可以了。	<b>Interviewer:</b> Okay, the screen. Okay okay, that's fine then.

### 16.1.19 Transcript 2025-03-06 - Chiayi (CCU) - 2W7HO

**Source Files:** \* 2025-03-06 - Chiayi (CCU) - 2W7HO.json \* 2025-03-06 - Chiayi (CCU) - 2W7HO.txt

**Ziran ID Code:** 2W7HO

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 問你，我可以錄影我們的對話嗎？	<b>Interviewer:</b> Let me ask you, can I record our conversation?
<b>Interviewee:</b> 嗯，可以。	<b>Interviewee:</b> Um, yes you can.
<b>Interviewer:</b> 好。那我要介紹一下，我是建功大學創意設計所的學生，然後這個是我的論文的一部分，一個環保的 app。那我們等一下會測試這個 app，然後晚一點你可以幫我填那個問卷。好。	<b>Interviewer:</b> Okay. Then I want to introduce myself, I'm a student from the Institute of Creative Design at Jian Gong University, and this is part of my thesis, an environmental app. So we'll be testing this app in a moment, and later you can help me fill out the questionnaire. Okay.
<b>Interviewer:</b> 那第一個問題是，你會在網路上買東西嗎？	<b>Interviewer:</b> So the first question is, do you buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你使用什麼平台？	<b>Interviewer:</b> What platforms do you use?
<b>Interviewee:</b> 我是比較常用蝦皮，比較方便。	<b>Interviewee:</b> I use Shopee more often, it's more convenient.
<b>Interviewer:</b> 好。那你使用蝦皮的 app 還是網頁？	<b>Interviewer:</b> Okay. Do you use the Shopee app or the website?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> app。	<b>Interviewee:</b> App.
<b>Interviewer:</b> 啊，那你也有使用過其他的平台嗎？	<b>Interviewer:</b> Ah, have you also used other platforms?
<b>Interviewee:</b> 嗯，有用過 momo。	<b>Interviewee:</b> Um, I've used momo.
<b>Interviewer:</b> 那你平常會買什麼樣的東西？	<b>Interviewer:</b> What kind of things do you usually buy?
<b>Interviewee:</b> 通常是買衣服，或者日用品。	<b>Interviewee:</b> Usually clothes, or daily necessities.
<b>Interviewer:</b> 好。那 momo 上呢？ 你有買過什麼嗎？	<b>Interviewer:</b> Okay. What about on momo? Have you bought anything there?
<b>Interviewee:</b> momo 好像是快煮鍋。	<b>Interviewee:</b> On momo, I think it was a quick-cook pot.
<b>Interviewer:</b> 好。那現在就是開 momo，你可以幫我找一個商品嗎？ 你想要買的。	<b>Interviewer:</b> Okay. So now let's open momo, can you help me find a product? Something you'd want to buy.
<b>Interviewee:</b> (Searches)	<b>Interviewee:</b> (Searches)
<b>Interviewer:</b> 你剛剛在查什麼？	<b>Interviewer:</b> What were you just searching for?
<b>Interviewee:</b> 電磁爐，就是可以煮火鍋的那個。	<b>Interviewee:</b> An induction cooker, the kind for making hot pot.
<b>Interviewer:</b> 啊。那你電磁爐的話，你有找到你想要的這種的嗎？	<b>Interviewer:</b> Ah. For induction cookers, did you find the type you were looking for?
<b>Interviewee:</b> (Browses>Selects)	<b>Interviewee:</b> (Browses>Selects)
<b>Interviewer:</b> 你跟電磁爐的品牌熟嗎？	<b>Interviewer:</b> Are you familiar with induction cooker brands?
<b>Interviewee:</b> 你說這個嗎？	<b>Interviewee:</b> You mean this one?
<b>Interviewer:</b> 就是你之前有買過嗎？	<b>Interviewer:</b> Like, have you bought it before?
<b>Interviewee:</b> 沒有沒有，但就是想買買看。	<b>Interviewee:</b> No, no, but I just wanted to buy and try it.
<b>Interviewer:</b> 那為什麼選剛才選這個呢？	<b>Interviewer:</b> Then why did you choose this one just now?
<b>Interviewee:</b> 因為他有講到，像如果是買電磁爐的話，我就會看他會不會挑鍋子啊，或者是有沒有特別其他的需求之類的。畢竟是買電器。	<b>Interviewee:</b> Because it mentioned, like if I'm buying an induction cooker, I'll check if it's compatible with all pots, or if there are any other special requirements. After all, it's an electrical appliance.
<b>Interviewer:</b> 那你還是會考慮其他的嗎？	<b>Interviewer:</b> Would you still consider others?
<b>Interviewee:</b> 還有一個應該是價錢，就是它的價錢是可以接受的，不會太貴。	<b>Interviewee:</b> Another factor would be the price; its price is acceptable, not too expensive.
<b>Interviewer:</b> 那其他的重要點是什麼？ 你覺得這個網頁上最重要的點是什麼？	<b>Interviewer:</b> What are other important points? What do you think is the most important point on this webpage?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這個網頁上最重要的點？ 嗯...喔，照片，照片。就是它會不會吸引我點進去看。	<b>Interviewee:</b> The most important point on this webpage? Um... Oh, the photos, the photos. Like, whether they attract me to click and look.
<b>Interviewer:</b> 好。那還有什麼嗎？重要的？	<b>Interviewer:</b> Okay. Is there anything else? That's important?
<b>Interviewee:</b> 如果是看網頁的話，我應該會蠻重視就是它不容易使用。就是我可以很清楚，比如說我現在要找這個東西，我知道它哪裡，比如說它會幫我分類好，這邊就是電器用品，那我就可點進去，然後查之類的。就比較方便我使用。	<b>Interviewee:</b> If I'm looking at the webpage, I'd probably place importance on how easy it is to use. Like, I can clearly see, for example, if I want to find this item now, I know where it is. For instance, it helps categorize things well, here are the electrical appliances, then I can click in and search, etc. It's more convenient for me to use.
<b>Interviewer:</b> 那你會看它的評論嗎？	<b>Interviewer:</b> Do you look at its reviews?
<b>Interviewee:</b> 評論還是會小小看一下，但評論我可能會比較偏向去網路上直接看人家...	<b>Interviewee:</b> I'll still briefly look at the reviews, but for reviews, I might be more inclined to go online and directly see what people say...
<b>Interviewer:</b> 你可以幫我講大聲一點好不好？	<b>Interviewer:</b> Could you speak a bit louder, please?
<b>Interviewee:</b> 就是如果是評論的話，我應該會比較偏向，比如說我直接再開一個網頁去找人家說有沒有用過這個。	<b>Interviewee:</b> Like, if it's about reviews, I'd probably lean towards, for example, opening another webpage directly to find if people say they've used this.
<b>Interviewer:</b> 為什麼呢？	<b>Interviewer:</b> Why is that?
<b>Interviewee:</b> 因為有可能他們買這個東西不是在這個平台買的。然後這樣我可以看到比較全面的評論。	<b>Interviewee:</b> Because it's possible they bought this item on a different platform. And this way, I can see more comprehensive reviews.
<b>Interviewer:</b> 好。那剛剛那個右邊有一個黃色的部分，你覺得這個是什麼？	<b>Interviewer:</b> Okay. Just now, there was a yellow section on the right side, what do you think that is?
<b>Interviewee:</b> 黃色的？這個嗎？	<b>Interviewee:</b> Yellow? This one?
<b>Interviewer:</b> 對。	<b>Interviewer:</b> Yes.
<b>Interviewee:</b> 介紹公司、這個產品的... 這個我可能就不太會看，因為我也看不懂。	<b>Interviewee:</b> Introducing the company, this product's... I probably wouldn't look closely at this, because I don't understand it anyway.
<b>Interviewer:</b> 哦，看不懂。嗯，OK。那，呃，你幫我看一下，你覺得它裡面有什麼重要的嗎？對你來說？	<b>Interviewer:</b> Oh, don't understand. Um, OK. Then, uh, take a look for me, do you think there's anything important inside it? For you?
<b>Interviewee:</b> 重要的可能是...像這個。	<b>Interviewee:</b> What might be important is... like this.
<b>Interviewer:</b> 這個是什麼？	<b>Interviewer:</b> What is this?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 塑膠和化學材料。	<b>Interviewee:</b> Plastics and chemical materials.
<b>Interviewer:</b> OK。為什麼這個很重要？	<b>Interviewer:</b> OK. Why is this important?
<b>Interviewee:</b> 感覺現在的人很重視這方面。就是包含什麼塑化劑啊，或是一些...之前不是有個什麼...什麼懸浮粒子什麼東東？我搞不清楚。反正就是環境方面的。	<b>Interviewee:</b> Feels like people nowadays care a lot about this aspect. Including things like plasticizers, or some... wasn't there something before... some suspended particles or something? I'm not clear. Anyway, it's related to the environment.
<b>Interviewer:</b> OK。那，你覺得這個內容的重點是什麼？	<b>Interviewer:</b> OK. So, what do you think is the main point of this content?
<b>Interviewee:</b> 重點是...這個產品對環境的影響。雖然有受到批評，但他們有...還是已經有在進步了。	<b>Interviewee:</b> The main point is... the environmental impact of this product. Although it has received criticism, they have... they have already been improving.
<b>Interviewer:</b> 嗯。那下面還有其他的嗎？	<b>Interviewer:</b> Um. Are there others below?
<b>Interviewee:</b> 下面的就是在講材料，然後產地吧。我覺得產地有些人可能也會看，就是有可能，不是會有人會覺得中國製造的就是品質比較不好之類的。	<b>Interviewee:</b> Below it talks about materials, and origin, I guess. I think some people might look at the origin, because it's possible, aren't there people who feel that 'Made in China' means lower quality, etc.
<b>Interviewer:</b> 嗯。那，你覺得其他這個會影響你的想法嗎？	<b>Interviewer:</b> Um. So, do you think these other things would influence your thoughts?
<b>Interviewee:</b> 我可能會看東西。就是如果像我剛剛，因為我剛剛沒有看到這個，如果是電器的話，我可能就會再思考一下，因為有點危險的感覺。	<b>Interviewee:</b> I might look at the item itself. Like just now, because I didn't see this earlier, if it's an electrical appliance, I might reconsider, because it feels a bit risky.
<b>Interviewer:</b> 哦，好。那上面還有其他的部分，幫我...幫忙按一下，有看得到嗎？	<b>Interviewer:</b> Oh, okay. Then there are other sections above, help me... click them please, can you see them?
<b>Interviewee:</b> 這個嗎？對。	<b>Interviewee:</b> This one? Yes.
<b>Interviewer:</b> 你覺得這個部分是什麼？	<b>Interviewer:</b> What do you think this part is?
<b>Interviewee:</b> 這個好酷喔。	<b>Interviewee:</b> This is cool.
<b>Interviewer:</b> 這個是什麼呢？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 這也是在講環境的嗎？現在好像很多人都在注重這個碳排放，就包含氣候變遷啊那些的。	<b>Interviewee:</b> Is this also talking about the environment? It seems like many people are focusing on carbon emissions now, including climate change and those things.
<b>Interviewer:</b> 哦。那下面的在說什麼？不是，剛剛那個黃色的...你覺得這些東西是什麼？	<b>Interviewer:</b> Oh. What does the part below say? No, the yellow one from earlier... what do you think these things are?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這個嗎？ 不是不是，那個剛剛下面這邊。哦，這些是什麼？ 這些綠科技？ 哦哦... 然後第三層應該是在告訴我們這個產品，它就是有關碳排放的東西，然後可能怕我們看不懂，所以旁邊很有解釋之類的。	<b>Interviewee:</b> This one? No no, the one below just now. Oh, what are these? These green technologies? Oh oh... And the third layer is probably telling us about this product, things related to carbon emissions, and maybe because they're afraid we won't understand, there are explanations on the side.
<b>Interviewer:</b> 好好，沒問題。那第三個部分你可以幫我按嗎？	<b>Interviewer:</b> Okay okay, no problem. Can you click the third section for me?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 你覺得這個部分是什麼？	<b>Interviewer:</b> What do you think this part is?
<b>Interviewee:</b> 股票。	<b>Interviewee:</b> Stocks.
<b>Interviewer:</b> 那你之前有投資過嗎？	<b>Interviewer:</b> Have you invested before?
<b>Interviewee:</b> 沒有。最近有開始要學。	<b>Interviewee:</b> No. Recently I've started wanting to learn.
<b>Interviewer:</b> 哦。那看到這個你有興趣嗎？	<b>Interviewer:</b> Oh. Seeing this, are you interested?
<b>Interviewee:</b> 這個我會有興趣。	<b>Interviewee:</b> I would be interested in this.
<b>Interviewer:</b> 那你覺得它的內容怎麼樣呢？	<b>Interviewer:</b> What do you think of its content?
<b>Interviewee:</b> 我覺得蠻不錯的。因為通常在買股票的時候，還是會看一下公司，當然公司的發展啦。然後它這裡又有圖表，然後又蠻好，就是蠻明顯可以看得出來的。然後又有公司的介紹。然後這邊還有自然方面，因為可能自然方面，就是以後在買股票，自然方面可能也會蠻注重，就有一些比較重視環保的產業可能也會慢慢的股價會上升之類的。	<b>Interviewee:</b> I think it's quite good. Because usually when buying stocks, you still look at the company, of course, the company's development. And here it has charts, and they are quite good, quite clear and easy to see. And there's a company introduction. Then there's the nature aspect here, because maybe the nature aspect, like when buying stocks in the future, the nature aspect might also be quite important, some industries that value environmental protection more might see their stock prices rise slowly, etc.
<b>Interviewer:</b> 那你有現在在考慮買什麼股票嗎？	<b>Interviewer:</b> Are you currently considering buying any stocks?
<b>Interviewee:</b> 沒有啊，因為我還沒上課，我不知道，不敢亂買。	<b>Interviewee:</b> No, because I haven't taken the class yet, I don't know, I don't dare to buy randomly.
<b>Interviewer:</b> 那如果這個軟體讓你買股票，你會使用嗎？	<b>Interviewer:</b> If this software allowed you to buy stocks, would you use it?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我應該不會為了買股票特別購入這個東西。但是如果它是，譬如說，我是這個網站的會員，買了會員可以有這個的話，那我會買會員，因為我買東西的同時還可以順便看這個。	<b>Interviewee:</b> I probably wouldn't specifically get this thing just to buy stocks. But if it was, for example, if I was a member of this website, and buying a membership gave access to this, then I would buy the membership, because while shopping, I could also look at this conveniently.
<b>Interviewer:</b> 好。那你可以幫我回那個第一個表嗎？	<b>Interviewer:</b> Okay. Can you help me go back to that first tab/section?
<b>Interviewee:</b> (Goes back)	<b>Interviewee:</b> (Goes back)
<b>Interviewer:</b> 對。那最下面有按鈕...這樣有按嗎？	<b>Interviewer:</b> Right. Then at the very bottom there are buttons... did it register the click?
<b>Interviewee:</b> 這個嗎？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 啊，你看看...你...啊，有兩個按鈕，你覺得哪一個比較有興趣？	<b>Interviewer:</b> Ah, take a look... you... ah, there are two buttons, which one are you more interested in?
<b>Interviewee:</b> (Clicks button)	<b>Interviewee:</b> (Clicks button)
<b>Interviewer:</b> 啊，你剛剛...你幫我講出來，你剛剛按什麼按鈕？	<b>Interviewer:</b> Ah, you just... tell me, what button did you just press?
<b>Interviewee:</b> 我剛剛是按替代產品。	<b>Interviewee:</b> I just pressed "Alternative Products".
<b>Interviewer:</b> 好。那為什麼你選這個按鈕呢？	<b>Interviewer:</b> Okay. Why did you choose this button?
<b>Interviewee:</b> 因為可能這個產品我剛點進來的時候，我覺得他還可以有更好的地方。比如說我考慮的點可能會是，假設我剛剛是因為他的價格進來的的話，結果我發現我進來之後發現他使用的可能方法比較複雜啊，或者是像剛剛那個產地的問題。所以我就會想要看一下有沒有跟他差不多，然後可以替代他的。	<b>Interviewee:</b> Because maybe when I first clicked on this product, I felt there could be better aspects. For example, the points I consider might be, suppose I came in because of its price, but then after entering, I found that its usage might be more complicated, or like the origin issue just mentioned. So I would want to see if there's something similar to it that can replace it.
<b>Interviewer:</b> 好。那你可以幫我按那個...嗯...對。那，嗯，你有什麼問題你想要問他嗎？就是看到這個...呃...你有什麼問題你想要問嗎？	<b>Interviewer:</b> Okay. Can you press that... um... right. So, um, do you have any questions you want to ask it? Seeing this... uh... do you have any questions you want to ask?
<b>Interviewee:</b> 我應該會想要問他，就是請他直接給我可以替代的產品。就他跟我講，他是跟我講品牌的，但品牌裡面的電磁鍋可能還是有很多種。我會跟他講我的需求，然後請他能不能幫我找到。	<b>Interviewee:</b> I would probably want to ask it, like, ask it to directly give me alternative products. Like it told me, it told me brands, but within the brands, there might still be many types of induction cookers. I would tell it my needs, and ask if it can help me find one.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那你可幫我打字嗎？	<b>Interviewer:</b> Okay. Can you type that for me?
<b>Interviewee:</b> (Types) 完成。好。	<b>Interviewee:</b> (Types) Done. Okay.
<b>Interviewer:</b> 那你覺得這個內容有什麼重要的嗎？	<b>Interviewer:</b> Do you think this content is important in any way?
<b>Interviewee:</b> 嗯...就是因為像剛剛上面這邊，他...我重視的點可能是有沒有不挑鍋，但他沒有寫到，所以我又特別問他。然後他這邊也直接跟我講說他有不挑鍋的設計，然後包含他的優點。然後我可能就想要問他他有什麼缺點之類的，就讓我的那個挑選的時候方便，更全面一點。	<b>Interviewee:</b> Um... because like above just now, it... the point I cared about was maybe whether it's compatible with all pots, but it didn't mention that, so I specifically asked it. And then here it directly told me it has a design compatible with all pots, including its advantages. Then I might want to ask it about its disadvantages, etc., just to make my selection process more convenient and comprehensive.
<b>Interviewer:</b> 好。那你可幫我使用你的手機拍照這個部分？ 然後還有你知道這裡的裡面最重要的地方在哪裡？	<b>Interviewer:</b> Okay. Can you use your phone to take a photo of this part? And also, do you know where the most important part is within this?
<b>Interviewee:</b> 你是說哪方面？	<b>Interviewee:</b> In what aspect do you mean?
<b>Interviewer:</b> 就是全部的裡面，剛剛那個momo上，還是這裡？ 對你來說最重要的地方在哪裡？	<b>Interviewer:</b> Like within everything, on the momo page earlier, or here? For you, where is the most important part?
<b>Interviewee:</b> 我覺得這個功能應該對我來說會是目前最重要的。	<b>Interviewee:</b> I think this function [the chatbot/alternative finder] would probably be the most important for me right now.
<b>Interviewer:</b> 那你可以幫我回那個momo那邊？	<b>Interviewer:</b> Can you help me go back to the momo page?
<b>Interviewee:</b> (Goes back)	<b>Interviewee:</b> (Goes back)
<b>Interviewer:</b> 那最上面有一個代碼，上面上面，那個綠色的。你可以幫我講出來？	<b>Interviewer:</b> Then at the very top there's a code, up top, the green one. Can you say it out loud for me?
<b>Interviewee:</b> 點進去嗎？	<b>Interviewee:</b> Click into it?
<b>Interviewer:</b> 沒有沒有，你講出來。	<b>Interviewer:</b> No no, just say it.
<b>Interviewee:</b> 呃，2W7HO。	<b>Interviewee:</b> Uh, 2W7HO.
<b>Interviewer:</b> 好。那你可以幫我點那個卡片上，寫這個代碼。畫面可以...這樣就可以了。	<b>Interviewer:</b> Okay. Then can you help me tap on the card, write this code. The screen can... that's fine.
<b>Interviewee:</b> (Writes code)	<b>Interviewee:</b> (Writes code)
<b>Interviewer:</b> 好，謝謝。	<b>Interviewer:</b> Okay, thank you.

## 16.1.20 Transcript 2025-03-06 - Chiayi (CCU) - 4XGN4

**Source Files:** \* 2025-03-06 - Chiayi (CCU) - 4XGN4.json \* 2025-03-06 - Chiayi (CCU) - 4XGN4.txt

**Ziran ID Code:** 4XGN4

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我可以錄影這個對話嗎？	<b>Interviewer:</b> Can I record this conversation?
<b>Interviewee:</b> 可以可以。	<b>Interviewee:</b> Yes, yes.
<b>Interviewer:</b> 好。那我要介紹一下，我是建功大學創意設計所的學生，這個是我的論文的一部分，一個環保的 app。然後等一下我們會測試這個 app，還有晚一點可以幫我填一個問卷。好。那第一個問題是，你之前...你平常會在網路上買東西嗎？	<b>Interviewer:</b> Okay. Then I want to introduce myself, I'm a student from the Institute of Creative Design at Jian Gong University, this is part of my thesis, an environmental app. Then later we will test this app, and also later you can help me fill out a questionnaire. Okay. So the first question is, before... do you usually buy things online?
<b>Interviewee:</b> 會會。	<b>Interviewee:</b> Yes, yes.
<b>Interviewer:</b> 那你平常使用什麼平台呢？	<b>Interviewer:</b> What platforms do you usually use?
<b>Interviewee:</b> 蝦皮跟淘寶。	<b>Interviewee:</b> Shopee and Taobao.
<b>Interviewer:</b> 好。那 momo 你有用過嗎？	<b>Interviewer:</b> Okay. Have you used momo?
<b>Interviewee:</b> 呃，比較少，但會用，有用過。	<b>Interviewee:</b> Uh, less often, but I do use it, I have used it.
<b>Interviewer:</b> OK。那你平常會買什麼樣的產品？	<b>Interviewer:</b> OK. What kind of products do you usually buy?
<b>Interviewee:</b> 呃，可能跟家電用品比較有關係，就是...呃...快煮鍋。	<b>Interviewee:</b> Uh, maybe more related to home appliances, like... uh... a quick-cook pot.
<b>Interviewer:</b> 快煮鍋，好。那 momo 上你有買過什麼嗎？	<b>Interviewer:</b> Quick-cook pot, okay. Have you bought anything on momo?
<b>Interviewee:</b> 就是快煮鍋。	<b>Interviewee:</b> Just the quick-cook pot.
<b>Interviewer:</b> 哟一樣的。好。那現在你幫我找一個產品，你想要買的嗎？ momo 上。	<b>Interviewer:</b> Oh, the same one. Okay. Now help me find a product, is there something you want to buy? On momo.
<b>Interviewee:</b> momo 上想買的？ 呃...	<b>Interviewee:</b> Something I want to buy on momo? Uh...
<b>Interviewer:</b> 什麼都可以。	<b>Interviewer:</b> Anything is fine.
<b>Interviewee:</b> 安全帽。	<b>Interviewee:</b> Helmet.
<b>Interviewer:</b> 好。那你幫我打字嗎？	<b>Interviewer:</b> Okay. Can you type that for me?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> (Types)	<b>Interviewee:</b> (Types)
<b>Interviewer:</b> 你有特別想要這個品牌嗎？還是...呃...特別想要什麼品牌嗎？	<b>Interviewer:</b> Do you particularly want this brand? Or... uh... do you particularly want any brand?
<b>Interviewee:</b> 沒有特別想要的。	<b>Interviewee:</b> No particular one wanted.
<b>Interviewer:</b> 沒有特別想要的。你有...找到了嗎？	<b>Interviewer:</b> No particular one wanted. Have you... found it?
<b>Interviewee:</b> 看一下喔。嗯...怎麼感覺會跳掉？好像下面嗎？	<b>Interviewee:</b> Let me see. Um... why does it feel like it jumps away? Is it further down?
<b>Interviewer:</b> 你要想要怎麼樣子的安全帽的？	<b>Interviewer:</b> What kind of helmet are you looking for?
<b>Interviewee:</b> 呃，要四分之三的，就是這種，這種模式的。然後希望是白色的，這樣。	<b>Interviewee:</b> Uh, I want a three-quarter one, like this type, this style. And I hope it's white, like that.
<b>Interviewer:</b> 哦，沒有什麼品牌限制？	<b>Interviewer:</b> Oh, no brand restrictions?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Right.
<b>Interviewer:</b> 那有白色的嗎？來看一下。	<b>Interviewer:</b> Are there white ones? Let's take a look.
<b>Interviewee:</b> 網路慢慢的。嗯，這邊地下室網路比較弱。	<b>Interviewee:</b> The internet is slow. Um, the internet is weaker here in the basement.
<b>Interviewer:</b> 所以平常會遇到這個網路的問題嗎？你說用 momo 的時候？	<b>Interviewer:</b> So do you usually encounter this internet problem? When using momo, you mean?
<b>Interviewee:</b> 對。嗯，不太會，不太會。	<b>Interviewee:</b> Yes. Um, not really, not really.
<b>Interviewer:</b> 你剛剛選這個呃產品是為什麼？	<b>Interviewer:</b> Why did you choose this uh product just now?
<b>Interviewee:</b> 這個嗎？就是，就是第一眼看的時候覺得造型好看。	<b>Interviewee:</b> This one? It's just, at first glance, I thought the design looked good.
<b>Interviewer:</b> 好。那這個網頁上，你覺得最重要的地方在哪裡？	<b>Interviewer:</b> Okay. On this webpage, where do you think the most important part is?
<b>Interviewee:</b> 這個網頁上最重要的地方嗎？最重要的地方是...呃...搜尋的時候就會有很多跟這個有關，然後會...會有我們想不到，但可能跟這個產品有關的東西也會跳出來。然後可能就會順便想要買。	<b>Interviewee:</b> The most important part on this webpage? The most important part is... uh... when searching, there will be many related items, and then... there will be things we didn't think of, but possibly related to this product, that also pop up. Then maybe I'll want to buy them along the way.
<b>Interviewer:</b> 嗯嗯。那還有什麼其他的嗎？	<b>Interviewer:</b> Mhm. Is there anything else?
<b>Interviewee:</b> 其他？	<b>Interviewee:</b> Else?
<b>Interviewer:</b> 其他的嗎？	<b>Interviewer:</b> Anything else?
<b>Interviewee:</b> 以現在這個畫面來說嗎？	<b>Interviewee:</b> In terms of this current screen?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 嗯嗯，還是什麼都可以。	<b>Interviewer:</b> Mhm, or anything is fine.
<b>Interviewee:</b> 嗯，什麼都可以。	<b>Interviewee:</b> Um, anything is fine.
<b>Interviewer:</b> 就是網頁上，呃，有很多，不是有很多資料嗎？你覺得哪裡是比較重要？	<b>Interviewer:</b> Like on the webpage, uh, there's a lot, isn't there a lot of information? Where do you think is more important?
<b>Interviewee:</b> 就是這個本身產品的畫面，跟價格有寫清楚。	<b>Interviewee:</b> Just the image of the product itself, and that the price is clearly written.
<b>Interviewer:</b> 價格，還有價格。那評論呢？	<b>Interviewer:</b> Price, and price. What about reviews?
<b>Interviewee:</b> 評論的話，我覺得...我覺得momo的評論我會比較...可能我沒有很常用momo，所以我沒有很知道，就是它的評論好像都會想要可以往下滑就找到。	<b>Interviewee:</b> For reviews, I think... I think momo's reviews I would more... maybe because I don't use momo very often, so I don't really know, it seems like its reviews, you'd want to be able to just scroll down and find them.
<b>Interviewer:</b> 嗯。那是不太會看評論？	<b>Interviewer:</b> Um. So you don't really look at reviews much?
<b>Interviewee:</b> 評論的話嗎？會看會看，會希望有實體的圖片，就是別人購買後，就是買家購買後的那個實體的，實體的樣品這樣。	<b>Interviewee:</b> Reviews? I do look, I do look. I hope there are real photos, like after someone else buys it, the buyer's actual, actual sample photos like that.
<b>Interviewer:</b> 那評論的話，你是比較相信那個momo上的評論，還是在其他的平台上的評論？	<b>Interviewer:</b> For reviews, do you trust the reviews on momo more, or reviews on other platforms?
<b>Interviewee:</b> 比起蝦皮那些嘛，我覺得會比較相信momo。	<b>Interviewee:</b> Compared to Shopee and those, I think I trust momo more.
<b>Interviewer:</b> 哟，為什麼呢？	<b>Interviewer:</b> Oh, why is that?
<b>Interviewee:</b> 因為...呃...蝦皮感覺有很...比較方便，就是買家的...呃...賣家的身份確認上好像比momo的還容易一些，所以比較容易買到就是比較...呃...不符合圖片的一些商品的感覺。好好。	<b>Interviewee:</b> Because... uh... Shopee feels very... convenient, meaning the buyer's... uh... the seller's identity verification seems easier than momo's, so it's easier to buy things that are more... uh... don't match the pictures. Okay okay.
<b>Interviewer:</b> 你可以幫我...去上面？好。剛剛那個右邊有一個黃色的地方？黃色的部分。這個。好。你覺得這個是什麼？	<b>Interviewer:</b> Can you help me... go up? Okay. Just now on the right side, there was a yellow area? The yellow part. This one. Okay. What do you think this is?
<b>Interviewee:</b> 這個是...呃...就是關於產品的一些資料，跟品牌的資料跟內容嘛。	<b>Interviewee:</b> This is... uh... just some information about the product, and the brand's information and content.
<b>Interviewer:</b> 那你覺得他講的，呃，有什麼重要的嗎？	<b>Interviewer:</b> Do you think what it says, uh, is important in any way?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 你說這有什麼重要的嗎？ 嗯...了解一個產品本身的品牌能夠讓我們更知道這個產品本身對我們的效果是不是好的，然後是不是我們想要買到的材質，跟品牌本身給的信用也會比較有保障的感覺，會比較願意下單。	<b>Interviewee:</b> You mean is this important? Um... Understanding the brand of a product itself allows us to know better if the product itself will be effective for us, and if it's the material we want to buy. And the credit given by the brand itself also feels more guaranteed, making one more willing to place an order.
<b>Interviewer:</b> 嗯。那你會覺得這個內容是關於這個產品嗎？	<b>Interviewer:</b> Um. Do you feel this content is about this product?
<b>Interviewee:</b> 對對。	<b>Interviewee:</b> Yes, yes.
<b>Interviewer:</b> 那跟這個產品有關係嗎？	<b>Interviewer:</b> Is it related to this product?
<b>Interviewee:</b> 跟這個產品有關係嗎？有。 因為他有講到蠻多關於產品本身的，就是製造的...呃...國家，然後還有用的材料。 我覺得是會想要...呃...買家買東西之前會想要先知道是哪裡出產的。	<b>Interviewee:</b> Related to this product? Yes. Because it mentioned quite a bit about the product itself, like the manufacturing... uh... country, and also the materials used. I think buyers would want to know where it's produced before buying.
<b>Interviewer:</b> 好，OK。那你可以幫我看第二個部分嗎？	<b>Interviewer:</b> Okay, OK. Can you look at the second section for me?
<b>Interviewee:</b> 第二個部分？嗯。	<b>Interviewee:</b> The second section? Um.
<b>Interviewer:</b> 有看到嗎？第...這個嗎？ 呃，上面一點。你看，你有發現有...有三個部分嗎？	<b>Interviewer:</b> Did you see it? The... this one? Uh, a bit higher. Look, did you notice there are... three sections?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。這個是什麼？	<b>Interviewer:</b> Okay. What is this?
<b>Interviewee:</b> 哟...問你幹嘛來著？就是... 呃...就是這個東西本身，產品對於環境的影響，就是有沒有環保的效果嘛。	<b>Interviewee:</b> Oh... what was I asking you? It's... uh... just this thing itself, the product's impact on the environment, like whether it has environmental effects.
<b>Interviewer:</b> 嗯。哦。那這些其他的牌子你有看過嗎？	<b>Interviewer:</b> Um. Oh. Have you seen these other brands before?
<b>Interviewee:</b> 你說...嗯...好像有聽過這個。哦，但沒有很熟。	<b>Interviewee:</b> You mean... um... I think I've heard of this one. Oh, but not familiar.
<b>Interviewer:</b> 那是你覺得它是做安全帽的嗎？	<b>Interviewer:</b> Do you think it makes helmets?
<b>Interviewee:</b> 感覺不只會有安全帽，感覺會跟很多其他我沒有想像得到，但好像不會只是安全帽的牌子，聽起來也不像。	<b>Interviewee:</b> Feels like it's not just helmets, feels like it's related to many other things I wouldn't have imagined, but it seems like it wouldn't just be a helmet brand, doesn't sound like it either.
<b>Interviewer:</b> 那你是覺得是真的還是假的呢？	<b>Interviewer:</b> Do you think it's real or fake?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 你說這邊的品牌資訊嗎？我會相信是真的。	<b>Interviewee:</b> You mean the brand information here? I would believe it's real.
<b>Interviewer:</b> 好。那第三個部分呢？那我還是問你，為什麼你覺得是真的？	<b>Interviewer:</b> Okay. What about the third section? Then let me ask again, why do you think it's real?
<b>Interviewee:</b> 嗯...因為覺得他寫得算蠻清楚的，然後也不只提供一個品牌，是提供了不同品牌來做比較，然後也有解釋到原因，所以我會覺得是真的，會相信看看。	<b>Interviewee:</b> Um... because I feel it's written quite clearly, and it doesn't just provide one brand, it provides different brands for comparison, and also explains the reasons, so I would feel it's real, I would believe it and take a look.
<b>Interviewer:</b> 好，OK。那第三個部分是什麼？	<b>Interviewer:</b> Okay, OK. What is the third section?
<b>Interviewee:</b> 第三個部分是投資。	<b>Interviewee:</b> The third section is investment.
<b>Interviewer:</b> 投資，好。那你之前有投資過嗎？	<b>Interviewer:</b> Investment, okay. Have you invested before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那你覺得如果你喜歡一個產品，那你想要投資那個公司嗎？	<b>Interviewer:</b> Do you think if you like a product, would you want to invest in that company?
<b>Interviewee:</b> 你說喜歡這個產品的話，會想要投資這個公司嗎？目前的話會沒有想。嗯...如果年紀可能再一兩年可能會想到。	<b>Interviewee:</b> You mean if I like this product, would I want to invest in this company? Right now, I wouldn't think so. Um... if maybe in another year or two, I might think about it.
<b>Interviewer:</b> 那我的意思是，賣東西跟投資有什麼關係嗎？還是是完全不一樣的？	<b>Interviewer:</b> What I mean is, is there any relationship between selling things and investing? Or are they completely different?
<b>Interviewee:</b> 嗯...我覺得是完全不一樣的。	<b>Interviewee:</b> Um... I think they are completely different.
<b>Interviewer:</b> OK。好。那你幫我回那個第一個部分喔。	<b>Interviewer:</b> OK. Okay. Can you help me go back to that first section?
<b>Interviewee:</b> 好的。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那下面一點有一些按鈕可以...呃...你想要按一個嗎？	<b>Interviewer:</b> Then a bit lower there are some buttons you can... uh... do you want to press one?
<b>Interviewee:</b> (Clicks button)	<b>Interviewee:</b> (Clicks button)
<b>Interviewer:</b> 你剛剛按哪一個？	<b>Interviewer:</b> Which one did you just press?
<b>Interviewee:</b> 尋找替代產品。	<b>Interviewee:</b> Find Alternative Products.
<b>Interviewer:</b> 那為什麼按這個呢？	<b>Interviewer:</b> Why press this one?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 噢...因為會想看看，就是有沒有更符合我想要的，安全帽的樣式或功能。所以會想看一下有沒有其他的，就是可以拿來比較看看，然後或者是價格上有什麼不一樣的話，也會拿來比較看看。	<b>Interviewee:</b> Um... because I'd want to see, like, if there's something that better fits what I want, the style or function of the helmet. So I'd want to see if there are others, that I can compare, and then or if the price is different, I'd also compare them.
<b>Interviewer:</b> 好。那你還有什麼其他的問題，你想要問他嗎？	<b>Interviewer:</b> Okay. Do you have any other questions you want to ask it?
<b>Interviewee:</b> 有問題...你也可以直接打字...就是會想問有沒有...呃...產品會不會有...就是如果損壞的話，會不會有...就是可以去哪裡修？	<b>Interviewee:</b> Have questions... you can also type directly... like, I'd want to ask if there's... uh... if the product will have... like if it gets damaged, will there be... like where can I go to get it repaired?
<b>Interviewer:</b> 要打上去嗎？	<b>Interviewer:</b> Should I type it in?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 你也可以...可以可以。問他。	<b>Interviewer:</b> You can also... yes, yes. Ask it.
<b>Interviewee:</b> (Types) 好。	<b>Interviewee:</b> (Types) Okay.
<b>Interviewer:</b> 上面？你要去上面？	<b>Interviewer:</b> Above? You need to go up?
<b>Interviewee:</b> 在上面看嗎？對。嗯。	<b>Interviewee:</b> Look above? Yes. Um.
<b>Interviewer:</b> 那他說什麼？	<b>Interviewer:</b> What does it say?
<b>Interviewee:</b> 通常來說，像這樣的品 牌應該會提供產品保固服務，但具體的保固條款和修理政策可能會因產品、你所在地區和購買地點有所不同。可以查看購買時的保固說明，或是聯繫客服獲知詳細資訊。	<b>Interviewee:</b> Generally speaking, brands like this should provide product warranty services, but specific warranty terms and repair policies may vary depending on the product, your region, and the place of purchase. You can check the warranty description at the time of purchase, or contact customer service for detailed information.
<b>Interviewer:</b> 噢。你想要嗎？	<b>Interviewer:</b> Do you want to?
<b>Interviewee:</b> 現在嗎？	<b>Interviewee:</b> Now?
<b>Interviewer:</b> 找找看？如果你想要可以跟他說 OK。	<b>Interviewer:</b> Look for it? If you want, you can tell it OK.
<b>Interviewee:</b> 你可以打字。好。	<b>Interviewee:</b> You can type. Okay.
<b>Interviewer:</b> 你覺得這個是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 哟...他跟你說哪裡可以修嘛，在這附近。哦。	<b>Interviewee:</b> Oh... it tells you where you can get it repaired, near here. Oh.
<b>Interviewer:</b> 那你覺得這個有用嗎？	<b>Interviewer:</b> Do you think this is useful?
<b>Interviewee:</b> 有用，很有用。	<b>Interviewee:</b> Useful, very useful.
<b>Interviewer:</b> 這個答案是真的嗎？	<b>Interviewer:</b> Is this answer real?
<b>Interviewee:</b> 哈？是真的嗎？	<b>Interviewee:</b> Huh? Is it real?
<b>Interviewer:</b> 這個是假的。	<b>Interviewer:</b> This is fake.
<b>Interviewee:</b> 這個嗎？	<b>Interviewee:</b> This one?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 對。但是客人未來可以這樣問他。哦，因為我們有這個系列。好。	<b>Interviewer:</b> Yes. But customers can ask it like this in the future. Oh, because we have this series. Okay.
<b>Interviewer:</b> 那你可以幫我拍照，你剛剛的那個...你問的問題跟答案嗎？然後你就是一起...好，拍到這兩題都要拍得到嗎？	<b>Interviewer:</b> Then can you help me take a photo, of that just now... the question you asked and the answer? And then you just... together... okay, need to capture both questions?
<b>Interviewee:</b> 對對。	<b>Interviewee:</b> Yes, yes.
<b>Interviewer:</b> 可以？ 好。	<b>Interviewer:</b> Can you? Okay.
<b>Interviewee:</b> (Takes photo)	<b>Interviewee:</b> (Takes photo)
<b>Interviewer:</b> 那你覺得剛剛全部的裡面最重要的是什麼？ 比如說這個...這個跟 momo 全部裡面，你覺得最有用的是什麼呢？	<b>Interviewer:</b> Then what do you think was the most important part out of everything just now? For example, this... this and everything in momo, what do you think was the most useful?
<b>Interviewee:</b> 嗯嗯...評論。	<b>Interviewee:</b> Um um... reviews.
<b>Interviewer:</b> 好。那你可以幫我拍那個評論的部分？	<b>Interviewer:</b> Okay. Can you help me take a photo of the reviews section?
<b>Interviewee:</b> (Takes photo)	<b>Interviewee:</b> (Takes photo)
<b>Interviewer:</b> 那這樣就可以了。啊，還有還有，你剛剛有講出來那個代碼嗎？我忘記了。	<b>Interviewer:</b> Then that's fine. Ah, also, also, did you say that code out loud just now? I forgot.
<b>Interviewee:</b> 代碼？ 哪邊？	<b>Interviewee:</b> Code? Where?
<b>Interviewer:</b> 最上面這個？ 你幫我講出來。	<b>Interviewer:</b> The very top one? Help me say it out loud.
<b>Interviewee:</b> 要講出來嗎？ 報告的編號是 4XGN4。	<b>Interviewee:</b> Need to say it? The report number is 4XGN4.
<b>Interviewer:</b> 好。那你可以幫我卡片上寫一下？	<b>Interviewer:</b> Okay. Can you help me write it on the card?
<b>Interviewee:</b> (Writes code)	<b>Interviewee:</b> (Writes code)
<b>Interviewer:</b> 好，這樣就可以了。	<b>Interviewer:</b> Okay, that's fine.

### 16.1.21 Transcript 2025-03-06 - Chiayi (CCU) - BPDSA

**Source Files:** \* 2025-03-06 - Chiayi (CCU) - BPDSA.json \* 2025-03-06 - Chiayi (CCU) - BPDSA.txt

**Ziran ID Code:** BPDSA

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那我首先問你，我可以錄影我們對話嗎？	<b>Interviewer:</b> Okay. First, let me ask you, can I record our conversation?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。我是建功大學創意設計所的學生，然後這個是我的論文的一部分，呃，一個環保的 app。那等一下我們會測試這個 app，還有晚一點你可以幫我填問卷。好。那第一個問題是，你...呃...你會買網路上的東西嗎？	<b>Interviewer:</b> Okay. I'm a student from the Institute of Creative Design at Jian Gong University, and this is part of my thesis, uh, an environmental app. Then later we will test this app, and also later you can help me fill out the questionnaire. Okay. So the first question is, you... uh... do you buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 你使用什麼平台呢？	<b>Interviewer:</b> What platforms do you use?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 蝦皮。還有其他的嗎？	<b>Interviewer:</b> Shopee. Are there any others?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那你呃...有使用過 momo 嗎？	<b>Interviewer:</b> Okay. Have you uh... used momo?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那今天第一次使用 momo，你有什麼想要買的嗎？	<b>Interviewer:</b> Then today is the first time using momo, is there anything you want to buy?
<b>Interviewee:</b> 我想一下。	<b>Interviewee:</b> Let me think.
<b>Interviewer:</b> 有什麼...你可以直接打字，如果有什麼喜歡的品牌啊...	<b>Interviewer:</b> Anything... you can type directly, if there are any brands you like...
<b>Interviewee:</b> (Types)	<b>Interviewee:</b> (Types)
<b>Interviewer:</b> 是什麼？ Maybelline 的打...這個？	<b>Interviewer:</b> What is it? Maybelline's... this one?
<b>Interviewee:</b> Maybelline。好。這個唇釉。	<b>Interviewee:</b> Maybelline. Okay. This lip glaze.
<b>Interviewer:</b> 為什麼？ 為什麼這個品 牌呢？	<b>Interviewer:</b> Why? Why this brand?
<b>Interviewee:</b> 因為它就是評價一直都還不 錯，然後我有用過他們家的粉底液，然後還 有一支口紅，顏色跟質地都還不錯。	<b>Interviewee:</b> Because its reviews have always been quite good, and I've used their foundation, and also a lipstick, the color and texture were both quite good.
<b>Interviewer:</b> 啊。那這個產品你有用 過嗎？	<b>Interviewer:</b> Ah. Have you used this specific product?
<b>Interviewee:</b> 這個沒有。	<b>Interviewee:</b> This one, no.
<b>Interviewer:</b> 好。那這是什麼產品？	<b>Interviewer:</b> Okay. What product is this?
<b>Interviewee:</b> 這個是 Maybelline 超持久水 光鎖色唇釉。	<b>Interviewee:</b> This is Maybelline SuperStay Vinyl Ink Liquid Lipstick.
<b>Interviewer:</b> 好。那這個網頁上最重要的地 方在哪裡？	<b>Interviewer:</b> Okay. On this webpage, where is the most important part?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 最重要嗎？	<b>Interviewee:</b> Most important?
<b>Interviewer:</b> 對。對你來說？	<b>Interviewer:</b> Yes. For you?
<b>Interviewee:</b> 對我來說最重要的...呃...應該會是他的色號吧？他應該可以選色號。	<b>Interviewee:</b> For me, the most important... uh... would probably be its shades? It should allow selecting shades.
<b>Interviewer:</b> 好。那第二個？	<b>Interviewer:</b> Okay. What's the second?
<b>Interviewee:</b> 第二個的話，價格吧。看他近期有沒有一些折扣之類的。	<b>Interviewee:</b> Second would be the price. See if there are any recent discounts or things like that.
<b>Interviewer:</b> 好。那第三個？	<b>Interviewer:</b> Okay. What's the third?
<b>Interviewee:</b> 第三個的話...看一下喔。應該會看他的評價吧。	<b>Interviewee:</b> Third would be... let me see. Probably look at its reviews.
<b>Interviewer:</b> 嗯，好，評價。他們在說什麼？	<b>Interviewer:</b> Um, okay, reviews. What are they saying?
<b>Interviewee:</b> 評價...他寫說顏色適合，上唇舒適沒有負擔，然後買第二個顏色，這個顏色適合淡妝。	<b>Interviewee:</b> Reviews... it says the color is suitable, comfortable on the lips without burden, and bought a second color, this color is suitable for light makeup.
<b>Interviewer:</b> 好。那你覺得這個會影響你的想法嗎？	<b>Interviewer:</b> Okay. Do you think this would influence your thoughts?
<b>Interviewee:</b> 這個...這些評價可能會讓我再考慮一下下，因為他們沒有寫得特別的明確。	<b>Interviewee:</b> This... these reviews might make me reconsider a bit, because they didn't write very specifically.
<b>Interviewer:</b> 那最上面右邊有一個黃色的部分，你覺得這個是什麼？	<b>Interviewer:</b> Then at the top right, there's a yellow section, what do you think that is?
<b>Interviewee:</b> 這個是...喔，他幫我分析了一下他的，它的品牌，然後還有這個產品的一些材質、環境問題等等。	<b>Interviewee:</b> This is... oh, it helped me analyze its, its brand, and also some materials, environmental issues, etc., of this product.
<b>Interviewer:</b> 嗯。那有什麼你覺得重要的嗎？	<b>Interviewer:</b> Um. Is there anything you think is important?
<b>Interviewee:</b> 你說這三個上面的嗎？還是剛剛那個內容？	<b>Interviewee:</b> You mean the three above? Or the content just now?
<b>Interviewer:</b> 內容。對。	<b>Interviewer:</b> The content. Yes.
<b>Interviewee:</b> 嘴...它是有環保爭議的品牌嗎？不知道這件事耶。	<b>Interviewee:</b> Oh... it's a brand with environmental controversies? I didn't know about this.
<b>Interviewer:</b> 覺得...你說這邊覺得重要的嗎？嗯？對你來說？還是有什麼你之前不知道的？	<b>Interviewer:</b> Feel... you mean do you feel this part is important? Huh? For you? Or is there anything you didn't know before?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 之前不知道的是，我之前不知道他居然是有環保爭議的品牌。然後這邊的話，可能會看一下這邊。對我重要的話...這個。	<b>Interviewee:</b> What I didn't know before is, I didn't know it was actually a brand with environmental controversies. Then here, I might look at this part. If it's important to me... this one.
<b>Interviewer:</b> 這個？ 這個成因？	<b>Interviewer:</b> This one? This cause/reason?
<b>Interviewee:</b> 產品包裝及原料選擇被批評不符合環保標準。	<b>Interviewee:</b> Product packaging and raw material choices criticized for not meeting environmental standards.
<b>Interviewer:</b> 為什麼這個重要？	<b>Interviewer:</b> Why is this important?
<b>Interviewee:</b> 就是可能...對不起...可能對於...就是我要買這個東西，然後我之後可能要做一些回收啊等等的，然後它也對環境有一些不太好的影響，就會影響我繼續購買這個品牌的東西。	<b>Interviewee:</b> Just maybe... sorry... maybe for... like I want to buy this thing, and then later I might need to do some recycling, etc., and it also has some not-so-good impacts on the environment, that would affect whether I continue to buy things from this brand.
<b>Interviewer:</b> 嗯。好。那你...你看可以幫我看第二個部分一下？	<b>Interviewer:</b> Um. Okay. Can you... look, can you help me look at the second section?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 你覺得這個是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 這個...這邊是...等一下...什麼？ 好...這邊應該是他的化學成分嗎？	<b>Interviewee:</b> This... this part is... wait... what? Okay... this part should be its chemical ingredients?
品牌名稱。好。然後檢判...這個部分，他的潛力嗎？ 因為現在很多企業都在注重永續，然後他們沒有繼續在做一些環保產品的話，可能會對環境造成汙染，然後消費者也可能會去抵制他們的產品。	Brand name. Okay. Then review... this section, its potential? Because many companies now focus on sustainability, and if they don't continue to make some environmentally friendly products, it might pollute the environment, and consumers might also boycott their products.
<b>Interviewer:</b> 嗯。那你自己你會考慮這些其他的品牌嗎？	<b>Interviewer:</b> Um. Would you personally consider these other brands?
<b>Interviewee:</b> 其他的品牌？ 如果我在這邊這個測驗中看到這些，我可能會回去想要查一下，可能會考慮這些品牌。	<b>Interviewee:</b> Other brands? If I saw these here in this test, I might go back and want to look them up, might consider these brands.
<b>Interviewer:</b> 那你之前有看過這些品牌嗎？	<b>Interviewer:</b> Have you seen these brands before?
<b>Interviewee:</b> 沒有耶。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那如果你...嗯...有什麼問題嗎？ 想要問什麼嗎？ 關於這些品牌？	<b>Interviewer:</b> Then if you... um... do you have any questions? Want to ask anything? About these brands?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這些品牌...嗯...我也想要看他們...嗯...因為我現在知道他們這些已經對環境有減少一些汙染，那之後可能就會想要繼續看他們的口紅的品牌，品牌的色號出的符不符合標準，然後再來我可以看一下他的外觀是否符合我的期待，可以帶出門的期待。嗯。然後它的價格。	<b>Interviewee:</b> These brands... um... I'd also want to see them... um... because I now know these have already reduced some pollution to the environment, so later I might want to continue looking at their lipstick brands, whether the shades released meet standards, and then I can look at its appearance to see if it meets my expectations, expectations for carrying it out. Um. And its price.
<b>Interviewer:</b> 好。那第三個部分，幫你看一下。	<b>Interviewer:</b> Okay. Then the third section, let me take a look for you.
<b>Interviewee:</b> (Looks)	<b>Interviewee:</b> (Looks)
<b>Interviewer:</b> 這個是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 投資。	<b>Interviewee:</b> Investment.
<b>Interviewer:</b> 你之前有投資過嗎？	<b>Interviewer:</b> Have you invested before?
<b>Interviewee:</b> 沒有，我沒有投資過耶。	<b>Interviewee:</b> No, I haven't invested.
<b>Interviewer:</b> 那你覺得如果你有買過這個品牌，你會想要投資這個公司嗎？如果你覺得這個品牌是好品牌？	<b>Interviewer:</b> Then do you think if you had bought from this brand, would you want to invest in this company? If you feel this brand is a good brand?
<b>Interviewee:</b> 是好品牌...我如果是好品牌，我才會願意投資他們。但是依我剛剛看，他們對於...呃...環保議題已經有些問題了，而且如果大眾知道這些東西的話，可能會考慮購買其他品牌選擇，就是減少選擇他們的品牌。所以我覺我可能不太會投資他們。	<b>Interviewee:</b> Is it a good brand... If it's a good brand, only then would I be willing to invest in them. But based on what I just saw, they already have some issues with... uh... environmental topics, and if the public knows about these things, they might consider buying other brands, meaning reducing the choice of their brand. So I think I probably wouldn't invest in them much.
<b>Interviewer:</b> 嗯。那投資不是為了賺錢嗎？	<b>Interviewer:</b> Um. Isn't investment for making money?
<b>Interviewee:</b> 投資不是為了賺錢嗎？可是...呃...如果我剛剛看那樣的話，他們再持續做同樣的事情的話，股價就會下跌，我這樣也不會賺錢啊。	<b>Interviewee:</b> Isn't investment for making money? But... uh... if based on what I just saw, if they continue doing the same things, the stock price will fall, and I won't make money that way either.
<b>Interviewer:</b> 嗯。好。那第一個部分，最...最下面...呃，第一個部分...呃，抱歉。最下面有按鈕，你想要按一個嗎？	<b>Interviewer:</b> Um. Okay. Then the first section, the very... bottom... uh, the first section... uh, sorry. At the very bottom there are buttons, do you want to press one?
<b>Interviewee:</b> 嗯。這個。	<b>Interviewee:</b> Um. This one.
<b>Interviewer:</b> 你要按什麼？	<b>Interviewer:</b> What do you want to press?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃...等一下喔。尋找替代產品。	<b>Interviewee:</b> Uh... wait a moment. Find Alternative Products.
<b>Interviewer:</b> 好。那他說什麼？	<b>Interviewer:</b> Okay. What does it say?
<b>Interviewee:</b> 呃...好。他說以下是一 Maybelline 跟其他更具有可持續性的化妝品品牌的比較表。然後他給出的除了 Maybelline，還有資生堂，他有減少包裝物、動物試驗，然後對於可持續發展計畫有積極的推行。他們也沒有動物實驗，然後包裝廢棄物也較低，有更多可持續的選擇。然後露華濃，減少包裝物試驗，也沒有動物的試驗，然後積極推行可持續發展計劃，沒有動物試驗，然後同樣跟資生堂一樣，沒有...包裝廢棄物也更低...有更多可持續選擇。 然後這個...Ilia？ 應該也是。	<b>Interviewee:</b> Uh... okay. It says below is a comparison table of Maybelline and other more sustainable cosmetics brands. Then besides Maybelline, it gives Shiseido, which has reduced packaging waste, animal testing, and actively promotes sustainable development plans. They also don't have animal testing, and packaging waste is lower, with more sustainable options. Then Revlon, reduced packaging waste testing, also no animal testing, and actively promotes sustainable development plans, no animal testing, and similarly to Shiseido, no... packaging waste is also lower... more sustainable options. Then this... Ilia? Probably also.
<b>Interviewer:</b> 你覺得這裡有什麼對你來說重要的資料嗎？	<b>Interviewer:</b> Do you think there's any important information here for you?
<b>Interviewee:</b> 你說這幾個？ 就是你可以選，如果你覺得有什麼重要的，在哪一個部分？	<b>Interviewee:</b> You mean these few? Like, you can choose, if you feel something is important, in which part?
<b>Interviewee:</b> 我蠻看重這個耶，動物實驗的。因為我覺得我蠻喜歡小動物的，所以我對於一些...而且我看過一些就是用動物測試實驗的，我覺得都不太好。所以我蠻看重這個。我覺得有動物的實驗我都盡量不太會買他們。	<b>Interviewee:</b> I care quite a bit about this one, animal testing. Because I feel I quite like small animals, so for some... and I've seen some that use animals for testing experiments, I feel they are not very good. So I care a lot about this. I feel if there's animal testing, I try my best not to buy from them.
<b>Interviewer:</b> 好。那你有什麼問題你想要問他們？ 你可以直接打字，還是也可以按這些按鈕。	<b>Interviewer:</b> Okay. Do you have any questions you want to ask them? You can type directly, or you can also press these buttons.
<b>Interviewee:</b> 哦，這些按鈕？	<b>Interviewee:</b> Oh, these buttons?
<b>Interviewer:</b> 有些按鈕，但是你可以直接打字，如果有其他的問題。	<b>Interviewer:</b> Some buttons, but you can type directly if you have other questions.
<b>Interviewee:</b> 其他的問題...嗯...	<b>Interviewee:</b> Other questions... um...
<b>Interviewer:</b> 那這個...你要去上面？	<b>Interviewer:</b> Then this... you need to go up?
<b>Interviewee:</b> 講？ 哟...對不起，沒事沒事。	<b>Interviewee:</b> Say? Oh... sorry, it's okay, it's okay.
<b>Interviewer:</b> 你剛剛問什麼？	<b>Interviewer:</b> What did you just ask?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我問我買的產品裡有沒有對我身體有害化學物質。嗯。然後他說，要了解你購買的產品中是否含有化學物質，可以查看產品的成分標籤或是產品的數位產品護照，這通常會提供詳細的成分跟 ESG 數據。	<b>Interviewee:</b> I asked if the product I bought contains any harmful chemical substances for my body. Um. Then it said, to understand if the product you purchased contains chemical substances, you can check the product's ingredient label or the product's digital product passport, which usually provides detailed ingredients and ESG data.
<b>Interviewer:</b> 嗯。那還有待會問你的問題嗎？	<b>Interviewer:</b> Um. Are there any questions it will ask you later?
<b>Interviewee:</b> 還要問別的問題嗎？	<b>Interviewee:</b> Need to ask other questions?
<b>Interviewer:</b> 不是，他剛剛不是問一個問題嗎？ 我可以幫你查看數位產品護照？	<b>Interviewer:</b> No, didn't it just ask a question? I can help you check the digital product passport?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那你想要嗎？	<b>Interviewer:</b> Do you want to?
<b>Interviewee:</b> 好好。	<b>Interviewee:</b> Okay okay.
<b>Interviewer:</b> 那你可以幫我跟他講 OK ?	<b>Interviewer:</b> Then can you help me tell it OK?
<b>Interviewee:</b> OK。好。	<b>Interviewee:</b> OK. Okay.
<b>Interviewer:</b> 那這個...這個都是假的，它跟這個產品沒有關係。但是基本上這個想法是，如果...如果一個產品，那個產品可以有一個護照...這個基本上是假的。它...什麼樣的產品...你知道這個嗎？ 你知道有一些產品有護照嗎？	<b>Interviewer:</b> Then this... this is all fake, it's not related to this product. But basically the idea is, if... if a product, that product could have a passport... this is basically fake. It... what kind of product... do you know about this? Do you know some products have passports?
<b>Interviewee:</b> 有，我知道這個東西。	<b>Interviewee:</b> Yes, I know about this thing.
<b>Interviewer:</b> 那你有看過嗎？	<b>Interviewer:</b> Have you seen one?
<b>Interviewee:</b> 我沒有看過耶。我之前有在找這個...有人在看這個東西，但是我沒有看過。	<b>Interviewee:</b> I haven't seen one. I was looking for this before... someone was looking at this thing, but I haven't seen one.
<b>Interviewer:</b> 好。那如果就是...如果有這個護照，你覺得護照應該是有什麼樣的...什麼樣的內容？	<b>Interviewer:</b> Okay. Then if just... if, if there was this passport, what kind of... what kind of content do you think the passport should have?
<b>Interviewee:</b> 護照...他先告訴我他產地、成分，然後...他...有一些...不是說...	<b>Interviewee:</b> Passport... it first tells me its origin, ingredients, then... it... has some... wasn't it said...
<b>Interviewer:</b> 這邊嗎？ 如果你可以選的話，你想要看什麼樣的內容？	<b>Interviewer:</b> Here? If you could choose, what kind of content would you want to see?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 產地、成分，然後我也想看剛剛那個有沒有動物試驗。嗯...還有什麼...我想一下喔。有些有永續標章，我覺得有沒有永續標章可以標出來。嗯，大概就這樣。	<b>Interviewee:</b> Origin, ingredients, then I also want to see that one just now about animal testing. Um... what else... let me think. Some have sustainability labels, I think whether it has a sustainability label could be marked. Um, probably just that.
<b>Interviewer:</b> 好。那這樣就可以了。那你可以幫我回那個原本的地方？它最上面有一個代碼。這個綠色的代碼。你可以幫我講出來嗎？	<b>Interviewer:</b> Okay. Then that's fine. Can you help me go back to the original place? At the very top, there's a code. This green code. Can you say it out loud for me?
<b>Interviewee:</b> 綠...就是這個？這個代碼？ 哟...B-P-D-S-A。	<b>Interviewee:</b> Green... just this one? This code? Oh... B-P-D-S-A.
<b>Interviewer:</b> 好。那你可以幫我寫在卡片上？那你覺得最重要的部分是什麼？你可以幫我拍照一張？	<b>Interviewer:</b> Okay. Can you help me write it on the card? Then what do you think is the most important part? Can you take one photo for me?
<b>Interviewee:</b> 最重要？嗯。	<b>Interviewee:</b> Most important? Um.
<b>Interviewer:</b> 可以用你的手機拍照。	<b>Interviewer:</b> You can use your phone to take the photo.
<b>Interviewee:</b> 這邊？為什麼？這邊？欸...就是我剛剛，我覺得這麼...我對於這個我蠻驚訝的，因為我一直都不知道 Maybelline 是這種品牌，就嚇到我。	<b>Interviewee:</b> Here? Why? Here? Eh... just now, I felt this... I was quite surprised by this, because I never knew Maybelline was this kind of brand, it shocked me.
<b>Interviewer:</b> 你講出來一下。	<b>Interviewer:</b> Say it out loud briefly.
<b>Interviewee:</b> 呃...Maybelline 過去受環保爭議，包括包裝廢棄物跟動物試驗問題。然後這件事讓我蠻驚訝的，因為我一直以為 Maybelline 沒有做出這種事情，所以我之前都會買他們商品。但是可能看過這個之後，我就會對要買他們商品這件事再考慮一下。	<b>Interviewee:</b> Uh... Maybelline has faced environmental controversies in the past, including packaging waste and animal testing issues. Then this matter surprised me quite a bit, because I always thought Maybelline didn't do this kind of thing, so I used to buy their products. But maybe after seeing this, I will reconsider buying their products.
<b>Interviewer:</b> 好，謝謝。	<b>Interviewer:</b> Okay, thank you.

### 16.1.22 Transcript 2025-03-06 - Chiayi (CCU) - V7W8A

**Source Files:** \* 2025-03-06 - Chiayi (CCU) - V7W8A.json \* 2025-03-06 - Chiayi (CCU) - V7W8A.txt

**Ziran ID Code:** V7W8A

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我要首先問你，我可以錄音我們的對話嗎？	<b>Interviewer:</b> First I want to ask you, can I record our conversation?
<b>Interviewee:</b> 可以錄音？可以。	<b>Interviewee:</b> Record? Yes.
<b>Interviewer:</b> 好。基本上我是建功大學創意設計所的學生，然後這個是我的論文的一部分，那個環保的 app。那等一下我們會測試這個 app，然後之後還有一個問卷。好。那第一個問題是，你會網路上買東西嗎？	<b>Interviewer:</b> Okay. Basically, I'm a student from the Institute of Creative Design at Jian Gong University, and this is part of my thesis, that environmental app. Then later we will test this app, and after that, there's also a questionnaire. Okay. So the first question is, do you buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你基本上使用什麼平台？	<b>Interviewer:</b> What platforms do you basically use?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 蝦皮。還有其他的嗎？	<b>Interviewer:</b> Shopee. Are there any others?
<b>Interviewee:</b> 淘寶。	<b>Interviewee:</b> Taobao.
<b>Interviewer:</b> 淘寶。你有用過 momo 嗎？	<b>Interviewer:</b> Taobao. Have you used momo?
<b>Interviewee:</b> momo 還沒。	<b>Interviewee:</b> Not yet for momo.
<b>Interviewer:</b> 好。那平常你會買什麼類型的東西？	<b>Interviewer:</b> Okay. What type of things do you usually buy?
<b>Interviewee:</b> 衣服。	<b>Interviewee:</b> Clothes.
<b>Interviewer:</b> 衣服。那現在是你第一次試用 momo 嗎？	<b>Interviewer:</b> Clothes. So is this your first time trying momo?
<b>Interviewee:</b> 是。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那你有什麼想要買的嗎？	<b>Interviewer:</b> Okay. Is there anything you'd like to buy?
<b>Interviewee:</b> 想要買的？呃...	<b>Interviewee:</b> Want to buy? Uh...
<b>Interviewer:</b> 你也可以直接打字。	<b>Interviewer:</b> You can also just type directly.
<b>Interviewee:</b> 好，那我直接打字。	<b>Interviewee:</b> Okay, then I'll type directly.
<b>Interviewee:</b> (Types)	<b>Interviewee:</b> (Types)
<b>Interviewer:</b> 你剛剛打什麼？剛剛查什麼品牌？	<b>Interviewer:</b> What did you just type? What brand did you just search for?
<b>Interviewee:</b> 呃，Nike。	<b>Interviewee:</b> Uh, Nike.
<b>Interviewer:</b> 呃，你要講出來。	<b>Interviewer:</b> Uh, you need to say it out loud.
<b>Interviewee:</b> 呃，我想要買 Nike 的 Dunk。	<b>Interviewee:</b> Uh, I want to buy Nike Dunks.
<b>Interviewer:</b> 所以你之前有買過 Nike 嗎？	<b>Interviewer:</b> So have you bought Nike before?
<b>Interviewee:</b> 呃，有，但是不是在 momo 買的。	<b>Interviewee:</b> Uh, yes, but not bought on momo.
<b>Interviewer:</b> 好。那你有找得到你想要的那樣的嗎？	<b>Interviewer:</b> Okay. Did you find the kind you were looking for?
<b>Interviewee:</b> 呃，有。	<b>Interviewee:</b> Uh, yes.
<b>Interviewer:</b> 有？好，請問...	<b>Interviewer:</b> Yes? Okay, may I ask...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我要點進去嗎？	<b>Interviewee:</b> Should I click into it?
<b>Interviewer:</b> 可以。好。那為什麼你選這個？	<b>Interviewer:</b> You can. Okay. Why did you choose this one?
<b>Interviewee:</b> 呃，因為好看。	<b>Interviewee:</b> Uh, because it looks good.
<b>Interviewer:</b> 好看。是。那這個網頁上你覺得對你來說最重要的地方是什麼？	<b>Interviewer:</b> Looks good. Right. On this webpage, what do you think is the most important part for you?
<b>Interviewee:</b> 呃...商品的照片。	<b>Interviewee:</b> Uh... the product photos.
<b>Interviewer:</b> 照片。還有？	<b>Interviewer:</b> Photos. Also?
<b>Interviewee:</b> 價格。	<b>Interviewee:</b> Price.
<b>Interviewer:</b> 價格。那第三個呢？	<b>Interviewer:</b> Price. What's the third?
<b>Interviewee:</b> 可能是看尺寸，有沒有我的尺寸。	<b>Interviewee:</b> Maybe looking at the size, whether my size is available.
<b>Interviewer:</b> 好。那你還是會考慮其他的商品嗎？還是你已經知道你要買的？	<b>Interviewer:</b> Okay. Would you still consider other products? Or do you already know what you want to buy?
<b>Interviewee:</b> 呃...我可能會往下看一下有沒有就是類似的商品。有時候像旁邊會有，然後可能會看...呃...	<b>Interviewee:</b> Uh... I might scroll down to see if there are similar products. Sometimes there are ones on the side, and then I might look... uh...
<b>Interviewer:</b> 那因為是你第一次使用momo，那你覺得這裡的資料夠嗎？還有其他的問題你想要知道嗎？	<b>Interviewer:</b> Since this is your first time using momo, do you think the information here is sufficient? Are there other questions or things you want to know?
<b>Interviewee:</b> 沒有。我覺得這邊的資料，就是可能有附尺碼跟價格，然後還有...可能會再看評論。	<b>Interviewee:</b> No. I think the information here, like having the size chart and price included, and also... I might look at the reviews again.
<b>Interviewer:</b> 好。那評論嗎？這裡有評論嗎？	<b>Interviewer:</b> Okay. What about reviews? Are there reviews here?
<b>Interviewee:</b> 嗯，找一下。這裡有評論嗎？有。	<b>Interviewee:</b> Um, let me look. Are there reviews here? Yes.
<b>Interviewer:</b> 評論說什麼？	<b>Interviewer:</b> What do the reviews say?
<b>Interviewee:</b> 評論說版型比較小，要買大一點。	<b>Interviewee:</b> Reviews say the fit is smaller, need to buy a size up.
<b>Interviewer:</b> 好。那你可幫我去最上面？	<b>Interviewer:</b> Okay. Can you help me go to the very top?
<b>Interviewee:</b> 好的。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那旁邊那個右邊有一個部分，你覺得這個是什麼？	<b>Interviewer:</b> Then on the side, the right side, there's a section, what do you think that is?
<b>Interviewee:</b> 這個嗎？嗯。這個是這個商品的環保程度嗎？	<b>Interviewee:</b> This one? Um. Is this the environmental friendliness level of this product?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那，你覺得這個裡面有什麼對你來說重要的嗎？	<b>Interviewer:</b> Okay. So, do you think there's anything important in here for you?
<b>Interviewee:</b> 好像 Nike 這個公司不太環保，這樣子。	<b>Interviewee:</b> It seems Nike, this company, isn't very environmentally friendly, like that.
<b>Interviewer:</b> 那可以點嗎？	<b>Interviewer:</b> Can you click it?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。你剛剛點什麼？	<b>Interviewer:</b> Okay. What did you just click?
<b>Interviewee:</b> 儲蓄。嗯。	<b>Interviewee:</b> Savings. Um.
<b>Interviewer:</b> 那這個是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 呃...呃...比較，比較環保的品牌？	<b>Interviewee:</b> Uh... uh... more, more environmentally friendly brands?
<b>Interviewer:</b> 那這些其他的品牌你有買過嗎？	<b>Interviewer:</b> Have you bought these other brands?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 沒有看過啊？	<b>Interviewer:</b> Never seen them?
<b>Interviewee:</b> 也沒有聽說過。	<b>Interviewee:</b> Haven't heard of them either.
<b>Interviewer:</b> 沒有。你想要按第三個嗎？	<b>Interviewer:</b> No. Do you want to press the third one?
<b>Interviewee:</b> 可以按嗎？	<b>Interviewee:</b> Can I press it?
<b>Interviewer:</b> 可以啊可以啊。	<b>Interviewer:</b> Yes, you can.
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 你覺得這個是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 股票價格。	<b>Interviewee:</b> Stock price.
<b>Interviewer:</b> 你有投資過嗎？	<b>Interviewer:</b> Have you invested before?
<b>Interviewee:</b> 沒有投資過。	<b>Interviewee:</b> Haven't invested.
<b>Interviewer:</b> 那看到這個有興趣嗎？	<b>Interviewer:</b> Seeing this, are you interested?
<b>Interviewee:</b> 有興趣。	<b>Interviewee:</b> Interested.
<b>Interviewer:</b> 你覺得剛剛這個是什麼？	<b>Interviewer:</b> What do you think that one just now was?
<b>Interviewee:</b> 現在這個嗎？ 嗯。Nike 的股價。	<b>Interviewee:</b> This current one? Um. Nike's stock price.
<b>Interviewer:</b> 那下面那個內容，他跟你說什麼？	<b>Interviewer:</b> Then the content below, what does it tell you?
<b>Interviewee:</b> 他說短期的，短期的股價比較跌，然後也因為勞工問題，然後遭受批評。	<b>Interviewee:</b> It says short-term, the short-term stock price has fallen, and also due to labor issues, it has received criticism.
<b>Interviewer:</b> 還有什麼嗎？	<b>Interviewer:</b> Anything else?
<b>Interviewee:</b> 如果這個品牌持續努力的話，他的評價會提高，然後會有助於整體的品牌形象。	<b>Interviewee:</b> If this brand continues to work hard, its evaluation will improve, and it will help the overall brand image.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那這些三個...考慮這些三個部分，你覺得哪一個比較你有興趣的？	<b>Interviewer:</b> Then these three... considering these three sections, which one are you more interested in?
<b>Interviewee:</b> 呃...有興趣的？ 請問是會影響到我買這個商品的哪一部分會比較影響到我買商品的原因嗎？	<b>Interviewee:</b> Uh... interested in? Do you mean which part would affect my purchase of this product, which part would influence my reason for buying the product more?
<b>Interviewer:</b> 對對對。	<b>Interviewer:</b> Yes, yes, yes.
<b>Interviewee:</b> 呃...可能是第一個吧。因為投資可能跟這個...這個公司的未來的股價可能跟我買這個商品沒有太大的關聯，所以我可能會看第一個買東西。因為它有很明確的指出這個商品它不太環保，然後就跟...就是可能我以後再看其他的商品之後會比較考慮到環保的部分。因為平常買東西不太會考慮環保的部分。但是如果其他的品 牌沒有那麼好看，可能還是會考慮一下，會平衡一下。對，因為現在應該還沒有聽過。	<b>Interviewee:</b> Uh... maybe the first one. Because investment might be related to this... this company's future stock price might not have much connection to me buying this product, so I might look at the first one about buying things. Because it very clearly pointed out that this product is not very environmentally friendly, and then... just maybe when I look at other products in the future, I will consider the environmental aspect more. Because normally when buying things, I don't really consider the environmental part. But if other brands don't look as good, I might still consider it, balance it out. Yes, because I probably haven't heard of them yet.
<b>Interviewer:</b> 嗯。那你可以幫我去下面一點？ 然後有兩個按鈕，你想要按一個嗎？	<b>Interviewer:</b> Um. Can you help me go down a bit? Then there are two buttons, do you want to press one?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> (Waits) 這裡你還是可以直接問他問題。你有什麼問題你想要問嗎？ 嗯，也可以直接打字。	<b>Interviewer:</b> (Waits) Here you can still directly ask it questions. Do you have any questions you want to ask? Um, you can also type directly.
<b>Interviewee:</b> 哦...你們可以點這個嗎？	<b>Interviewee:</b> Oh... can you click this?
<b>Interviewer:</b> 可以可以。	<b>Interviewer:</b> Yes, yes.
<b>Interviewee:</b> 按鈕...去下面吧。	<b>Interviewee:</b> Button... let's go down.
<b>Interviewer:</b> 下面嗎？ 嗯。	<b>Interviewer:</b> Down? Um.
<b>Interviewee:</b> 還是上面？ 上面？ 上面？ 哟...	<b>Interviewee:</b> Or up? Up? Up? Oh...
<b>Interviewer:</b> 有了。嗯。有。哦，有有。	<b>Interviewer:</b> Got it. Um. Yes. Oh, yes yes.
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 你剛剛問什麼？	<b>Interviewer:</b> What did you just ask?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃...我能怎麼增加我的儲蓄？他說可以設定預算、減少不必要的開支、尋找優惠、自製餐點、然後設定儲蓄目標跟自動轉帳，還有投資。	<b>Interviewee:</b> Uh... How can I increase my savings? It says I can set a budget, reduce unnecessary expenses, look for deals, make my own meals, then set savings goals and automatic transfers, and also invest.
<b>Interviewer:</b> 那你覺得對你來說，有什麼你之前不知道的嗎？	<b>Interviewer:</b> Then for you, is there anything you didn't know before?
<b>Interviewee:</b> 呃...可能投資這方面我比較不熟悉。	<b>Interviewee:</b> Uh... maybe the investment aspect, I'm less familiar with.
<b>Interviewer:</b> 好。那你還有其他的問題想問嗎？	<b>Interviewer:</b> Okay. Do you have other questions you want to ask?
<b>Interviewee:</b> 下面...可以打字。好。(Types)我點了：什麼是可以持續發展的股票？好。呃...特斯拉、太陽能、風力、還有賣植物肉類替代品的。	<b>Interviewee:</b> Below... can type. Okay. (Types) I clicked: What are sustainable development stocks? Okay. Uh... Tesla, solar energy, wind power, and also sellers of plant-based meat alternatives.
<b>Interviewer:</b> 你覺得這是什麼？你覺得剛的回答怎麼樣？	<b>Interviewer:</b> What do you think this is? What do you think of the answer just now?
<b>Interviewee:</b> 這個...這個的回答嗎？	<b>Interviewee:</b> This... this answer?
<b>Interviewer:</b> 對。	<b>Interviewer:</b> Yes.
<b>Interviewee:</b> 我覺得...呃...可能會再需要去多了解，因為這邊公司那麼多裡面，我只聽過特斯拉。那可能只是我沒有在涉略這部分。	<b>Interviewee:</b> I think... uh... I might need to understand more, because among so many companies here, I've only heard of Tesla. That might just be because I haven't delved into this area.
<b>Interviewer:</b> 沒問題。那你可以幫我去那個原本的地方嗎？原本的地方...嗯，momo那個。喔，好的。對。然後還有另外一個按鈕。	<b>Interviewer:</b> No problem. Can you help me go back to the original place? The original place... um, the momo one. Oh, okay. Yes. Then there's the other button.
<b>Interviewee:</b> 好。看一下。	<b>Interviewee:</b> Okay. Let me see.
<b>Interviewer:</b> 有網路嗎？有一點欸...沒有開嗎？	<b>Interviewer:</b> Is there internet? A little bit eh... is it not on?
<b>Interviewee:</b> (Checks connection)	<b>Interviewee:</b> (Checks connection)
<b>Interviewer:</b> 看一下，不然用我的網路？	<b>Interviewer:</b> Take a look, otherwise use my internet?
<b>Interviewee:</b> (Connects) 連線中。	<b>Interviewee:</b> (Connects) Connecting.
<b>Interviewer:</b> 會有網路的問題嗎？	<b>Interviewer:</b> Will there be internet problems?
<b>Interviewee:</b> 不太會。有了。呃...	<b>Interviewee:</b> Not really. Got it. Uh...
<b>Interviewer:</b> 他說什麼？	<b>Interviewer:</b> What does it say?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 他說 Nike 的 Dunk 鞋型主要採用人工皮革還有聚酯纖維，這些材料通常來自於化石產品，對環境影響較大。然後這些產品的生產過程中常常會有汙染排放。	<b>Interviewee:</b> It says Nike's Dunk shoe style mainly uses artificial leather and polyester fiber. These materials usually come from fossil products and have a greater impact on the environment. Then, the production process of these products often involves pollution emissions.
<b>Interviewer:</b> 好。那幫我去那個 momo 那邊。	<b>Interviewer:</b> Okay. Then help me go to that momo page.
<b>Interviewee:</b> 好的。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那我還要問你，之前你不是使用 Shopee 嗎？你是使用 Shopee 的網頁還是 app？	<b>Interviewer:</b> Then I also want to ask you, didn't you use Shopee before? Do you use the Shopee website or the app?
<b>Interviewee:</b> app。	<b>Interviewee:</b> App.
<b>Interviewer:</b> OK。那最上面有一個代碼是...對，你去上面...這邊嗎？上面上面上...	<b>Interviewer:</b> OK. Then at the very top there's a code which is... yes, you go up... here? Up up up...
<b>Interviewee:</b> 面？	<b>Interviewee:</b> ...top?
<b>Interviewer:</b> 對。你看那個綠色的代碼？你可以幫我講出來嗎？	<b>Interviewer:</b> Yes. See that green code? Can you help me say it out loud?
<b>Interviewee:</b> 呃...V7W8A。	<b>Interviewee:</b> Uh... V7W8A.
<b>Interviewer:</b> 你可以寫這個號碼在卡片上，這樣不會忘記。	<b>Interviewer:</b> You can write this number on the card, so you won't forget.
<b>Interviewee:</b> 哟。	<b>Interviewee:</b> Oh.

### 16.1.23 Transcript 2025-03-13 - Tainan (NCKU) - 17LSR

**Source Files:** \* 2025-03-13 - Tainan (NCKU) - 17LSR.json \* 2025-03-13 - Tainan (NCKU) - 17LSR.txt

**Ziran ID Code:** 17LSR

Traditional Chinese Transcript	English Translation
<b>Me:</b> 那我先問你喔，我可以錄影這個對話嗎？	<b>Me:</b> Let me ask first, can I record this conversation?
<b>Interviewee:</b> 可以，沒問題。	<b>Interviewee:</b> Yes, no problem.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那我先介紹 (註: JSON 誤聽為切掃)一下，我是成功大學創意設計所 (註: JSON 誤聽為工大師創意出去說神) 的學生，然後這個是我的論文的一部分，一個環保軟體 (註: JSON 誤聽為你跟漢堡軟體)。那等一下你可以幫我測試這個軟體嗎？	<b>Me:</b> Okay. Let me introduce (Note: JSON misheard as “cut sweep”) myself first. I’m a student from the Institute of Creative Design at National Cheng Kung University (Note: JSON misheard as “Master Gongda Creative Out Said God”), and this is part of my thesis, an environmental protection software (Note: JSON misheard as “you and hamburger software”). Can you help me test this software later?
<b>Interviewee:</b> 可以，沒問題。	<b>Interviewee:</b> Yes, no problem.
<b>Me:</b> 好的。那第一個問題是你平常 (註: JSON 誤聽為冰山) 會網路上買東西嗎？	<b>Me:</b> Okay. So the first question is, do you usually (Note: JSON misheard as “iceberg”) buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那妳使用什麼平台呢？	<b>Me:</b> What platforms do you use?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Me:</b> 好。那 Momo 呢有使用過嗎？	<b>Me:</b> Okay. Have you used Momo?
<b>Interviewee:</b> 有，有用過。	<b>Interviewee:</b> Yes, I have used it.
<b>Me:</b> 那妳平常會買什麼樣的東西？	<b>Me:</b> What kind of things do you usually buy?
<b>Interviewee:</b> 買衣服、化妝品跟額... (註: Me asks to speak louder) ...書，買書。	<b>Interviewee:</b> Buy clothes, cosmetics, and uh... (Note: Me asks to speak louder) ...books, buy books.
<b>Me:</b> 好。那目前妳有什麼想要買的嗎？	<b>Me:</b> Okay. Is there anything you want to buy right now?
<b>Interviewee:</b> 我想買...我想買口紅。	<b>Interviewee:</b> I want to buy... I want to buy lipstick.
<b>Me:</b> 好。妳幫我查吧。	<b>Me:</b> Okay. Help me search for it.
<b>Interviewee:</b> (Searching) ...有，找到了。	<b>Interviewee:</b> (Searching) ...Yes, found it.
<b>Me:</b> 好。那可以幫我選一個產品嗎？	<b>Me:</b> Okay. Can you select a product for me?
<b>Interviewee:</b> 我想看這個。	<b>Interviewee:</b> I want to look at this one.
<b>Me:</b> 好。那妳為什麼選這個呢？	<b>Me:</b> Okay. Why did you choose this one?
<b>Interviewee:</b> 因為這個是我有在想要買的，最近...顏色跟外型好看。	<b>Interviewee:</b> Because this is one I’ve been thinking about buying recently... the color and appearance look good.
<b>Me:</b> 有買過嗎？	<b>Me:</b> Have you bought it before?
<b>Interviewee:</b> 之前沒有，一直有想買。	<b>Interviewee:</b> Not before, but I’ve always wanted to buy it.
<b>Me:</b> 好。那這個網頁上，對妳來說最重要的地方在哪裡？	<b>Me:</b> Okay. On this webpage, what is the most important part for you?
<b>Interviewee:</b> 最重要的在價錢。	<b>Interviewee:</b> The most important is the price.
<b>Me:</b> 好，品名和價錢。	<b>Me:</b> Okay, product name and price.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 第二個重要的... <b>Me:</b> 第二個重要的？ 嗯。 <b>Interviewee:</b> 就是圖片吧。 <b>Me:</b> 好。然後第三個？ <b>Interviewee:</b> 第三個我想看喔...它的功能介紹這些。 <b>Me:</b> 好。那價格呢？ 然後還是評論？ 還是其他的？ 喔，第一個重要的是價格啊。對的。那評論呢？ <b>Interviewee:</b> 評論喔？ 對，評論也是很重 要的。OK。喔對，抱歉。那應該要改成第 一個是...對我來說第一個重要的是價格， 嗯，然後第二個是圖片，第三個我就會看評 論了。	<b>Interviewee:</b> The second most important... <b>Me:</b> The second most important? Hmm. <b>Interviewee:</b> Probably the pictures. <b>Me:</b> Okay. And the third? <b>Interviewee:</b> The third, let me see... its feature descriptions, these things. <b>Me:</b> Okay. What about the price? Then reviews? Or others? Oh, the first important thing is the price. Right. What about reviews? <b>Interviewee:</b> Reviews? Oh yes, reviews are also very important. OK. Oh right, sorry. Then it should be changed to the first... for me, the first important thing is price, hmm, then the second is pictures, and the third I would look at reviews.
<b>Me:</b> 好啊。那剛剛那個旁邊右邊有一個黃 色(註: TXT 誤聽為換色)的部分，你覺得 這個是什麼？ <b>Interviewee:</b> 這個是聊天視窗嗎？ 這是什 麼？ 喔，這是你做的嗎？ 它是可以幫你分 析喔...ESG 相關的東西？ <b>Me:</b> 那你覺得這裡的重點在哪裡？ <b>Interviewee:</b> 這裡的重點是...這邊的重點 是它會分析，呃，這個產品的環保...類似環 保指數嗎？ 就是他們對於環保的部分有貢 獻，或者是它是傷害環境的，這樣子。	<b>Me:</b> Okay. Just now, on the right side, there was a yellow (Note: TXT misheard as “color changing”) section, what do you think that is? <b>Interviewee:</b> Is this a chat window? What is this? Oh, you made this? It can help analyze... ESG-related things? <b>Me:</b> What do you think is the main point here? <b>Interviewee:</b> The main point here is... the point here is that it analyzes, uh, the environmental protection of this product... like an environmental index? Meaning whether they contribute to environmental protection, or if it harms the environment, like that.
<b>Me:</b> 好。那你會擔心這個嗎？ <b>Interviewee:</b> 有，我會，我會，我會在乎 這個。 <b>Me:</b> 那這個內容的裡面，最重要的部分在 哪裡？ <b>Interviewee:</b> 應該是這個吧...「雖然 Dior (註: TXT 誤聽為 dial) 有使用可持續材料的 承諾，但 ESG 評分仍偏低」這樣。	<b>Me:</b> Okay. Would you worry about this? <b>Interviewee:</b> Yes, I would, I would, I would care about this. <b>Me:</b> Within this content, what is the most important part? <b>Interviewee:</b> Probably this one... “Although Dior (Note: TXT misheard as dial) has committed to using sustainable materials, its ESG rating remains low,” like that.
<b>Me:</b> 為什麼這個重要？ <b>Interviewee:</b> 因為就是，嗯，就是有它好的 部分嘛，跟不太好的結果，這樣子。嗯。	<b>Me:</b> Why is this important? <b>Interviewee:</b> Because, well, hmm, it has its good parts, right, and the not-so-good results, like that. Hmm.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那妳可以幫我開那個第二個部分嗎？第二個部分，妳覺得這個是什麼？	<b>Me:</b> Okay. Can you open the second section for me? The second section, what do you think this is?
<b>Interviewee:</b> 嗯...這個是，喔，它會告訴我，呃，如果我不買的話，就可以類似保護環境多少的那種感覺，或者是會有怎麼樣的影響，這樣。	<b>Interviewee:</b> Hmm... This is, oh, it tells me, uh, if I don't buy it, it's like a feeling of protecting the environment to some extent, or what kind of impact it would have, like that.
<b>Me:</b> 那下面這些是什麼？	<b>Me:</b> What are these below?
<b>Interviewee:</b> 那一些比起這個牌子，然後對於環保更重要...更有致力於環保的品牌。嗯。	<b>Interviewee:</b> Those are brands that, compared to this one, are more important for environmental protection... more committed to environmental protection. Hmm.
<b>Me:</b> 那這些其他的品牌妳有買過嗎？	<b>Me:</b> Have you bought these other brands before?
<b>Interviewee:</b> 有，我有買過 Aveda (註: TXT 誤聽為 avenda)。	<b>Interviewee:</b> Yes, I have bought Aveda (Note: TXT misheard as avenda).
<b>Me:</b> OK。妳覺得怎麼樣？	<b>Me:</b> OK. What do you think of it?
<b>Interviewee:</b> 我覺得還不錯啊，我覺得它的東西是好的。	<b>Interviewee:</b> I think it's quite good, I think their products are good.
<b>Me:</b> 好。那看到這個會影響妳的想法嗎？妳會考慮買其他的品牌嗎？	<b>Me:</b> Okay. Does seeing this influence your thoughts? Would you consider buying other brands?
<b>Interviewee:</b> 會，我會考慮買其他的品牌。但，呃...我覺得還是要有...他們要有，怎麼講，相同的性質嗎？這樣子。我覺得，因為我覺得化妝品的可替代性不一定有那麼大。如果我很在乎這個產品，因為像，其實像 Dior 的唇膏，它其實是高價位的嘛。我今天在選擇買高價位的東西的時候，可能代表(註: TXT 誤聽為 代錄)著它背後有我想要的東西，例如說：一、我想要拿著，呃，因為類似我想要拿著名牌的東西之類的；然後二、就是這個東西它足夠那麼好，讓我願意花那麼多的價格。所以其實像其他的品牌的話，除非它有達到我這兩個需求跟想法，不然我可能不會輕易地做替代。	<b>Interviewee:</b> Yes, I would consider buying other brands. But, uh... I feel there still needs to be... they need to have, how should I put it, similar characteristics? Like that. I feel, because I think the substitutability of cosmetics isn't necessarily that high. If I really care about this product, because like, actually like Dior lipstick, it's high-priced, right? When I choose to buy high-priced items today, it might represent (Note: TXT misheard) that behind it, there's something I want, for example: one, I want to hold, uh, because it's like I want to hold designer items, things like that; and two, this item is good enough that I'm willing to pay such a high price. So actually, for other brands, unless they meet these two needs and thoughts of mine, otherwise I probably wouldn't easily substitute.
<b>Me:</b> 好。然後妳幫我開第三個部分。好，妳覺得這個是什麼？	<b>Me:</b> Okay. Then help me open the third section. Okay, what do you think this is?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這個...「你可以購買過去」喔？這是代號？這是什麼意思啊？可以追蹤你購買的產品的公司？這都是這個品牌的，是嗎？都是這個品牌的。對。那為什麼代號不一樣？喔，產地不一樣是嗎？	<b>Interviewee:</b> This... “You can buy past” huh? Is this a code? What does this mean? Can track the company of the products you bought? Are these all from this brand? All from this brand. Right. Then why are the codes different? Oh, is the place of origin different?
<b>Me:</b> 兩個不同的國家。對，兩個不同。可以投資這個品牌。嗯，對。那妳之前有投資過嗎？	<b>Me:</b> Two different countries. Yes, two different ones. You can invest in this brand. Hmm, yes. Have you invested before?
<b>Interviewee:</b> 我之前沒有投資過這兩個品牌。	<b>Interviewee:</b> I haven't invested in these two brands before.
<b>Me:</b> 有接觸(註: TXT 誤聽為 金屬)投資嗎？妳說股票那種嗎？對。妳說妳有做過投資這件事嗎？	<b>Me:</b> Have you had contact with (Note: TXT misheard as “metal”) investing? You mean stocks? Yes. You mean have you done investing before?
<b>Interviewee:</b> 有，有。但我沒有投資過這個品牌。對。	<b>Interviewee:</b> Yes, yes. But I haven't invested in this brand. Right.
<b>Me:</b> 那妳有投資過是台灣的公司還是國外？	<b>Me:</b> Have you invested in Taiwanese companies or foreign ones?
<b>Interviewee:</b> 我投資過台灣跟國外的都有。OK。嗯。	<b>Interviewee:</b> I've invested in both Taiwanese and foreign ones. OK. Hmm.
<b>Me:</b> 那妳覺得買(註: TXT 誤聽為 賣)東西跟投資這個公司有什麼(關係)？還是在完全不一樣的世界？	<b>Me:</b> So, do you think buying (Note: TXT misheard as “selling”) things and investing in this company have any (relationship)? Or are they in completely different worlds?
<b>Interviewee:</b> 買東西跟投資這個東西，我覺得是有(關係)。我覺得有可能性質不太一樣，但是我覺得買東西也是在增加嗎？增加這個...這個公司的那些資金啊那些的東西。就是妳其實是在...妳做這件事情對於公司是有好的效益。	<b>Interviewee:</b> Buying things and investing in this thing, I think there is (a relationship). I think the nature might be slightly different, but I feel buying things is also increasing, right? Increasing this... this company's funds and those things. It means you actually are... doing this action has a good benefit for the company.
<b>Me:</b> 那如果妳非常喜歡一個公司的產品，妳會比較考慮買這個公司的股票嗎？	<b>Me:</b> So if you really like a company's product, would you be more inclined to consider buying that company's stock?
<b>Interviewee:</b> 我覺得我會，我覺得我會。	<b>Interviewee:</b> I think I would, I think I would.
<b>Me:</b> 好。那妳可以幫我回第一個部分嗎？第一個部分。	<b>Me:</b> Okay. Can you help me go back to the first section? The first section.
<b>Me:</b> 那最下面有兩個按鈕，妳想要按一個嗎？	<b>Me:</b> At the very bottom, there are two buttons. Do you want to press one?
<b>Interviewee:</b> 好，我按這個好了。	<b>Interviewee:</b> Okay, I'll press this one.
<b>Me:</b> 呀剛剛按什麼？	<b>Me:</b> What did you just press?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我按了「尋找替代產品」。	<b>Interviewee:</b> I pressed “Find Alternative Products”.
<b>Me:</b> 那為什麼按這個？	<b>Me:</b> Why press this one?
<b>Interviewee:</b> 因為我已經看到這個產品不好的部分，我確實會想要去看看有沒有其他可以替代的產品。	<b>Interviewee:</b> Because I've already seen the not-so-good parts of this product, I would indeed want to see if there are other products that can substitute it.
<b>Me:</b> 好 (註: TXT 誤聽為蛤)。那，呃，它有跟你說什麼？	<b>Me:</b> Okay (Note: TXT misheard as “Huh”). Then, uh, what did it tell you?
<b>Interviewee:</b> 他說，喔，就他講出 Dior 它這個品牌對於環境汙染的問題，然後除此之外有三家公司嗎？有三家公司，它其實是對環境比較友善的，這樣子。然後他就在分析說這幾家公司的 ESG 評分，還有一些跟環境有關的項目。	<b>Interviewee:</b> It said, oh, it pointed out the environmental pollution issues of this Dior brand, and besides that, are there three companies? There are three companies that are actually more environmentally friendly, like that. Then it analyzed the ESG ratings of these companies, and some environment-related items.
<b>Me:</b> 那妳覺得它跟妳說的是有用的嗎？	<b>Me:</b> Do you think what it told you is useful?
<b>Interviewee:</b> 這個是...當然是有用的，我覺得這是有用的，確實這是真的。	<b>Interviewee:</b> This is... of course it's useful, I think this is useful, indeed this is true.
<b>Me:</b> 對，我剛剛有想到這個問題。	<b>Me:</b> Yes, I just thought of this question.
<b>Interviewee:</b> 會，我會。而且其實它雖然告訴我這些資訊是有用的，但是它這些東西，因為我看不見它的數據，所以我覺得這是有點類似主觀的想法嗎？這樣子。例如說，他直接跟我說喔這是低 (註: TXT 誤聽為 d)、這是高、這是中，然後有待改善、哪裡不好什麼之類的，但他沒有給我看到那個數據。	<b>Interviewee:</b> Yes, I would. And actually, although the information it tells me is useful, but these things, because I can't see its data, so I feel it's a bit like a subjective thought? Like that. For example, it directly tells me oh this is low (Note: TXT misheard as d), this is high, this is medium, then needs improvement, where it's not good, things like that, but it didn't show me the data.
<b>Me:</b> 好。那妳有什麼問題想問它嗎？也可以自己打字，還是可以按按鈕都可以。問它什麼都可以問。妳要去上面...上面。	<b>Me:</b> Okay. Do you have any questions you want to ask it? You can also type yourself, or you can press the buttons. You can ask it anything. You need to go up... up.
<b>Me:</b> 呀剛剛問什麼？	<b>Me:</b> What did you just ask?
<b>Interviewee:</b> 我剛剛問它「我怎麼可以更環保？」	<b>Interviewee:</b> I just asked it, “How can I be more environmentally friendly?”
<b>Me:</b> 那這個內容裡面有什麼妳之前 (註: TXT 用 最近) 不知道的嗎？	<b>Me:</b> Is there anything in this content that you didn't know before (Note: TXT used “recently”)?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我之前 (註: TXT 用 最近) 不知道... 「考慮購買就」 ...沒有，其實這些東西我都知道。	<b>Interviewee:</b> Before (Note: TXT used "recently") I didn't know... "Consider buying then" ... No, actually, I know all these things.
<b>Me:</b> OK。那妳可以介紹一下它跟妳說什麼嗎？ 好。妳自己覺得重點在哪裡？ 妳覺得哪裡重要？	<b>Me:</b> OK. Can you explain what it told you? Okay. What do you think the main point is? Where do you think is important?
<b>Interviewee:</b> 呃，我覺得重要的有那個吧，「減少購物頻率」，還有「修理而非丟棄」，還有「支持本地產品」，這三個。	<b>Interviewee:</b> Uh, I think the important ones are that, "Reduce shopping frequency," also "Repair instead of discarding," and "Support local products," these three.
<b>Me:</b> 好的。那妳有其他的問題想問嗎？ 嗯，也可以再次打字 (註: TXT 誤聽為 答次) 問。	<b>Me:</b> Okay. Do you have other questions you want to ask? Hmm, you can also type (Note: TXT misheard as "answer times") again to ask.
<b>Me:</b> 這個妳問什麼？	<b>Me:</b> What did you ask about this?
<b>Interviewee:</b> 「欸，我買的產品裡有沒有對我身體有害的化學物質？」	<b>Interviewee:</b> "Hey, are there any chemical substances harmful to my body in the products I buy?"
<b>Interviewee:</b> 喔，然後它跟我說可以告訴它具體的產品或品牌，所以我（下次）是要打字嗎？	<b>Interviewee:</b> Oh, then it told me I can tell it the specific product or brand, so do I need to type (next time)?
<b>Me:</b> 對。好。(看到 interviewee 在打字) 妳要寫什麼？ 沒關係。	<b>Me:</b> Yes. Okay. (Sees interviewee typing) What are you writing? It's okay.
<b>Me:</b> 那如果不需打字，可以跟它用聲音對話比較好嗎？	<b>Me:</b> So if typing isn't needed, would it be better to have a voice conversation with it?
<b>Interviewee:</b> 可以用聲音？ 好...我覺得目前沒有這個設定。... 會比較方便一點。	<b>Interviewee:</b> Use voice? Okay... I think currently there isn't this setting. ... It would be a bit more convenient.
<b>Me:</b> 好。妳也可以用英文跟它講喔。好，如果比較方便。	<b>Me:</b> Okay. You can also speak to it in English. Okay, if it's more convenient.
<b>Interviewee:</b> (嘗試打英文) 好像不太好... 嘴... 噴... (Me: 妳在找什麼？) 我在找那個...那個品牌的英文是什麼...沒關係，那我換一個好了。	<b>Interviewee:</b> (Tries typing in English) Seems not quite right... Oh. Hmm... (Me: What are you looking for?) I'm looking for the... the English name of that brand... Never mind, I'll switch to another one.
<b>Me:</b> 那這個（回答）的裡面有什麼妳不知道的嗎？	<b>Me:</b> Is there anything in this (answer) that you didn't know?
<b>Interviewee:</b> 像其實我不知道口紅裡面會有鉛，然後我也沒有知道鄰苯二甲酸酯這種比較學名一點的化學物質。	<b>Interviewee:</b> Like, actually I didn't know there could be lead in lipstick, and I also didn't know about phthalates, this kind of more scientific chemical substance.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。那妳剛剛提到這個，妳有什麼感覺嗎？ 會影響妳的想法還是什麼？	<b>Me:</b> Okay. You mentioned this just now, do you have any feelings about it? Does it influence your thoughts or anything?
<b>Interviewee:</b> 嗯，我會意識到好像不要那麼常化妝。對。	<b>Interviewee:</b> Hmm, I'll realize maybe I shouldn't wear makeup so often. Yes.
<b>Me:</b> 好的。OK。那妳可以幫我回那個 Momo 那邊。	<b>Me:</b> Okay. OK. Can you help me go back to the Momo page?
<b>Me:</b> 呃，最(註: TXT 誤聽為 桌子)上面有一個代碼，綠色的那個，妳可以幫我講出來嗎？	<b>Me:</b> Uh, at the very (Note: TXT misheard as "table") top, there's a code, the green one, can you say it out loud for me?
<b>Interviewee:</b> 這個代碼是 17LSR。(註: Participant read E7L)	<b>Interviewee:</b> This code is 17LSR. (Note: Participant read E7L)
<b>Me:</b> 好。那妳要用剛剛那個卡片嗎？ 我給妳新的。好好好。	<b>Me:</b> Okay. Do you want to use the card from just now? I'll give you a new one. Okay, okay, okay.
<b>Me:</b> 婦可以幫我在它的上面寫那個（代碼）。好好。	<b>Me:</b> Can you help me write that (code) on top of it? Okay, okay.
<b>Interviewee:</b> (Writing code) 這樣就可以了。	<b>Interviewee:</b> (Writing code) This should be fine.

#### 16.1.24 Transcript 2025-03-13 - Tainan (NCKU) - 6E5N5

**Source Files:** \* 2025-03-13 - Tainan (NCKU) - 6E5N5.json \* 2025-03-13 - Tainan (NCKU) - 6E5N5.txt

**Ziran ID Code:** 6E5N5

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我要先問你，嗯，我可以錄影這個對話嗎？	<b>Interviewer:</b> I want to ask you first, um, can I record this conversation?
<b>Interviewee:</b> 可以可以可以。	<b>Interviewee:</b> Yes yes yes.
<b>Interviewer:</b> 好的。那我介紹一下，我是成功大學創意設計所的學生，然後這個是我論文的一部分，一個環保的 App。那等一下你可以幫我測試這個軟體嗎？	<b>Interviewer:</b> Okay. Let me introduce myself. I'm a student from the Institute of Creative Design at National Cheng Kung University, and this is part of my thesis, an environmental App. Can you help me test this software in a moment?
<b>Interviewee:</b> 好好。	<b>Interviewee:</b> Okay okay.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那第一個問題啊...平常你網路上會買東西嗎？	<b>Interviewer:</b> Then the first question... do you usually buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 很常？	<b>Interviewer:</b> Very often?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 那你通常使用什麼平台呢？	<b>Interviewer:</b> What platforms do you usually use?
<b>Interviewee:</b> 蝦皮、momo。	<b>Interviewee:</b> Shopee, momo.
<b>Interviewer:</b> 那其他的你有用過嗎？	<b>Interviewer:</b> Have you used others?
<b>Interviewee:</b> 博客來、PChome。	<b>Interviewee:</b> Books.com.tw, PChome.
<b>Interviewer:</b> 好。那平常你會買什麼類型的東西？	<b>Interviewer:</b> Okay. What type of things do you usually buy?
<b>Interviewee:</b> 化妝品啊、書之類的。	<b>Interviewee:</b> Cosmetics, books, things like that.
<b>Interviewer:</b> 好。那你目前...你之前 momo 有買過嗎？	<b>Interviewer:</b> Okay. Then currently... have you bought on momo before?
<b>Interviewee:</b> 有欸。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 蝦皮、博客來、誠品？	<b>Interviewer:</b> Shopee, Books.com.tw, Eslite?
<b>Interviewee:</b> 都有。	<b>Interviewee:</b> All of them.
<b>Interviewer:</b> 那你覺得哪一個比較好用？	<b>Interviewer:</b> Which one do you think is better to use?
<b>Interviewee:</b> 我覺得蝦皮蠻好用的。	<b>Interviewee:</b> I think Shopee is quite good to use.
<b>Interviewer:</b> 那目前 momo 上你有什麼想要買的嗎？	<b>Interviewer:</b> Then currently on momo, is there anything you want to buy?
<b>Interviewee:</b> 我最近想要買隨身的包包。	<b>Interviewee:</b> Recently I want to buy a portable bag.
<b>Interviewer:</b> 應該找得到？ 幫我...幫我查一下。	<b>Interviewer:</b> Should be able to find it? Help me... help me search a bit.
<b>Interviewee:</b> 好。(Searches) 你好。Thank you。哇，這沒有注音啊？ 應該是純吧？ 這可以用這個打嗎？ 謝謝嘛？ 哟。	<b>Interviewee:</b> Okay. (Searches) Hello. Thank you. Wow, this doesn't have Zhuyin input? It should be... pure [Pinyin]? Can I use this to type? Thanks? Oh.
<b>Interviewer:</b> 你可以幫我講出來就好。	<b>Interviewer:</b> Just help me say it out loud.
<b>Interviewee:</b> 包包。(Types 'bag') 男？ 已經送出去了。	<b>Interviewee:</b> Bag. (Types 'bag') Male? Already sent it out.
<b>Interviewer:</b> (Laughs) 還在車上啊？	<b>Interviewer:</b> (Laughs) Still loading [on the car]?
<b>Interviewee:</b> (Selects product) 這個。	<b>Interviewee:</b> (Selects product) This one.
<b>Interviewer:</b> 那我要這個？ 你要這個嗎？	<b>Interviewer:</b> Then I want this one? Do you want this one?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 對。香奈兒經典經典鏈子皮夾斜肩。	<b>Interviewee:</b> Yes. Chanel classic classic chain wallet crossbody.
<b>Interviewer:</b> 那幫我開...打開嗎？	<b>Interviewer:</b> Then help me open... open it?
<b>Interviewee:</b> 打開。	<b>Interviewee:</b> Open.
<b>Interviewer:</b> 對啊。為什麼你選這個？	<b>Interviewer:</b> Right. Why did you choose this one?
<b>Interviewee:</b> 因為我剛才第一眼看到他，我就覺得很好看，我也不知道為什麼。	<b>Interviewee:</b> Because when I first saw it just now, I thought it looked very good, I don't know why either.
<b>Interviewer:</b> 好。這個...這個品牌嗎？	<b>Interviewer:</b> Okay. This... this brand?
<b>Interviewee:</b> 沒有。沒有買過。	<b>Interviewee:</b> No. Haven't bought it.
<b>Interviewer:</b> 你覺得...	<b>Interviewer:</b> You think...
<b>Interviewee:</b> 他剛剛第一眼看起來，我覺得小而精美，然後看起來是我喜歡的類型。還有那個鏈子很加分，我很喜歡。	<b>Interviewee:</b> It just now at first glance, I felt it was small and exquisite, and looked like a type I like. Also that chain adds a lot of points, I really like it.
<b>Interviewer:</b> 好。那這個網頁上最重要...我覺得是...特價？	<b>Interviewer:</b> Okay. Then on this webpage, the most important... I think it's... special price?
<b>Interviewee:</b> 應該不是特價。然後還有一些什麼累積多少錢，然後有送什麼 momo 的幣給你。還有一些...就是它的介紹。	<b>Interviewee:</b> Probably not a special price. And then there are some things like accumulate how much money, and then get some momo coins given to you. Also some... just its description.
<b>Interviewer:</b> 其他的重要的地方在哪裡？	<b>Interviewer:</b> Where are other important places?
<b>Interviewee:</b> 重要的地方嗎？ 是它的價錢嗎？	<b>Interviewee:</b> Important places? Is it its price?
<b>Interviewer:</b> 啊，可以。價錢多少？ 這個...這個可以嗎？	<b>Interviewer:</b> Ah, yes. How much is the price? This... is this okay?
<b>Interviewee:</b> (Checks price) 安安。	<b>Interviewee:</b> (Checks price) Ann Ann [greeting].
<b>Interviewer:</b> 所以這裡 momo 網頁上什麼你之前沒有看過的嗎？ 什麼新的？ 新的部分嗎？	<b>Interviewer:</b> So here on the momo webpage, is there anything you haven't seen before? Anything new? New sections?
<b>Interviewee:</b> 新的部分嗎？ 沒有呢。	<b>Interviewee:</b> New sections? No.
<b>Interviewer:</b> 好。那你覺得剛剛那個黃色的，它是這個網頁的一部分嗎？	<b>Interviewer:</b> Okay. Then that yellow part just now, do you think it's part of this webpage?
<b>Interviewee:</b> 看起來不是。	<b>Interviewee:</b> Doesn't look like it.
<b>Interviewer:</b> 好。為什麼？	<b>Interviewer:</b> Okay. Why?
<b>Interviewee:</b> 因為這裡是白色的，這個黃色，然後有特別的框框。	<b>Interviewee:</b> Because here it's white, this is yellow, and it has a special frame.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那最上面，你可以看一下有三個不一樣的部分喔。可以幫我按第二個？	<b>Interviewer:</b> Okay. At the very top, can you take a look, there are three different sections. Can you help me press the second one?
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 你覺得這是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 它的材料跟環保的關係啊。	<b>Interviewee:</b> Its materials and the relationship with environmental protection.
<b>Interviewer:</b> 其他的品牌你有買過嗎？	<b>Interviewer:</b> Have you bought the other brands?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。其實我才養貓耶，兩三個月。啊...	<b>Interviewer:</b> Okay. Actually, I just got a cat, only two or three months ago. Ah...
<b>Interviewer:</b> 那你對這些品牌有興趣嗎？	<b>Interviewer:</b> Are you interested in these brands?
<b>Interviewee:</b> 這個...因為看不懂...感覺不一樣。	<b>Interviewee:</b> This one... because I don't understand... feels different.
<b>Interviewer:</b> 你講出來是哪一個？	<b>Interviewer:</b> Which one are you pointing out?
<b>Interviewee:</b> OK，應該是 EcoCat。	<b>Interviewee:</b> OK, should be EcoCat.
<b>Interviewer:</b> 好。那最上面的第三個部分？	<b>Interviewer:</b> Okay. Then the third section at the top?
<b>Interviewee:</b> 投資？	<b>Interviewee:</b> Investment?
<b>Interviewer:</b> 你覺得這是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 哦，這是有關於這個商品的公司。	<b>Interviewee:</b> Oh, this is about the company of this product.
<b>Interviewer:</b> 嗯。它說什麼？	<b>Interviewer:</b> Um. What does it say?
<b>Interviewee:</b> 它說它有代號，還有國家跟公司的名稱。	<b>Interviewee:</b> It says it has a code, and the country and company name.
<b>Interviewer:</b> 那這個會影響你的想法嗎？	<b>Interviewer:</b> Would this affect your thoughts?
<b>Interviewee:</b> 可能會。	<b>Interviewee:</b> Maybe.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?
<b>Interviewee:</b> 因為有些人不買中國的東西，所以有些人會因為這個公司有不好的事情，他就會影響他要不要買。	<b>Interviewee:</b> Because some people don't buy things from China, so some people, because this company has had bad incidents, it will affect whether they buy or not.
<b>Interviewer:</b> 哦，好。那...OK。所以這個商品是從中國來的？	<b>Interviewer:</b> Oh, okay. Then... OK. So this product is from China?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那...好。那你可以幫我回第一個部分那邊嗎？這個？那最上面有一個號碼，可以幫我寫這個號碼卡片上？	<b>Interviewer:</b> Okay. Then... okay. Can you help me go back to the first section there? This one? Then at the very top, there's a number, can you help me write this number on the card?
<b>Interviewee:</b> 這裡啊？就是這個號碼？	<b>Interviewee:</b> Here? Just this number?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那你可以幫我講出來嗎？	<b>Interviewer:</b> Can you help me say it out loud?
<b>Interviewee:</b> C-O-Z-N-2。	<b>Interviewee:</b> C-O-Z-N-2.
<b>Interviewer:</b> 好。這個都是匿名的，所以這樣我可以知道。好。那你可以幫我取下面一點嗎？ 好。所以下面有...有兩個案子？ 你可以幫我按一下按鈕？ 對。	<b>Interviewer:</b> Okay. This is all anonymous, so this way I can know. Okay. Can you help me go down a bit? Okay. So below there are... there are two cases? Can you help me press the button? Yes.
<b>Interviewee:</b> (Clicks button) 然後這裡還有什麼？	<b>Interviewee:</b> (Clicks button) Then what else is here?
<b>Interviewer:</b> 嗯。	<b>Interviewer:</b> Um.
<b>Interviewee:</b> 啊...我點進來之後，它就幫我顯示出我的商品，嗯，品牌，然後它就給我其他建議的品牌。不同的。	<b>Interviewee:</b> Ah... after I clicked in, it showed me my product, um, the brand, and then it gave me other recommended brands. Different ones.
<b>Interviewer:</b> 哦，那這些你有看過嗎？ 之前有看過嗎？	<b>Interviewer:</b> Oh, have you seen these before? Have you seen them previously?
<b>Interviewee:</b> 沒有。就不同的成分，也不同的牌子。	<b>Interviewee:</b> No. Just different ingredients, and different brands.
<b>Interviewer:</b> 那你還有什麼其他的問題，你想要問他嗎？ 這個 AI？	<b>Interviewer:</b> Do you have any other questions you want to ask it? This AI?
<b>Interviewee:</b> 嗯...可以點這個嗎？	<b>Interviewee:</b> Um... can I click this?
<b>Interviewer:</b> 你可以點，還是也可以直接直接打字。	<b>Interviewer:</b> You can click, or you can also directly type.
<b>Interviewee:</b> 啊...我怎麼減少亂買？ (Clicks button, scrolls) 幹。你要去上面一點吧？ 哟，有有。有。哦有了。點兩次了。嗯。	<b>Interviewee:</b> Ah... How do I reduce impulse buying? (Clicks button, scrolls) Damn. You need to go up a bit? Oh, yes yes. Yes. Oh, got it. Clicked twice. Um.
<b>Interviewer:</b> 他就會給你一些建議。	<b>Interviewer:</b> It will give you some suggestions.
<b>Interviewee:</b> 制定預算、列清單、三思而後行。	<b>Interviewee:</b> Set a budget, make a list, think twice before acting.
<b>Interviewer:</b> 那你覺得這裡面的重點是什麼？	<b>Interviewer:</b> What do you think is the main point in here?
<b>Interviewee:</b> 嗯...他會針對我的問題回答。	<b>Interviewee:</b> Um... it answers my question specifically.
<b>Interviewer:</b> 嗯。然後你說他的回答的重點嗎？	<b>Interviewer:</b> Um. And you're saying the main point of its answer?
<b>Interviewee:</b> 對。嗯...要想好自己到底要的是什麼。	<b>Interviewee:</b> Yes. Um... need to think clearly about what one really wants.
<b>Interviewer:</b> 好。OK。你還有其他的問題嗎？	<b>Interviewer:</b> Okay. OK. Do you have any other questions?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那這樣...這樣可以了。 OK，謝謝。好嗎？	<b>Interviewer:</b> Okay. Then this... this is fine. OK, thank you. Okay?
<b>Interviewee:</b> (Nods)	<b>Interviewee:</b> (Nods)

### 16.1.25 Transcript 2025-03-13 - Tainan (NCKU) - 6N9ZO

**Source Files:** \* 2025-03-13 - Tainan (NCKU) - 6N9ZO.json \* 2025-03-13 - Tainan (NCKU) - 6N9ZO.txt

**Ziran ID Code:** 6N9ZO

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那我先問你，我可以錄影這個對話嗎？	<b>Interviewer:</b> Okay. Let me ask you first, can I record this conversation?
<b>Interviewee:</b> 可以可以可以。	<b>Interviewee:</b> Yes yes yes.
<b>Interviewer:</b> 好的。那我介紹一下，我是成功大學創意設計所的學生，然後這個是我的論文的一部分，一個環保的軟體。那等一下你可以幫我測試這個軟體嗎？	<b>Interviewer:</b> Okay. Let me introduce myself. I'm a student from the Institute of Creative Design at National Cheng Kung University, and this is part of my thesis, an environmental software. Can you help me test this software in a moment?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那第一個問題是你啊... 平常會網路上買東西？	<b>Interviewer:</b> Okay. Then the first question is you... do you usually buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你必須使用什麼平台？	<b>Interviewer:</b> What platforms must you use? [What platforms do you usually use?]
<b>Interviewee:</b> 品牌嗎？ Apple 的可以嗎？	<b>Interviewee:</b> Brands? Is Apple okay?
<b>Interviewer:</b> 都可以。Apple？ 啊... 那你有用過其他的嗎？	<b>Interviewer:</b> Anything is fine. Apple? Ah... Have you used others?
<b>Interviewee:</b> 其他東西可以嗎？	<b>Interviewee:</b> Are other things okay?
<b>Interviewer:</b> 我是說那個平台，那個網頁。你不需要上來...	<b>Interviewer:</b> I mean the platform, the webpage. You don't need to come up...
<b>Interviewee:</b> 喔，蝦皮。	<b>Interviewee:</b> Oh, Shopee.
<b>Interviewer:</b> 蝦皮。好。那蝦皮的之外還有其他的嗎？	<b>Interviewer:</b> Shopee. Okay. Besides Shopee, are there any others?
<b>Interviewee:</b> 淘寶。	<b>Interviewee:</b> Taobao.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那 momo 你有使用過嗎？	<b>Interviewer:</b> Okay. Have you used momo?
<b>Interviewee:</b> 目前沒有。	<b>Interviewee:</b> Not currently.
<b>Interviewer:</b> 好。那那先...先今天的第一次使用。好。那你最近有什麼產品你想要買嗎？	<b>Interviewer:</b> Okay. Then then first... first time using it today. Okay. Is there any product you want to buy recently?
<b>Interviewee:</b> 想要買捲頭髮的。	<b>Interviewee:</b> Want to buy a hair curler.
<b>Interviewer:</b> 好。那你可以幫我找這個這個產品嗎？	<b>Interviewer:</b> Okay. Can you help me find this product?
<b>Interviewee:</b> 有注音嗎？ 等一下，我不會用。	<b>Interviewee:</b> Is there Zhuyin input? Wait, I don't know how to use it.
<b>Interviewer:</b> 好。你想要寫什麼？	<b>Interviewer:</b> Okay. What do you want to write?
<b>Interviewee:</b> 電捲棒。電捲棒。好。	<b>Interviewee:</b> Curling iron. Curling iron. Okay.
<b>Interviewer:</b> (Waits) 這樣嗎？ 還不是？第二個？ 第二個？ 這個嗎？	<b>Interviewer:</b> (Waits) Like this? Not yet? Second one? Second one? This one?
<b>Interviewee:</b> 對對對。	<b>Interviewee:</b> Yes yes yes.
<b>Interviewer:</b> 那這裡有你想要喜歡的嗎？你有什麼特別喜歡的...呃...商品還是品牌嗎？	<b>Interviewer:</b> Is there one here that you like? Do you have any particularly favorite... uh... products or brands?
<b>Interviewee:</b> 這兩個感覺不錯。	<b>Interviewee:</b> These two feel pretty good.
<b>Interviewer:</b> 你幫我講出來一下？ 為什麼這些？	<b>Interviewer:</b> Help me say it out loud briefly? Why these?
<b>Interviewee:</b> 因為它可以自動捲髮。	<b>Interviewee:</b> Because it can automatically curl hair.
<b>Interviewer:</b> 好。就是要按嗎？	<b>Interviewer:</b> Okay. Just need to press it?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那剛剛你說有兩個？ 第二個為什麼？	<b>Interviewer:</b> You just said there were two? Why the second one?
<b>Interviewee:</b> 這個...因為它們都是...兩個是自動捲髮。好。然後因為這個比較便宜一點。嗯。	<b>Interviewee:</b> This one... because they are both... the two are automatic curlers. Okay. And because this one is a bit cheaper. Um.
<b>Interviewer:</b> 對。那你幫我選一個？ 這個？ 打開。	<b>Interviewer:</b> Yes. Can you choose one for me? This one? Open it.
<b>Interviewee:</b> (Selects product)	<b>Interviewee:</b> (Selects product)
<b>Interviewer:</b> 你最近有買過這個品牌嗎？	<b>Interviewer:</b> Have you bought this brand recently?
<b>Interviewee:</b> 沒有，但是最近有在考慮想要買。	<b>Interviewee:</b> No, but recently I've been considering buying it.
<b>Interviewer:</b> 哦，所以你看過這個品牌？	<b>Interviewer:</b> Oh, so you've seen this brand?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那你你你關於這個品牌有什麼樣的想法？	<b>Interviewer:</b> Okay. So, what are your thoughts about this brand?
<b>Interviewee:</b> 品牌嗎？感覺很不錯，因為是可以上市，應該就是不錯。然後它有國際電壓，嗯，就是可以...感覺就是可以帶出國，然後不用再特別用轉接頭，所以是對女孩子來說很方便。	<b>Interviewee:</b> The brand? Feels pretty good, because it can be listed [publicly traded], it should be good. And it has international voltage, um, which means you can... feels like you can take it abroad, and don't need a special adapter, so it's very convenient for girls.
<b>Interviewer:</b> 是蠻貼心的。嗯。好。那這裡，這個網頁上最重要的地方在哪裡？	<b>Interviewer:</b> That's quite thoughtful. Um. Okay. So here, on this webpage, where is the most important part?
<b>Interviewee:</b> 最重要...	<b>Interviewee:</b> Most important...
<b>Interviewer:</b> 這邊？你幫我講出來，為什麼這邊？	<b>Interviewer:</b> Here? Help me say it out loud, why here?
<b>Interviewee:</b> 因為這樣我就可以知道我要怎麼用它。然後因為它也是要插電的，這樣它有寫出來我就會比較知道說要怎麼使用才會比較安全。	<b>Interviewee:</b> Because this way I can know how to use it. And because it also needs to be plugged in, having it written out like this makes me understand better how to use it more safely.
<b>Interviewer:</b> 好。那第二個重要的部分？	<b>Interviewer:</b> Okay. What's the second important part?
<b>Interviewee:</b> 這邊。嗯。	<b>Interviewee:</b> Here. Um.
<b>Interviewer:</b> 這是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 第一個是他的品牌的介紹，然後第二個是寫他詳細的產品資訊。	<b>Interviewee:</b> The first is the introduction of its brand, and the second writes its detailed product information.
<b>Interviewer:</b> 嗯。那這個資訊裡面的重點在哪裡？	<b>Interviewer:</b> Um. Then what's the main point within this information?
<b>Interviewee:</b> 嗯...製造國家是...然後它的使用材質是陶瓷塗層、PTC 導熱體。	<b>Interviewee:</b> Um... manufacturing country is... and its material used is ceramic coating, PTC heating element.
<b>Interviewer:</b> 嗯。那這個資訊會影響你的想法嗎？	<b>Interviewer:</b> Um. Would this information affect your thoughts?
<b>Interviewee:</b> 嗯...不...有可能會。	<b>Interviewee:</b> Um... no... possibly yes.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?
<b>Interviewee:</b> 因為國家是中國，會有點擔心，還是會有一點擔心安全的問題。	<b>Interviewee:</b> Because the country is China, I'd be a little worried, still a bit worried about safety issues.
<b>Interviewer:</b> 好。那網頁上第三個重要的地方呢？	<b>Interviewer:</b> Okay. Then the third important place on the webpage?
<b>Interviewee:</b> 第三個嗎？沒了。還有...還要嗎？如果沒有也可以。沒有。	<b>Interviewee:</b> The third? Gone. Also... want more? If not, that's fine too. No.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 沒有。好的。那可以幫我去上面一點？ 啊，第二個？ 可以幫我打開第二個部分？	<b>Interviewer:</b> No. Okay. Can you help me go up a bit? Ah, the second one? Can you help me open the second section?
<b>Interviewee:</b> 這個嗎？ (Clicks)	<b>Interviewee:</b> This one? (Clicks)
<b>Interviewer:</b> 噢。這個是什麼？	<b>Interviewer:</b> Um. What is this?
<b>Interviewee:</b> 這是什麼...他的品牌建議？ 碳排？ 環保的感覺。	<b>Interviewee:</b> What is this... its brand recommendation? Carbon emissions? Feels environmental.
<b>Interviewer:</b> 是在講環保？ 為什麼？	<b>Interviewer:</b> Is it talking about environmental protection? Why?
<b>Interviewee:</b> 因為現在溫室效應，所以碳排很重要。因為他有減少碳排放量 30%。	<b>Interviewee:</b> Because of the greenhouse effect now, so carbon emissions are very important. Because it has reduced carbon emissions by 30%.
<b>Interviewer:</b> 那作...別人的是什麼事情？	<b>Interviewer:</b> Then do... what about others? [Referring to other brands listed]
<b>Interviewee:</b> 應該是其他品牌名稱嗎？ 我不太確定。	<b>Interviewee:</b> Should be other brand names? I'm not quite sure.
<b>Interviewer:</b> 這些其他的品牌你有看過嗎？	<b>Interviewer:</b> Have you seen these other brands?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那你還是會考慮其他的品 牌嗎？	<b>Interviewer:</b> Would you still consider other brands?
<b>Interviewee:</b> 或許會考慮 Dyson。	<b>Interviewee:</b> Maybe I would consider Dyson.
<b>Interviewer:</b> 那如果你考慮其他的，你想要 有什麼樣的資訊呢？	<b>Interviewer:</b> If you consider others, what kind of information would you want?
<b>Interviewee:</b> 嗯...想要的資訊...他的製造 國家，然後怎麼設計，然後它是用什麼材質 做的，我要怎麼用它會比較安全，有沒有 保固。	<b>Interviewee:</b> Um... information wanted... its manufacturing country, then how it's designed, then what material it's made of, how to use it more safely, whether there's a warranty.
<b>Interviewer:</b> 好。那為什麼你那麼擔心 安全？	<b>Interviewer:</b> Okay. Why are you so worried about safety?
<b>Interviewee:</b> 因為畢竟是會靠近臉部、頭 部，那如果萬一發生就是爆炸會很危險。	<b>Interviewee:</b> Because after all, it will be close to the face, head, so if by any chance an explosion happens, it would be very dangerous.
<b>Interviewer:</b> 嗯。好。那幫我看一個商業部 分？ 上面一點？	<b>Interviewer:</b> Um. Okay. Help me look at one business section? Up a bit?
<b>Interviewee:</b> 這個？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 這個嗎？	<b>Interviewer:</b> This one?
<b>Interviewee:</b> 這個是什麼意思？	<b>Interviewee:</b> What does this mean?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 就是告訴我這個品牌，然後考慮...呃...再考慮他們其他的產品，這樣？我的解讀是這樣。	<b>Interviewer:</b> Just telling me this brand, then consider... uh... reconsider their other products, like that? My interpretation is like that.
<b>Interviewee:</b> 所以...呃...你有這個跟投資有關係嗎？	<b>Interviewee:</b> So... uh... does this have anything to do with investing?
<b>Interviewer:</b> 你是說這個跟什麼有關係？我剛剛聽不太懂。就是跟...就是可以考慮他們其他的產品？	<b>Interviewer:</b> You mean this is related to what? I didn't quite understand just now. Like with... like you can consider their other products?
<b>Interviewee:</b> 哦，考慮他們其他的產品。	<b>Interviewee:</b> Oh, consider their other products.
<b>Interviewer:</b> 對。好。呃...OK。那你可以幫我回那個這個部分那邊？ 第二個部分？第一個...第一個？ 第一個嗎？	<b>Interviewer:</b> Yes. Okay. Uh... OK. Can you help me go back to that section there? The second section? The first... first one? The first one?
<b>Interviewee:</b> 這個嗎？ (Goes back)	<b>Interviewee:</b> This one? (Goes back)
<b>Interviewer:</b> 下面一點，還有兩個按鈕。你想要按一個嗎？	<b>Interviewer:</b> Down a bit, there are two more buttons. Do you want to press one?
<b>Interviewee:</b> (Clicks button)	<b>Interviewee:</b> (Clicks button)
<b>Interviewer:</b> 這個嗎？ 你剛剛按什麼？ 幫我講出來。	<b>Interviewer:</b> This one? What did you just press? Help me say it out loud.
<b>Interviewee:</b> 尋找替代產品。	<b>Interviewee:</b> Find Alternative Products.
<b>Interviewer:</b> 為什麼按這個呢？	<b>Interviewer:</b> Why press this one?
<b>Interviewee:</b> 為什麼按這個嗎？ 呃...也許其他品牌也更好，或者是更便宜。嗯。所以就可以考慮，就是要比較才會知道適合自己的東西是什麼。	<b>Interviewee:</b> Why press this one? Uh... maybe other brands are even better, or cheaper. Um. So one can consider, need to compare to know what suits oneself.
<b>Interviewer:</b> 那剛剛給你說的內容裡面有什麼有用的嗎？	<b>Interviewer:</b> Then in the content it gave you just now, was there anything useful?
<b>Interviewee:</b> 說這邊嗎？ 材料使用，然後環保特點。因為他們在環保方面有更好的表現。	<b>Interviewee:</b> You mean here? Material usage, then environmental features. Because they perform better environmentally.
<b>Interviewer:</b> 所以這些是什麼意思？	<b>Interviewer:</b> So what do these mean?
<b>Interviewee:</b> 這個是...這是 Dyson，應該是日本那個品牌。剩下兩個我不太曉得。	<b>Interviewee:</b> This is... this is Dyson, should be that Japanese brand. The remaining two I don't really know.
<b>Interviewer:</b> 那剛剛他是跟你講英文的品牌，這裡是中文的，你覺得哪一個比較方便看得懂？	<b>Interviewer:</b> Then just now it told you the brands in English, here it's in Chinese, which one do you think is more convenient to understand?
<b>Interviewee:</b> 中文。	<b>Interviewee:</b> Chinese.
<b>Interviewer:</b> 你有其他的問題想要問他嗎？	<b>Interviewer:</b> Do you have other questions you want to ask it?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那幫我回那個第一個部分那邊？ momo 那邊？ 對。上面一點有一個綠色的號碼。可以幫我講出來？	<b>Interviewer:</b> Then help me go back to that first section there? The momo page? Yes. Up a bit there's a green number. Can you help me say it out loud?
<b>Interviewee:</b> 這個嗎？ APNOO。	<b>Interviewee:</b> This one? APNOO.
<b>Interviewer:</b> 好。那可以幫我寫卡片上嗎？這個號碼。	<b>Interviewer:</b> Okay. Can you help me write this number on the card?
<b>Interviewee:</b> (Writes code)	<b>Interviewee:</b> (Writes code)

### 16.1.26 Transcript 2025-03-13 - Tainan (NCKU) - ANGZQ

**Source Files:** \* 2025-03-13 - Tainan (NCKU) - ANGZQ.json \* 2025-03-13 - Tainan (NCKU) - ANGZQ.txt

**Ziran ID Code:** ANGZQ

Traditional Chinese Transcript	English Translation
<b>Me:</b> 那我先問 (註: JSON 誤聽為 玩) 你，我可以錄影這個對話嗎？	<b>Me:</b> Let me ask (Note: JSON misheard as “play”) first, can I record this conversation?
<b>Interviewee:</b> 可以，沒問題。	<b>Interviewee:</b> Yes, no problem.
<b>Me:</b> 好。那我首先要介紹一下，我是成功 (註: JSON 誤聽為 中呃天空) 大學創意設計所 (註: JSON 誤聽為 創藝術期說) 的學生，然後這個是我的論文的一部分，一個環保 (註: JSON 誤聽為 方法) 的 App。嗯，那等一下你可以幫我測試 (註: JSON 誤聽為 設置) 這個軟體嗎？	<b>Me:</b> Okay. First, let me introduce myself. I'm a student from the Institute of Creative Design at National Cheng Kung (Note: JSON misheard as “Middle uh Sky”) University (Note: JSON misheard as “Creative Arts Period Said”), and this is part of my thesis, an environmental protection (Note: JSON misheard as “method”) App. Hmm, can you help me test (Note: JSON misheard as “set up”) this software later?
<b>Interviewee:</b> 可以，沒關係。	<b>Interviewee:</b> Yes, it's okay.
<b>Me:</b> 好的。那第一個問題是你平常 (註: JSON 誤聽為 冰上) 會網路上買東西嗎？	<b>Me:</b> Okay. So the first question is, do you usually (Note: JSON misheard as “on ice”) buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那妳比較使用什麼平台？	<b>Me:</b> What platforms do you mostly use?
<b>Interviewee:</b> 呃，蝦皮。	<b>Interviewee:</b> Uh, Shopee.
<b>Me:</b> 還有其他的嗎？	<b>Me:</b> Are there others?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 嗯，主要都是用蝦皮。	<b>Interviewee:</b> Hmm, mostly just Shopee.
<b>Me:</b> 好。那 Momo (註: JSON 誤聽為 媚媽) 有用過？	<b>Me:</b> Okay. Have you used Momo (Note: JSON misheard as “mom”)?
<b>Interviewee:</b> 有，有用過。	<b>Interviewee:</b> Yes, I have used it.
<b>Me:</b> 那妳平常 (註: JSON 誤聽為 冰上回) 會買 (註: TXT 誤聽為 賣) 什麼樣的東西？	<b>Me:</b> What kind of things do you usually (Note: JSON misheard as “on ice back”) buy (Note: TXT misheard as “sell”)?
<b>Interviewee:</b> 額...大概化妝品，然後飾品之類的。	<b>Interviewee:</b> Uh... probably cosmetics, and accessories, things like that.
<b>Me:</b> 好。那因為目前我們這是 Momo，所以 Momo 上有什麼妳想要買的嗎？	<b>Me:</b> Okay. Since currently we’re on Momo, is there anything you want to buy on Momo?
<b>Interviewee:</b> 嗯...餅乾。	<b>Interviewee:</b> Hmm... cookies.
<b>Me:</b> 好。妳可以幫我找妳想要的。好，來，我幫妳。	<b>Me:</b> Okay. You can help me find what you want. Okay, come, I’ll help you.
<b>Interviewee:</b> (Searching) ... 有耶。	<b>Interviewee:</b> (Searching) ... Yes.
<b>Me:</b> 好。那可以幫我講出來妳在找什麼品牌？	<b>Me:</b> Okay. Can you tell me what brand you’re looking for?
<b>Interviewee:</b> 荷蘭傳統糖漿煎餅，Gouda (高達)。	<b>Interviewee:</b> Dutch traditional syrup waffles, Gouda.
<b>Me:</b> 好。那妳之前有買過嗎？	<b>Me:</b> Okay. Have you bought it before?
<b>Interviewee:</b> 呃...有。	<b>Interviewee:</b> Uh... yes.
<b>Me:</b> 好。那妳為什麼選這個餅乾呢？	<b>Me:</b> Okay. Why did you choose this cookie?
<b>Interviewee:</b> 因為我很喜歡吃這個餅乾。	<b>Interviewee:</b> Because I really like eating this cookie.
<b>Me:</b> 好。那這個網頁上，妳覺得最重要的部分在哪裡？	<b>Me:</b> Okay. On this webpage, what do you think is the most important part?
<b>Interviewee:</b> 嗯...圖片。	<b>Interviewee:</b> Hmm... pictures.
<b>Me:</b> 還有其他的嗎？	<b>Me:</b> Anything else?
<b>Interviewee:</b> 然後價錢，這樣子。	<b>Interviewee:</b> And the price, like that.
<b>Me:</b> 好。那第三個呢？	<b>Me:</b> Okay. What about the third?
<b>Interviewee:</b> 應該是評價吧。	<b>Interviewee:</b> Probably the reviews.
<b>Me:</b> 好。那這裡外面上，有什麼妳之前沒有看過的嗎？	<b>Me:</b> Okay. On this page, is there anything you haven’t seen before?
<b>Interviewee:</b> 嗯，有這個。	<b>Interviewee:</b> Hmm, there’s this.
<b>Me:</b> 好。那這個是什麼？	<b>Me:</b> Okay. What is this?
<b>Interviewee:</b> 比較詳細的這個品牌的介紹，還有一些可能平常不會知道關於公司的資訊。	<b>Interviewee:</b> A more detailed introduction of this brand, and some information about the company that one might not usually know.
<b>Me:</b> 那妳覺得這裡最重要的點 (註: TXT 誤聽為 地方) 在哪裡？	<b>Me:</b> What do you think is the most important point (Note: TXT misheard as “place”) here?
<b>Interviewee:</b> 環境問題跟勞工問題，還有 ESG 評分這些。嗯。	<b>Interviewee:</b> Environmental issues and labor issues, and also ESG ratings, these things. Hmm.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 那 ESG 是什麼啊？	<b>Me:</b> What is ESG?
<b>Interviewee:</b> 實際我不知道。	<b>Interviewee:</b> Actually, I don't know.
<b>Me:</b> 那妳買東西的時候會關心環保嗎？	<b>Me:</b> When you buy things, do you care about environmental protection?
<b>Interviewee:</b> 說實在平常沒有到很注意。	<b>Interviewee:</b> Honestly, usually I don't pay much attention.
<b>Me:</b> 好。那，嗯，妳覺得，因為這裡的內容蠻多的，妳可以選一個最重要的點嗎？	<b>Me:</b> Okay. Um, since there's quite a lot of content here, can you pick the most important point?
<b>Interviewee:</b> 應該是這個第三點，有一個總結，就是他說公司整體評分(註: TXT 誤聽為名分)是 10 之 5。	<b>Interviewee:</b> Probably this third point, there's a summary, it says the company's overall rating (Note: TXT misheard as "status") is 5 out of 10.
<b>Me:</b> 好，「環境不明，社會責任低」，這裡。好。那妳可以幫我(點)去上面一點，然後有第二個部分。妳覺得這個是什麼？	<b>Me:</b> Okay, "Environment unclear, Social responsibility low," here. Okay. Can you help me (click) go up a bit, then there's the second section. What do you think this is?
<b>Interviewee:</b> 「替代商品」。(註: TXT 誤聽為氣袋上面)	<b>Interviewee:</b> "Alternative Products". (Note: TXT misheard as "Above the airbag")
<b>Me:</b> 可以幫我講大聲一點嗎？	<b>Me:</b> Can you speak a bit louder for me?
<b>Interviewee:</b> 替代商品。	<b>Interviewee:</b> Alternative products.
<b>Me:</b> 好。那這些其他的商品妳有買過嗎？	<b>Me:</b> Okay. Have you bought these other products before?
<b>Interviewee:</b> 好像沒有耶。	<b>Interviewee:</b> Seems like no.
<b>Me:</b> 有看過嗎？	<b>Me:</b> Have you seen them?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 好。那為什麼會推薦這些呢？	<b>Me:</b> Okay. Why are these recommended then?
<b>Interviewee:</b> 因為碳排放比較低。	<b>Interviewee:</b> Because the carbon emissions are lower.
<b>Me:</b> 好。那會影響妳的想法嗎？還是妳還是想要買原本的？	<b>Me:</b> Okay. Does that influence your thoughts? Or do you still want to buy the original one?
<b>Interviewee:</b> 我覺得它如果顯示在頁面旁邊，我會覺得可以換一個品牌。	<b>Interviewee:</b> I think if it's displayed beside the page, I would feel like I could switch to another brand.
<b>Me:</b> 那原本不是最好吃的嗎？	<b>Me:</b> But wasn't the original one the tastiest?
<b>Interviewee:</b> 呃，我沒吃過，但可以試試看。	<b>Interviewee:</b> Uh, I haven't tried it, but I can give it a try.
<b>Me:</b> 好的。那可以幫我(點)去上面第三個部分嗎？妳覺得這個是什麼？	<b>Me:</b> Okay. Can you help me (click) go to the third section above? What do you think this is?
<b>Interviewee:</b> 投資(註: TXT 誤聽為過期產品的公司？我覺得這裡好像有點不太明顯。	<b>Interviewee:</b> Invest in (Note: TXT misheard as "Expired") the product's company? I feel this part seems a bit unclear.
<b>Me:</b> 這個跟什麼有關係？	<b>Me:</b> What is this related to?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 就是我買過這個產品，然後哪個公司製造的，這樣子。	<b>Interviewee:</b> Like, I bought this product, and which company manufactured it, like that.
<b>Me:</b> 好，這個跟投資有關係。妳有投資過嗎？	<b>Me:</b> Okay, this is related to investing. Have you invested before?
<b>Interviewee:</b> 沒有耶。	<b>Interviewee:</b> No.
<b>Me:</b> 沒有買過股票？	<b>Me:</b> Never bought stocks?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Me:</b> 好的。那妳可以幫我回第一個部分那邊嗎？	<b>Me:</b> Okay. Can you help me go back to the first section over there?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Me:</b> 好。那最下面有兩個按鈕，妳可以幫我按一個嗎？	<b>Me:</b> Okay. At the very bottom, there are two buttons. Can you press one for me?
<b>Interviewee:</b> 「尋找替代產品」。	<b>Interviewee:</b> "Find Alternative Products".
<b>Me:</b> 那為什麼妳選這個呢？	<b>Me:</b> Why did you choose this one?
<b>Interviewee:</b> 因為我覺得它可以推薦我更多，就是跟...可能它在環保層面或是社會責任更高的品牌。	<b>Interviewee:</b> Because I feel it can recommend more to me, like... maybe brands that are higher in environmental aspects or social responsibility.
<b>Me:</b> 好。那它跟妳說什麼？妳看一下上面。呃，「高達」品牌與其他更... (提供建議) 不用講出來，是說妳看一下，妳覺得有什麼有用的嗎？	<b>Me:</b> Okay. What did it tell you? Look at the top. Uh, "Gouda" brand and other more... (giving advice) No need to say it out loud, just take a look, do you think there's anything useful?
<b>Interviewee:</b> 哟，就是別的品牌可能更環保一點，所以我可以購買這些品牌作為替代。	<b>Interviewee:</b> Oh, it means other brands might be a bit more environmentally friendly, so I can buy these brands as alternatives.
<b>Me:</b> 好。那妳有什麼問題妳想要自己問它嗎？	<b>Me:</b> Okay. Do you have any questions you want to ask it yourself?
<b>Interviewee:</b> 嗯...	<b>Interviewee:</b> Hmm...
<b>Me:</b> 呀要給它打字 (註: TXT 誤聽為 答案) 嘴？我可以按這個嗎？	<b>Me:</b> Do you want to type (Note: TXT misheard as "answer") to it? Can I press this?
<b>Interviewee:</b> 可以。「減少亂買」。	<b>Interviewee:</b> Yes. "Reduce impulsive buying".
<b>Me:</b> 好。妳去上面按。喔。	<b>Me:</b> Okay. Go up and press it. Oh.
<b>Me:</b> 在上面，妳幫我講出來妳問什麼？	<b>Me:</b> Up there, tell me what you asked.
<b>Interviewee:</b> 我問「要怎麼減少亂買東西？」好。	<b>Interviewee:</b> I asked, "How to reduce impulsive buying?" Okay.
<b>Me:</b> 然後它推薦我可以制定購物清單、設定預算或是「三思後行」。這些有什麼妳之前沒有自己想到的嗎？什麼新的嗎？	<b>Me:</b> Then it recommended I can create a shopping list, set a budget, or "Think thrice before acting." Is there anything here you hadn't thought of yourself before? Anything new?
<b>Interviewee:</b> 我覺得，嗯...「選擇可持續產品」可能是我之前沒有想過的。	<b>Interviewee:</b> I think, hmm... "Choose sustainable products" might be something I hadn't thought of before.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好的。那還有其他的問題妳想要問嗎？	<b>Me:</b> Okay. Are there any other questions you want to ask?
<b>Interviewee:</b> 這個，「我如何影響公司變得更環保？」	<b>Interviewee:</b> This one, “How can I influence companies to become more environmentally friendly?”
<b>Me:</b> 那妳覺得這個內容的重點在哪裡？	<b>Me:</b> What do you think is the main point of this content?
<b>Interviewee:</b> 嗯...我覺得重點...我覺得重點可能是...還是最重要的，是要多去有主動的一些行動，像是說你可以去直接跟公司反映啊，或者是政策上面的支持，這樣子。	<b>Interviewee:</b> Hmm... I think the point... I think the point might be... still the most important thing is to take more proactive actions, like, say, you can directly give feedback to the company, or support relevant policies, like that.
<b>Me:</b> 好。那妳可以幫我回 Momo 那邊嗎？然後最 (註: TXT 誤聽為 睡) 上面有一個代碼，妳可以幫我講出來嗎？	<b>Me:</b> Okay. Can you help me go back to the Momo page? Then at the very (Note: TXT misheard as “sleep”) top, there's a code, can you say it out loud for me?
<b>Interviewee:</b> ANGZQ。	<b>Interviewee:</b> ANGZQ.
<b>Me:</b> 好。妳有那個剛剛的卡片嗎？	<b>Me:</b> Okay. Do you have the card from just now?
<b>Interviewee:</b> 有，我有掃描了。	<b>Interviewee:</b> Yes, I scanned it.
<b>Me:</b> 好。現在妳可以幫我寫這個代碼。	<b>Me:</b> Okay. Now you can help me write this code.

### 16.1.27 Transcript 2025-03-13 - Tainan (NCKU) - C5LGY

**Source Files:** \* 2025-03-13 - Tainan (NCKU) - C5LGY.json \* 2025-03-13 - Tainan (NCKU) - C5LGY.txt

**Ziran ID Code:** C5LGY

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好，那我介紹一下，我是成功大學創意設計所 (註: JSON 誤聽為轉一次說想)，然後這個是我的論文的一部分，一個環保的 App。那你等一下會幫我測試 (註: JSON 誤聽為 介紹) 這個軟體嗎？OK，好。那第一個問題是你平常會網路上買東西嗎？(註: JSON 誤聽為 買到錢)	<b>Me:</b> Okay, let me introduce myself. I'm from the Institute of Creative Design at National Cheng Kung University (Note: JSON misheard as "turn once say think"), and this is part of my thesis, an environmental protection App. Will you help me test (Note: JSON misheard as "introduce") this software later? OK, good. So the first question is, do you usually buy things online? (Note: JSON misheard as "buy money")
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那你通常使用什麼平台？	<b>Me:</b> What platforms do you usually use?
<b>Interviewee:</b> 呃，旋轉或蝦皮。	<b>Interviewee:</b> Uh, Carousell or Shopee.
<b>Me:</b> 那你有使用過 Momo 嗎？	<b>Me:</b> Have you used Momo?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Me:</b> 那你當場 (註: 應為 通常) 會買什麼？	<b>Me:</b> What do you usually (Note: "on the spot" likely misspoken/misheard, context suggests "usually") buy?
<b>Interviewee:</b> Momo 的話，通常會買一些 3C 用品或家電比較多。	<b>Interviewee:</b> On Momo, I usually buy more 3C products or home appliances.
<b>Me:</b> 那其他的品牌呢？(註: TXT 用 平颱)	<b>Me:</b> What about other brands? (Note: TXT used "platforms")
<b>Interviewee:</b> 其他就是不一樣的，就是衣服或者之類的。	<b>Interviewee:</b> Others are different, like clothes or things like that.
<b>Me:</b> 買這樣沒關。(註: 應為 日用品？) 是不是衣服或者日用品？好。那 Momo 上沒有衣服嗎？	<b>Me:</b> Buying like this doesn't matter. (Note: Likely meant "Daily necessities?") Are they clothes or daily necessities? Okay. Doesn't Momo have clothes?
<b>Interviewee:</b> 就是通常大家會覺得 Momo 上面的家電比較便宜，而且 Momo 的宅配選項就是比較多的感覺。	<b>Interviewee:</b> It's just that people usually think home appliances on Momo are cheaper, and Momo's home delivery options feel more numerous.
<b>Me:</b> 好，跟其他的比。那目前你有什麼想要買嗎？(註: JSON/TXT 誤聽為 賣)	<b>Me:</b> Okay, compared to others. Is there anything you want to buy right now? (Note: JSON/TXT misheard as "sell")
<b>Interviewee:</b> 最近的話，嗯，應該是耳機吧。	<b>Interviewee:</b> Recently, um, probably headphones.
<b>Me:</b> 好。那你，呃，可以幫我找一下你要買的嗎？喔，我...注意一下...欸，找不到。你會打品牌嗎？因為我不知道他的那個在哪裡。	<b>Me:</b> Okay. Uh, can you help me find what you want to buy? Oh, I... pay attention... Hey, can't find it. Would you type the brand? Because I don't know where it is.
<b>Interviewee:</b> (Searches)	<b>Interviewee:</b> (Searches)

Traditional Chinese Transcript	English Translation
<b>Me:</b> 你要查什麼？	<b>Me:</b> What are you searching for?
<b>Interviewee:</b> 就是耳機。	<b>Interviewee:</b> Just headphones.
<b>Me:</b> 耳機，yeah。Mhm。那你想找什麼品牌嗎？	<b>Me:</b> Headphones, yeah. Mhm. Are you looking for a specific brand?
<b>Interviewee:</b> 還是...我最近是看這個，Sony 的。	<b>Interviewee:</b> Or... recently I've been looking at this one, Sony.
<b>Me:</b> Sony 的？那為什麼 Sony？Sony 的耳機？就是耳罩式的耳機？	<b>Me:</b> Sony? Why Sony? Sony headphones? The over-ear type?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Right.
<b>Me:</b> 好。那你為什麼要選(註: JSON 誤聽為幹嘛)這個呢？這個品牌？	<b>Me:</b> Okay. Why did you choose (Note: JSON misheard as "what for") this one? This brand?
<b>Interviewee:</b> 因為就是耳機的話其實很多選擇，可是我之前試過朋友的 Sony 的耳罩式，我覺得還蠻不錯的。就是它的那個戴起來...(註: JSON 誤聽為代償人)因為很多的耳機(註: JSON 誤聽為雞)戴久了都會痛啊，但是這些...還沒有買(註: JSON 誤聽為賣)過這個品牌。	<b>Interviewee:</b> Because for headphones, there are actually many choices, but I tried a friend's Sony over-ear ones before, and I thought they were quite good. Just the way they feel when worn... (Note: JSON misheard "wearing comfort" as "compensation person") Because many headphones (Note: JSON misheard "headphones" as "chicken") hurt after wearing them for a long time, but these... I haven't bought (Note: JSON misheard as "sell") this brand before.
<b>Me:</b> 對。好。那，呃，你這個...這個網頁上，重要的地方在哪裡？	<b>Me:</b> Right. Okay. Uh, on this... this webpage, where are the important parts?
<b>Interviewee:</b> 最重要的地方？	<b>Interviewee:</b> The most important parts?
<b>Me:</b> 對。	<b>Me:</b> Yes.
<b>Interviewee:</b> 就是如果是論一個商品的話，最重要的就是圖片跟價格嘛，然後還有品名這樣子，基本上就已經很夠了。	<b>Interviewee:</b> If we're talking about a product, the most important things are the picture and the price, right? And also the product name like that, basically that's enough.
<b>Me:</b> 好。那你覺得這裡還有什麼其他的新嗎？你之前沒有看過嗎？這一塊？	<b>Me:</b> Okay. Do you think there's anything else new here? Haven't you seen this part before? This section?
<b>Interviewee:</b> 這塊...	<b>Interviewee:</b> This section...
<b>Me:</b> 好。那你覺得這一塊是什麼？	<b>Me:</b> Okay. What do you think this section is?
<b>Interviewee:</b> 這一塊，它是類似給你建議的嗎？或是...就是會給你一些資訊讓你參考。好。	<b>Interviewee:</b> This section, is it something like giving you suggestions? Or... it just gives you some information for reference. Okay.
<b>Me:</b> 然後就是它下面還有這種環保指數...	<b>Me:</b> And then below it, there's this environmental index...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 應該會比較偏，就是會幫你看這個東西的個人環保，有沒有幫助。	<b>Interviewee:</b> It probably leans more towards, like, helping you see the personal environmental impact of this item, whether it's helpful.
<b>Me:</b> 好。那買東西的時候呢，你會考慮它的環保嗎？	<b>Me:</b> Okay. When buying things, do you consider their environmental impact?
<b>Interviewee:</b> 實際不太會。	<b>Interviewee:</b> Actually, not really.
<b>Me:</b> 好。那這個內容的重點在哪裡？	<b>Me:</b> Okay. What is the main point of this content?
<b>Interviewee:</b> 就是它會給你參考它這個品牌的，然後這個東西的資訊，讓你了解。好。	<b>Interviewee:</b> It gives you information about this brand for reference, and information about this item, letting you understand. Okay.
<b>Me:</b> 那我看完這個了，你可以找一些可能更好的替代品，不一定要馬上買，可以比較。好。那你幫我看到那個第二個部分，「儲蓄」，你覺得這個是什麼？	<b>Me:</b> Now that I've read this, you can find some potentially better alternatives, you don't have to buy immediately, you can compare. Okay. Can you help me look at the second part, "Savings"? What do you think this is?
<b>Interviewee:</b> 儲蓄？嗯...儲蓄喔？他可能...看一下喔，就是他會，就是可能有一些品牌的小品...小品牌，碳排放會比較少嘛，如果是...就是比起大公司的。	<b>Interviewee:</b> Savings? Um... Savings, huh? He might... let me see, it means he will, like, maybe some brands' small items... small brands, their carbon emissions might be lower, right? If it's... compared to big companies.
<b>Me:</b> 那再...現在其他的品牌你有買過還是看過嗎？	<b>Me:</b> Then again... have you bought or seen these other brands before?
<b>Interviewee:</b> 嗯...沒有。	<b>Interviewee:</b> Um... no.
<b>Me:</b> 好。那你覺得為什麼他會推薦這些品牌呢？	<b>Me:</b> Okay. Why do you think it recommends these brands?
<b>Interviewee:</b> 因為他的...他的解釋就是說這些要嘛就是，一開始的原料就比較環保，有些是可以用比較久，然後用比較久的話，它平均下來每天的...就是每天除下來的排放量(註: TXT 誤聽為 配方量)比較少。	<b>Interviewee:</b> Because its... its explanation is that these are either, the raw materials are more environmentally friendly from the start, or some can be used longer, and if used longer, its average daily... the daily divided emissions (Note: TXT misheard as "formula amount") are lower.
<b>Me:</b> 好。那看到這些其他的品牌，你會考慮其他的嗎？	<b>Me:</b> Okay. Seeing these other brands, would you consider others?
<b>Interviewee:</b> 會。因為其實我對原料這種東西比較還好，可是如果我，如果知道這個東西，就是我有另外一個品牌比較耐用，可以用比較久，我可能就會想要參考一下。	<b>Interviewee:</b> Yes. Because actually, I'm relatively indifferent to raw materials, but if I know this item, like, if I have another brand that's more durable and can be used longer, I might want to check it out for reference.

Traditional Chinese Transcript	English Translation
<p><b>Me:</b> 好。那因為這裡的氣壓不多啊 (註: JSON 誤聽, 應為資料不多啊), 你還是想要看什麼其他的嗎? 你說什麼意思? 就是這些品牌, 其他的品牌, 這裡有他的名詞而已, 沒有很多。有什麼你比較想知道嗎?</p>	<p><b>Me:</b> Okay. Since the air pressure here isn't much (Note: JSON misheard, should be "data isn't much"), do you still want to see anything else? What do you mean? Like these brands, other brands, there are only their names here, not much else. Is there anything you particularly want to know?</p>
<p><b>Interviewee:</b> 應該是這一個, 就是耐用設計。</p>	<p><b>Interviewee:</b> Probably this one, the durable design.</p>
<p><b>Me:</b> 好, 為什麼這個呢?</p>	<p><b>Me:</b> Okay, why this one?</p>
<p><b>Interviewee:</b> 因為如果我自己買東西的話, 我會比較注重, 我希望它可以永久很久 (註: 應為用很久)...因為我買東西會憂鬱很久 (註: 應為猶豫很久), 所以我會想說只要我這個東西我可以使用的很久的話就可以明確的麻煩 (註: 應為 買)。OK。</p>	<p><b>Interviewee:</b> Because if I buy things myself, I pay more attention, I hope it can last forever for a long time (Note: Should be "be used for a long time")... Because I get depressed for a long time when buying things (Note: Should be "hesitate for a long time"), so I'd think as long as I can use this thing for a long time, then I can clearly trouble (Note: Should be "buy"). OK.</p>
<p><b>Me:</b> 那你想要看的什麼圖片嗎? 還是什麼其他的評論? 還是...?</p>	<p><b>Me:</b> Do you want to see any pictures? Or any other reviews? Or...?</p>
<p><b>Interviewee:</b> 目前沒...目前沒有。</p>	<p><b>Interviewee:</b> Not currently... currently no.</p>
<p><b>Me:</b> 好。那如果, 如果我可以...因為現在什麼都沒有, 那如果有什麼其他的氣調 (註: JSON 誤聽, 應為 資料), 你讓...你要看什麼 (註: JSON 誤聽場嗎)? 它的評論還是照片還是價格還是...?</p>	<p><b>Me:</b> Okay. What if, what if I could... Because there's nothing now, but if there was some other air conditioning (Note: JSON misheard, should be "data"), you let... what do you want to see (Note: JSON misheard "place")? Its reviews or photos or price or...?</p>
<p><b>Interviewee:</b> 如果是這邊要再加一點東西的話, 我希望我可以看到價格跟, 就是可能跟這個牌子的比較。因為就是我看到這些, 可是我可能不太確定那我原本的是多少, 或是我不是這邊推薦的, 他可能不一定是一樣的東西啊。</p>	<p><b>Interviewee:</b> If something were to be added here, I hope I could see the price and, like, maybe a comparison with this brand. Because I see these, but I might not be sure how much my original one was, or maybe it's not the one recommended here, it might not necessarily be the exact same thing.</p>
<p><b>Me:</b> 嗯。對。然後我也想要看說, 就是比價這樣子。嗯。還是另外一個想法是, 你也可以...那個通常人會使用這個產品多久? 對。</p>	<p><b>Me:</b> Mhm. Right. And I also want to see, like, price comparison. Mhm. Or another idea is, you could also... how long do people typically use this product? Right.</p>

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 嗯。這個我覺得平常大家會使用多久感覺就比較難，就是比較難就是短時間研究出來吧，因為他假設這個產品剛出，他們也要一段時間才會知道說這個東西可以用多久。	<b>Interviewee:</b> Um. This one, I think how long everyone usually uses it feels harder, it's harder to research in a short time, right? Because assuming this product just came out, they also need some time to know how long this thing can be used.
<b>Me:</b> 好。來可以嗎？你幫我看到你的第三個部分，你覺得這個是什麼？	<b>Me:</b> Okay. Come on, can you? Help me look at your third part, what do you think this is?
<b>Interviewee:</b> 哦，是原本公司的股票嗎？嗯。哦，所以我到時候開的話還可以看到它這個公司的最近的市場發展？	<b>Interviewee:</b> Oh, is it the original company's stock? Um. Oh, so if I open it then, I can still see this company's recent market development?
<b>Me:</b> 對。那你，你趁現有要投資過嗎？(註: JSON 誤聽你趁現有要透直播嗎)	<b>Me:</b> Right. Have you, have you taken the opportunity to invest before? (Note: JSON misheard "Have you taken the opportunity to live stream now?")
<b>Interviewee:</b> 有，那種就是模擬投資啊。實際上的沒有。	<b>Interviewee:</b> Yes, the kind that's simulated investing. Not actual investing.
<b>Me:</b> 好。那你現在買(註: JSON/TXT 誤聽為賣)東西跟投資(註: JSON 誤聽為透抽)有什麼關係嗎？還是從完全不一樣的？	<b>Me:</b> Okay. Does buying (Note: JSON/TXT misheard as "selling") things now have any relation to investing (Note: JSON misheard as "cuttlefish")? Or are they completely different?
<b>Interviewee:</b> 就是，雖然說實際在投資的時候，你不會覺得說一般人買東西對這個，這個的波動有沒有那麼的明顯，就是我買不買其實對現在的股票其實不會差太多。但是假設每個人都，就是他可能這間，這間公司可能最近有什麼比較，比如說新品上市，或是出現什麼，就是比如說，呃，影響品牌的信譽的東西，那可能他的股票就會跌。我覺得那種比較重要。就是一般的消費的話可能比較還好。	<b>Interviewee:</b> Well, although when actually investing, you wouldn't feel that ordinary people buying things has such an obvious effect on the fluctuations of this, this stock. Like, whether I buy or not doesn't really make much difference to the current stock price. But suppose everyone, like, maybe this, this company recently had something major, like a new product launch, or something happened, like, uh, something affecting the brand's reputation, then maybe its stock price will fall. I think that kind of thing is more important. Regular consumption might be less significant.
<b>Me:</b> 可是品牌的信譽會影響人要不要消費。嗯。那如果你很喜歡這個，這個品牌，你會比較考慮買這個，這個股票嗎？	<b>Me:</b> But brand reputation affects whether people want to consume. Um. So if you really like this, this brand, would you be more likely to consider buying this, this stock?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 其實如果，如果我喜歡這個品牌是因為它的產品的話，可能會。因為就是假設這個產品真的好用的話，就會讓可能這個東西就會比較暢銷。可是我可能主要還是會比較 care 說這個品牌的發展性如何，因為像 Sony 已經上市很久了。然後我可能就是，就算我很喜歡，也是要看時間才可以去買，不一定說我很希望(註: JSON 誤聽)我就可以買。	<b>Interviewee:</b> Actually, if, if I like this brand because of its products, maybe. Because if this product is really good, it might make this thing sell better. But I might still mainly care more about the brand's development potential, because like Sony has been listed for a long time. And I might just, even if I like it a lot, I still need to consider the timing to buy, it's not necessarily that just because I really want (Note: JSON misheard "like" as "hope") it, I can buy it.
<b>Me:</b> 嗯。對啦。那它，它這裡跟你講的那個啊(註: 應為內容)，重點在哪裡？	<b>Me:</b> Um. Right. So, what it, what it tells you here (Note: "ah" likely filler, meant "content"), where is the main point?
<b>Interviewee:</b> 他會先跟你說就是最近他的近期的股票趨勢，那我就可以看出來它最近就是雖然前陣子有點跌(註: JSON 誤聽)，但是最近有在慢慢的上升。然後呢再來就是他會說他的，就是這些這個品牌對對環保的領域做了什麼事情，然後什麼事情沒有做，這樣子。	<b>Interviewee:</b> It first tells you its recent stock trend. Then I can see that recently, although it dipped (Note: JSON misheard "dipped" as "a bit") a while ago, it has been slowly rising recently. And then next, it will talk about its, like what this brand has done in the field of environmental protection, and what it hasn't done, like that.
<b>Me:</b> 好。那，呃，可以幫我回那個第一個部分那個嗎？	<b>Me:</b> Okay. Uh, can you help me go back to that first part?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Right.
<b>Me:</b> 那最下面有兩個按鈕，你想要按哪個嗎？	<b>Me:</b> At the very bottom, there are two buttons. Which one do you want to press?
<b>Interviewee:</b> 呃，這個。因為產地我應該會知道。	<b>Interviewee:</b> Uh, this one. Because I probably know the place of origin.
<b>Me:</b> 好。那為什麼你要這個呢？	<b>Me:</b> Okay. Why do you want this one?
<b>Interviewee:</b> 因為就是買東西的話，你一定要比較說會不會有比這個更好的商品。因為產地的話其實你自己如果這是一個大牌子或什麼的，你其實可以猜到說他產地是哪一天(註: 應為哪裡)。嗯。對。所以我可能會比較想要知道說其他品牌在這方面做得怎麼樣。	<b>Interviewee:</b> Because when buying things, you definitely need to compare if there are better products than this one. Because for the place of origin, if it's a big brand or something, you can actually guess where its place of origin is (Note: "which day" misspoken/misheard, meant "where"). Um. Right. So I might be more interested in knowing how other brands are doing in this aspect.
<b>Me:</b> 好。那這個，剛剛打...它給你講的內容裡面有什麼重要的嗎？	<b>Me:</b> Okay. This one, just typed... is there anything important in the content it gave you?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我看一下喔。就是他會，他因為他這裡的那個，他這裡舉例的就跟...就會牌子就會比較大，然後我就可以看說這三個，這三個關於環保的，關於環保或是人權管理的部分做了什麼事情。然後這些品牌會比較像是，一般人會參考的。因為剛剛那些就是說碳排放量很低的，可能平常我們要買的時候我們不會想到，但是我們想到這些，然後我們可以之間(註: 應為直接)比較的話其實還不錯。而且他最後也會幫我們統整說誰跟誰在評分上面比較好，然後就是會變成更好的選擇。	<b>Interviewee:</b> Let me see. It will, because here, the examples it gives are like... the brands will be bigger, and then I can see these three, what these three have done regarding environmental protection, or human rights management. And these brands are more like what ordinary people would refer to. Because those ones just now that said low carbon emissions, maybe we wouldn't think of them when we usually buy, but we think of these, and if we can compare between (Note: "between" likely misspoken, meant "directly") them, it's actually quite good. And finally, it also helps us summarize who compares better with whom in terms of rating, and then it becomes a better choice.
<b>Me:</b> 那你有什麼其他的問題你想要問他嗎？也可以做其他測試。	<b>Me:</b> Do you have any other questions you want to ask it? You can also do other tests.
<b>Interviewee:</b> 那個這題大車(註: JSON 誤聽，應為 替代產品)	<b>Interviewee:</b> That question, big car (Note: JSON misheard, likely meant "alternative products" based on button function)
<b>Me:</b> 好。你可以幫我講出來嗎？要去上面。	<b>Me:</b> Okay. Can you say it out loud for me? Need to go up.
<b>Interviewee:</b> 就是檢查一個產品的可課(註: 應為可持續性)...就是不管是買自己買東西或是買家用品，就是一個東西，可持續性。就是，我覺得就是之前會有人說你的消費決定你的生活，就是你要像是比如說像我可能不喜歡就是之前會有一些那種剝削的，使用剝削的棉花的品牌，我可能就不會消費。就是我覺得說聯合抵制或是什麼，這件事情是對公司會有壓力的。那假設我在環保這部分上，然後大家也許注意到這件事情去相對的比較少買，對品牌，對品牌也是硬傷(註: 應為 影響)。然後品牌就會想，就是知道這件事情，然後來改善這個狀況。	<b>Interviewee:</b> Just checking a product's class class (Note: Should be "sustainability")... It's like whether buying things for myself or buying household goods, just one thing, sustainability. It's like, I feel like someone said before, "Your consumption determines your world." It's like you need to, for example, like maybe I don't like brands that previously used exploitative, exploited cotton, I might not consume them. It's just, I feel that boycotting together or something, this matter puts pressure on the company. So suppose in the environmental aspect, and maybe everyone notices this matter and relatively buys less, for the brand, for the brand it's also a hard injury (Note: Should be "impact"). Then the brand will think, know about this matter, and then improve this situation.

Traditional Chinese Transcript	English Translation
<b>Me:</b> 好。好。可以幫我回那個 Momo 那邊。那最上面有一個代碼，你可以幫我講出來？	<b>Me:</b> Okay. Okay. Can you help me go back to the Momo page? At the very top, there's a code, can you say it out loud for me?
<b>Interviewee:</b> 代碼？ 哪一個？	<b>Interviewee:</b> Code? Which one?
<b>Me:</b> 這個綠色的代碼。	<b>Me:</b> This green code.
<b>Interviewee:</b> C5LGY。	<b>Interviewee:</b> C5LGY.
<b>Me:</b> 好。那用那個剛剛的卡片嗎？ 還是我給你新的？	<b>Me:</b> Okay. Use that card from just now? Or should I give you a new one?
<b>Interviewee:</b> C5LGY 的？	<b>Interviewee:</b> The C5LGY one?
<b>Me:</b> 好，謝謝。那你幫我寫下一個單 (註：應為寫下那個代碼)。好，這樣就可以了。	<b>Me:</b> Okay, thank you. Can you help me write the next order (Note: Should be "write down that code"). Okay, that's it.

### 16.1.28 Transcript 2025-03-19 - Tainan (CJCU) - 1E9NE

**Source Files:** \* 2025-03-19 - Tainan (CJCU) - 1E9NE.json \* 2025-03-19 - Tainan (CJCU) - 1E9NE.txt

**Ziran ID Code:** 1E9NE

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我要問你，我可以錄一部分的對話嗎？	<b>Interviewer:</b> I want to ask you, can I record part of the conversation?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 可以。好的。那我稍微介紹一下，我是政光大學專業設計所的學生，然後這個是我的論文的一部分，一個環保的 app。那等一下你可以幫我測試這個 app 嗎？	<b>Interviewer:</b> Yes. Okay. Let me briefly introduce myself. I'm a student from the Professional Design Institute at Zheng Guang University, and this is part of my thesis, an environmental app. Can you help me test this app in a moment?
<b>Interviewee:</b> 可以可以。	<b>Interviewee:</b> Yes, yes.
<b>Interviewer:</b> 好的。那第一個問題是，你平常會網路上買東西嗎？	<b>Interviewer:</b> Okay. So the first question is, do you usually buy things online?
<b>Interviewee:</b> 平常嗎？ 網路上的，有時候會。	<b>Interviewee:</b> Usually? Online, sometimes I do.
<b>Interviewer:</b> 那你會...你使用什麼平臺呢？	<b>Interviewer:</b> Then you would... what platforms do you use?
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那有其他的平臺嗎？	<b>Interviewer:</b> Are there other platforms?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> momo 你有使用過嗎？	<b>Interviewer:</b> Have you used momo?
<b>Interviewee:</b> 有，只是沒有買過。	<b>Interviewee:</b> Yes, just haven't bought anything.
<b>Interviewer:</b> 那你最近有什麼想要買的嗎？	<b>Interviewer:</b> Is there anything you want to buy recently?
<b>Interviewee:</b> 最近嗎？ 手機。	<b>Interviewee:</b> Recently? Phone.
<b>Interviewer:</b> 那你可以幫我 momo 上找幾個商品？	<b>Interviewer:</b> Can you help me find some products on momo?
<b>Interviewee:</b> (Searches)	<b>Interviewee:</b> (Searches)
<b>Interviewer:</b> 那你可以幫我講出來一下，你去找什麼產品？	<b>Interviewer:</b> Can you tell me briefly, what product are you looking for?
<b>Interviewee:</b> 我在查 iPhone 13。	<b>Interviewee:</b> I'm searching for iPhone 13.
<b>Interviewer:</b> 好。那為什麼你想要買這個產品？	<b>Interviewer:</b> Okay. Why do you want to buy this product?
<b>Interviewee:</b> 因為我想要換手機，這次在看手機。	<b>Interviewee:</b> Because I want to change my phone, I'm looking at phones this time.
<b>Interviewer:</b> 好。那你可以幫我選一個嗎？	<b>Interviewer:</b> Okay. Can you choose one for me?
<b>Interviewee:</b> 選一個嗎？ 好。 那就...(Selects product)	<b>Interviewee:</b> Choose one? Okay. Then just... (Selects product)
<b>Interviewer:</b> 那你為什麼剛剛選這個呢？	<b>Interviewer:</b> Why did you choose this one just now?
<b>Interviewee:</b> 嗯...它看起來比較符合我想要的需求。	<b>Interviewee:</b> Um... it looks like it better fits the requirements I want.
<b>Interviewer:</b> 好。你之前有買過蘋果手機嗎？	<b>Interviewer:</b> Okay. Have you bought an Apple phone before?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那你覺得這個網頁上最重要的地方在哪裡？	<b>Interviewer:</b> Okay. What do you think is the most important part of this webpage?
<b>Interviewee:</b> 最重要的地方...它的圖、的文字和敘事...	<b>Interviewee:</b> The most important part... its pictures, the text and narrative...
<b>Interviewer:</b> 可以幫我講大聲一點？	<b>Interviewer:</b> Can you speak a bit louder for me?
<b>Interviewee:</b> 它圖的文字敘述很清晰。	<b>Interviewee:</b> The text description for its picture is very clear.
<b>Interviewer:</b> 好。那第二個重要的部分？	<b>Interviewer:</b> Okay. What's the second important part?
<b>Interviewee:</b> 第二個重要的部分...嗯...就是他的產品內容跟那個價格的部分寫得很清楚。	<b>Interviewee:</b> The second important part... um... is that its product content and the price section are written very clearly.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那第三個重要的？	<b>Interviewer:</b> Okay. What's the third important one?
<b>Interviewee:</b> 第三個重要的就是它的...它的購買選擇。	<b>Interviewee:</b> The third important one is its... its purchase options.
<b>Interviewer:</b> 好。還有這些銀行的配合。	<b>Interviewer:</b> Okay. And the cooperation with these banks.
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那，呃，剛剛這裡有什麼新的嗎？你之前沒有看過的嗎？	<b>Interviewer:</b> Then, uh, was there anything new here just now? Anything you haven't seen before?
<b>Interviewee:</b> 嗯...這個網頁上...	<b>Interviewee:</b> Um... on this webpage...
<b>Interviewer:</b> 有什麼新的地方嗎？新的部分你沒有看過嗎？	<b>Interviewer:</b> Is there anything new? A new section you haven't seen?
<b>Interviewee:</b> 之前沒有看過的嗎？應該是這個部分吧。	<b>Interviewee:</b> Something I haven't seen before? Probably this part.
<b>Interviewer:</b> 啊，這個黃色的部分？那你覺得這個部分是什麼？	<b>Interviewer:</b> Ah, this yellow section? What do you think this part is?
<b>Interviewee:</b> 這是一個...應該算是...比較...評價？這是一個簡易的比較，能清楚看到他的一些背景資訊。	<b>Interviewee:</b> This is a... probably considered... comparative... evaluation? This is a simple comparison, allowing one to clearly see some of its background information.
<b>Interviewer:</b> 好。那你剛剛按那個第三個部分是什麼？就是投資？	<b>Interviewer:</b> Okay. What was that third section you pressed just now? The investment one?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那你有投資過嗎？	<b>Interviewer:</b> Have you invested before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那對投資有興趣嗎？你有興趣投資嗎？	<b>Interviewer:</b> Are you interested in investing? Are you interested in investing?
<b>Interviewee:</b> 投資這個嗎？目前看起來還好。	<b>Interviewee:</b> Investing in this? Currently, it looks okay.
<b>Interviewer:</b> 那你覺得投資跟買東西有什麼關係嗎？還是完全不一樣的事情？	<b>Interviewer:</b> Do you think investing and buying things have any relationship? Or are they completely different things?
<b>Interviewee:</b> 應該是有部分關聯性。	<b>Interviewee:</b> There should be some partial correlation.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 就是代表他...這個能夠看出他的一些公司營運狀態，尤其這個產品本身，他的...就是第一個能夠看得出他這個公司的背景，他比較能夠信任這個產品。那在它的一些後端服務呢，也比較能夠放心，對消費者來說。	<b>Interviewee:</b> It represents... this can show some of the company's operational status, especially the product itself, its... like the first one can show the background of this company, making one trust this product more. Then regarding its backend services, one can also feel more assured, for consumers.
<b>Interviewer:</b> 那如果你喜歡這個產品，你會比較想要投資這個公司嗎？	<b>Interviewer:</b> If you like this product, would you be more inclined to invest in this company?
<b>Interviewee:</b> 欸，應該...應該是會。	<b>Interviewee:</b> Eh, probably... probably yes.
<b>Interviewer:</b> 那你幫我回那個剛剛你第二個部分？那個...第二個部分？	<b>Interviewer:</b> Can you help me go back to that second section from just now? That... the second section?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那這個是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 就是它是...它的標題是儲蓄。嗯。	<b>Interviewee:</b> It's... its title is Savings. Um.
<b>Interviewer:</b> 那這些是...	<b>Interviewer:</b> Then these are...
<b>Interviewee:</b> 就是它說...它就跟我說我能夠購買這個產品能夠降低對環境的影響多少，那可以救多少自然。	<b>Interviewee:</b> It says... it tells me how much buying this product can reduce the impact on the environment, and how much nature it can save.
<b>Interviewer:</b> 好。那這裡好像有這些其他的事情，是什麼？	<b>Interviewer:</b> Okay. It seems there are these other things here, what are they?
<b>Interviewee:</b> 就是它可以解釋說它的產品可以回收的程度到哪裡，然後它主打的設計能夠讓它的壽命長度變多少，還有包含電池的浪費，還有它電源的設計那些，還有包含它的隱私跟環保的部分。	<b>Interviewee:</b> It explains the recyclability level of its product, how its highlighted design can affect its lifespan, also including battery waste, its power supply design, and also including its privacy and environmental aspects.
<b>Interviewer:</b> 那這些品牌你之前有看過嗎？	<b>Interviewer:</b> Have you seen these brands before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 好。那你會關心環保嗎？	<b>Interviewer:</b> Okay. Do you care about environmental protection?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那如果蘋果手機不環保，你會考慮其他的嗎？還是還好？	<b>Interviewer:</b> Then if Apple phones weren't environmentally friendly, would you consider others? Or is it okay?
<b>Interviewee:</b> 蘋果手機不環保的話...應該是可以研究一下。	<b>Interviewee:</b> If Apple phones aren't environmentally friendly... I should probably research it a bit.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。你幫我回那個第一個部分？第一個部分？對。那下面一點...嗯，你覺得這裡的最重要的地方在哪裡？	<b>Interviewer:</b> Okay. Help me go back to the first section? The first section? Yes. Then down a bit... um, where do you think the most important part is here?
<b>Interviewee:</b> 最重要的地方是...哈頓堂？應該是...哈頓堂？好，ESG 的評分。	<b>Interviewee:</b> The most important place is... Hutton...? Probably... Hutton? Okay, the ESG rating.
<b>Interviewer:</b> ESG 是什麼意思？	<b>Interviewer:</b> What does ESG mean?
<b>Interviewee:</b> E...	<b>Interviewee:</b> E...
<b>Interviewer:</b> SG 就是那個...那個那個永續環保的那個一個評鑑。	<b>Interviewer:</b> SG is that... that that sustainability and environmental protection evaluation standard.
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那下面一點有兩個按鈕，你想按一個嗎？	<b>Interviewer:</b> Then down a bit there are two buttons, do you want to press one?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 按一個。	<b>Interviewer:</b> Press one.
<b>Interviewee:</b> (Clicks button)	<b>Interviewee:</b> (Clicks button)
<b>Interviewer:</b> 你按哪一個？	<b>Interviewer:</b> Which one did you press?
<b>Interviewee:</b> 選擇產地狀況。	<b>Interviewee:</b> Choose origin status.
<b>Interviewer:</b> 好。那他跟你說什麼？	<b>Interviewer:</b> Okay. What did it tell you?
<b>Interviewee:</b> 他告訴我這個產品的來源地。	<b>Interviewee:</b> It told me the origin of this product.
<b>Interviewer:</b> 好。那你覺得這個重要嗎？	<b>Interviewer:</b> Okay. Do you think this is important?
<b>Interviewee:</b> 重要。	<b>Interviewee:</b> Important.
<b>Interviewer:</b> 其他這個嗎？這個算蠻重要的。	<b>Interviewer:</b> Other than this? This is considered quite important.
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 那你有其他的問題你想要問他嗎？直接打字還是可以按這些按鈕？	<b>Interviewer:</b> Do you have other questions you want to ask it? Type directly or you can press these buttons?
<b>Interviewee:</b> 都可以？那我按這個：購物、儲蓄跟投資有什麼可以持續的觀念？好。	<b>Interviewee:</b> Both are okay? Then I'll press this one: Shopping, savings, and investment, what sustainable concepts are there? Okay.
<b>Interviewer:</b> 他說什麼？	<b>Interviewer:</b> What does it say?
<b>Interviewee:</b> 他說儲蓄、儲蓄、投資這些東西可以從購買的話，可以從購買持續性品牌和產品，減少對環境的影響。對，能夠讓...社會責任...能夠支持有社會責任的公司。	<b>Interviewee:</b> It says savings, savings, investment, these things, regarding purchasing, one can buy sustainable brands and products to reduce environmental impact. Yes, enabling... social responsibility... supporting companies with social responsibility.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 不用想出來，大致講他的...你覺得有什麼有用的，有用的內容嗎？	<b>Interviewer:</b> No need to think it out fully, just roughly say its... do you think there's anything useful, useful content?
<b>Interviewee:</b> 他能夠讓我們了解說，選擇...購買選擇的時候要注意哪些部分。	<b>Interviewee:</b> It allows us to understand, when choosing... making purchase choices, which parts to pay attention to.
<b>Interviewer:</b> 好的。那你自己有什麼問題想要問嗎？	<b>Interviewer:</b> Okay. Do you yourself have any questions you want to ask?
<b>Interviewee:</b> 自己嗎？ 應該是目前是沒有。	<b>Interviewee:</b> Myself? Probably not at the moment.
<b>Interviewer:</b> 好。那幫我回那個 momo 那邊。那上面一點一個綠色的號碼，你可以幫我寫在卡片上嗎？	<b>Interviewer:</b> Okay. Then help me go back to the momo page. Then up a bit, there's a green number, can you help me write it on the card?
<b>Interviewee:</b> 綠色...呃...這個？ 這個代碼？ 喔...1E9NE。	<b>Interviewee:</b> Green... uh... this one? This code? Oh... 1E9NE.
<b>Interviewer:</b> 好。那你可以...好後面可以寫，它是這個編碼喔。對。好好。那幫我講出來這個代碼。	<b>Interviewer:</b> Okay. Then you can... okay, you can write it later, it's this code. Yes. Okay okay. Then help me say this code out loud.
<b>Interviewee:</b> 1E9NE。	<b>Interviewee:</b> 1E9NE.
<b>Interviewer:</b> 好的。1E9NE。可以了。	<b>Interviewer:</b> Okay. 1E9NE. That's fine.

### 16.1.29 Transcript 2025-03-19 - Tainan (CJCU) - 62WEN

**Source Files:** \* 2025-03-19 - Tainan (CJCU) - 62WEN.json \* 2025-03-19 - Tainan (CJCU) - 62WEN.txt

**Ziran ID Code:** 62WEN

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 要問你，我可以錄你們對話嗎？	<b>Interviewer:</b> I want to ask you, can I record your conversation?
<b>Interviewee:</b> 可以可以可以。	<b>Interviewee:</b> Yes, yes, yes.
<b>Interviewer:</b> 好的。那我介紹一下，我是長榮大學創意設計所的學生，然後這個是我的論文的一部分，一個環保的 App。	<b>Interviewer:</b> Okay. Let me introduce myself. I'm a student from the Institute of Creative Design at Chang Jung Christian University, and this is part of my thesis, an environmental App.
<b>Interviewer:</b> 好，好。等一下你可以幫我測試這個 TV 嗎？	<b>Interviewer:</b> Okay, okay. Can you help me test this TV [App intended] in a moment?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> OK。	<b>Interviewee:</b> OK.
<b>Interviewer:</b> 好。那第一個，你平常會網路上看東西？	<b>Interviewer:</b> Okay. So the first one, do you usually look at things online?
<b>Interviewee:</b> 嗯，看東西。	<b>Interviewee:</b> Um, look at things.
<b>Interviewer:</b> 那如果你買東西，你平常會用什麼平台？ 喔。	<b>Interviewer:</b> Then if you buy things, what platform do you usually use? Oh.
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 蝦皮。好。那其他的你有用過嗎？	<b>Interviewer:</b> Shopee. Okay. Have you used others?
<b>Interviewee:</b> 可能會在那個搜尋引擎上面找找東西，然後他可能跳了前幾個連結我都會點一次。	<b>Interviewee:</b> Maybe I'll search for things on that search engine, and then if it pops up the first few links, I'll click them once.
<b>Interviewer:</b> 好。那 momo 你有用過嗎？	<b>Interviewer:</b> Okay. Have you used momo?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那 momo 上你有買過什麼類似的東西？	<b>Interviewer:</b> Then on momo, have you bought anything similar?
<b>Interviewee:</b> 吹風機吧，還是什麼的。	<b>Interviewee:</b> A hairdryer, perhaps, or something like that.
<b>Interviewer:</b> 好。那你目前有什麼產品你要買嗎？	<b>Interviewer:</b> Okay. Is there any product you want to buy right now?
<b>Interviewee:</b> 最近喔？ 可能離子夾嗎？ 夾頭髮的。	<b>Interviewee:</b> Recently? Oh? Maybe a hair straightener? The kind for clamping hair.
<b>Interviewer:</b> 好。那你覺得 momo 上可以找得到嗎？	<b>Interviewer:</b> Okay. Do you think you can find it on momo?
<b>Interviewee:</b> 可以吧？	<b>Interviewee:</b> Probably?
<b>Interviewer:</b> 可以啊。好。那你可以幫我打字。	<b>Interviewer:</b> Yes, you can. Okay. Can you help me type?
<b>Interviewee:</b> 啊...你這個要怎樣打...你要那個注音嗎？ �恩...好...加油...	<b>Interviewee:</b> Ah... how do I type this... Do you need Zhuyin input? Um... Okay... Jia you [add oil/keep going]...
<b>Interviewee:</b> (Types) 這麼深是怎樣？ 嘴喎。我看一下喔...欸欸，我不會打字，在哪裡？	<b>Interviewee:</b> (Types) Why is it so deep [referring to nested menus/search results]? Ouch. Let me see... eh eh, I can't type, where is it?
<b>Interviewer:</b> 你想要打什麼字？	<b>Interviewer:</b> What character do you want to type?
<b>Interviewee:</b> 離子...離...離...	<b>Interviewee:</b> Li zi [Ion]... li... li...
<b>Interviewer:</b> 有找得到你想要的這種的嗎？	<b>Interviewer:</b> Did you find the type you were looking for?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那你可以幫我選一個？ 選一種？ �恩。	<b>Interviewer:</b> Can you help me choose one? Choose a type? Um.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 你是考慮哪一個？可能有優惠的會看，然後有牌子的也會看。好，先看這個，好了。	<b>Interviewee:</b> Which one are you considering? Maybe I'll look at ones with discounts, and also look at branded ones. Okay, look at this one first, done.
<b>Interviewer:</b> 為什麼你選這個呢？	<b>Interviewer:</b> Why did you choose this one?
<b>Interviewee:</b> 它上面寫日本熱銷第一名。	<b>Interviewee:</b> It says "Japan's No. 1 Bestseller" on it.
<b>Interviewer:</b> 好，這裡啊？「日本熱銷第一名」感覺很厲害。那你有用過這個品牌嗎？	<b>Interviewer:</b> Okay, here? "Japan's No. 1 Bestseller" sounds impressive. Have you used this brand?
<b>Interviewee:</b> 我看過。	<b>Interviewee:</b> I've seen it.
<b>Interviewer:</b> 看過。嗯。那這個網頁上最重要的點在哪？	<b>Interviewer:</b> Seen it. Um. Then what's the most important point on this webpage?
<b>Interviewee:</b> 最重要的地方...嗯...圖片。	<b>Interviewee:</b> The most important part... um... pictures.
<b>Interviewer:</b> 圖片。那第二個呢？	<b>Interviewer:</b> Pictures. What's the second?
<b>Interviewee:</b> 第二個...我要先看到圖片，然後才會來看這個字。	<b>Interviewee:</b> Second... I need to see the picture first, then I'll come to look at the text.
<b>Interviewer:</b> 嗯。那第三個最重要的點？	<b>Interviewer:</b> Um. Then the third most important point?
<b>Interviewee:</b> 留言。	<b>Interviewee:</b> Comments [Reviews].
<b>Interviewer:</b> 好。那你會看評論？	<b>Interviewer:</b> Okay. So you look at reviews?
<b>Interviewee:</b> 還是...評論會看。	<b>Interviewee:</b> Or... reviews, I do look.
<b>Interviewer:</b> 評論。嗯。好。那這裡剛剛有什麼新的嗎？之前在 momo 上沒有看過的嗎？	<b>Interviewer:</b> Reviews. Um. Okay. Was there anything new here just now? Anything you haven't seen on momo before?
<b>Interviewee:</b> 什麼新的...嗯...不知道耶，我沒有注意。	<b>Interviewee:</b> Anything new... um... don't know, I didn't notice.
<b>Interviewer:</b> 嗯。那這個黃色的部分呢？這是什麼？你覺得呢？	<b>Interviewer:</b> Um. What about this yellow section? What is this? What do you think?
<b>Interviewee:</b> 這是什麼...廣告嗎？	<b>Interviewee:</b> What is this... an ad?
<b>Interviewer:</b> 不是呢。	<b>Interviewer:</b> No.
<b>Interviewee:</b> 嘿？這是它的...它的品牌的 一些環保的資訊？	<b>Interviewee:</b> Eh? Is this its... its brand's environmental information?
<b>Interviewer:</b> 這是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 就表示他的社會責任不是很 高，優質這樣子嗎？環保的意識不是很 高？這家公司？	<b>Interviewee:</b> Does it mean its social responsibility isn't very high? Good quality like this? Environmental awareness isn't very high? This company?
<b>Interviewer:</b> 這個會影響你嗎？	<b>Interviewer:</b> Would this affect you?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這個...可能...這個應該會。我應該會想要去...就是因為也不是一定要選他，所以我可以選...呃...整體分數可以比較高的。因為我也不是說一定要買他，那如果他的這個分數比較低的話，那我可能會選其他分數比較高的。	<b>Interviewee:</b> This... maybe... this probably would. I'd probably want to... because it's not like I absolutely have to choose it, so I can choose... uh... one with a higher overall score. Because it's not like I have to buy it either, so if its score is lower, then I might choose others with higher scores.
<b>Interviewer:</b> 好。那，呃，這裡有兩個按鈕，你想要按一個嗎？	<b>Interviewer:</b> Okay. Then, uh, there are two buttons here, do you want to press one?
<b>Interviewee:</b> 嗯。(Clicks) 尋找替代的。	<b>Interviewee:</b> Um. (Clicks) Find Alternatives.
<b>Interviewer:</b> 好。然後他跟你說什麼？	<b>Interviewer:</b> Okay. What does it tell you?
<b>Interviewee:</b> 哦，快時尚。聽說人家不是很建議買快時尚的產品，這樣是嗎？	<b>Interviewee:</b> Oh, fast fashion. I heard people don't really recommend buying fast fashion products, is that right?
<b>Interviewer:</b> 那你覺得這個系列有用嗎？	<b>Interviewer:</b> Do you think this series [feature/information] is useful?
<b>Interviewee:</b> 有，有用。他還推薦我一些品牌。	<b>Interviewee:</b> Yes, useful. It also recommended some brands to me.
<b>Interviewer:</b> 哟。這些其他的品牌你知道嗎？ 有買過嗎？	<b>Interviewer:</b> Oh. Do you know these other brands? Have you bought them?
<b>Interviewee:</b> 有，UNIQLO 應該是UNIQLO 的意思。	<b>Interviewee:</b> Yes, UNIQLO should mean UNIQLO.
<b>Interviewer:</b> 哟。	<b>Interviewer:</b> Oh.
<b>Interviewee:</b> (Points) U N I Q L O 。	<b>Interviewee:</b> (Points) U N I Q L O .
<b>Interviewer:</b> 好。那你有什麼問題想要問他嗎？ 你可以直接打字，還是可以按...直接按嗎？	<b>Interviewer:</b> Okay. Do you have any questions you want to ask it? You can type directly, or you can press... press directly?
<b>Interviewee:</b> 可以啊。好。我想要問他，我要怎麼接受亂買？	<b>Interviewee:</b> Yes. Okay. I want to ask it, how do I accept [stop intended] impulse buying.
<b>Interviewer:</b> 啊？ 你剛剛有按嗎？	<b>Interviewer:</b> Ah? Did you press it just now?
<b>Interviewee:</b> 沒有，我還沒有按。	<b>Interviewee:</b> No, I haven't pressed it yet.
<b>Interviewer:</b> 那你按。	<b>Interviewer:</b> Then press it.
<b>Interviewee:</b> (Clicks button)	<b>Interviewee:</b> (Clicks button)
<b>Interviewer:</b> 好。我按了。你剛剛問什麼？	<b>Interviewer:</b> Okay. I pressed it. What did you just ask?
<b>Interviewee:</b> 我怎麼減少亂買。	<b>Interviewee:</b> How do I reduce impulse buying.
<b>Interviewer:</b> 好。那你覺得跟你說的內容有什麼有用的嗎？	<b>Interviewer:</b> Okay. Do you think the content it told you is useful in any way?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 呃...我覺得可能制定購物清單，就是...我有時候會看一看，然後就很想要，但是其實也不是那麼想要，就是腦波太弱了，看到廣告很吸引人就想要買。那制定購物清單就可以讓我三思而後行。	<b>Interviewee:</b> Uh... I think maybe making a shopping list, because... sometimes I look around, and then I really want something, but actually I don't want it that much, just my brain waves are too weak, I see an attractive ad and want to buy. So making a shopping list can make me think twice before acting.
<b>Interviewer:</b> 好。那你還有什麼其他的問題想問他嗎？	<b>Interviewer:</b> Okay. Do you have any other questions you want to ask it?
<b>Interviewee:</b> 在下面的嗎？	<b>Interviewee:</b> The ones below?
<b>Interviewer:</b> 你要...可以可以在其他車...也可以什麼都可以玩。	<b>Interviewer:</b> You want... yes, you can in other car... can also play anything. [likely misinterpreting user]
<b>Interviewee:</b> 如果沒有也沒問題。	<b>Interviewee:</b> If not, that's okay too.
<b>Interviewer:</b> 啊，我沒有耶。	<b>Interviewer:</b> Ah, I don't.
<b>Interviewer:</b> 好。那你幫我換一下 momo 那邊？ 啊，最最上面？ 還有上面一點？ 還有兩個部分可以幫我開...第二個？ 儲蓄？ 你覺得這個是什麼？	<b>Interviewer:</b> Okay. Can you help me switch back to the momo page? Ah, the very very top? Also up a bit? There are two more sections, can you help me open... the second one? Savings? What do you think this is?
<b>Interviewee:</b> 嗯。儲蓄？ 這個什麼意思？	<b>Interviewee:</b> Um. Savings? What does this mean?
<b>Interviewer:</b> 是透過買環保的產品來降低對環境的影響，這樣嗎？ 呃，你覺得嗎？	<b>Interviewer:</b> Is it about reducing environmental impact by buying eco-friendly products, like that? Uh, do you think so?
<b>Interviewee:</b> (Looks closely) 為什麼會有這些其他的品牌？ 這是他推薦的嗎？	<b>Interviewee:</b> (Looks closely) Why are there these other brands? Are these its recommendations?
<b>Interviewer:</b> 這是他推薦的品牌嗎？	<b>Interviewer:</b> Are these brands it recommended?
<b>Interviewee:</b> 如果你是這樣覺得，可以。哦呵呵，應該是他推薦的品牌。	<b>Interviewee:</b> If you think so, yes. Oh haha, they should be brands it recommended.
<b>Interviewer:</b> 好。那為什麼他會推薦這些品牌？	<b>Interviewer:</b> Okay. Why would it recommend these brands?
<b>Interviewee:</b> 因為他的...他的那些減...呃...製造出來的產品比 Giordano 還要好？是這樣嗎？	<b>Interviewee:</b> Because its... its those reduc... uh... the products manufactured are better than Giordano's? Is that it?
<b>Interviewer:</b> 好。那這些品牌你有看過嗎？	<b>Interviewer:</b> Okay. Have you seen these brands?
<b>Interviewee:</b> 沒有呢，也都沒有看過。所以我一開始不知道它是品牌。	<b>Interviewee:</b> No, haven't seen any of them. That's why I didn't know they were brands at first.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> OK。那你幫我看第三個部分？ 這個是什麼呢？	<b>Interviewer:</b> OK. Can you help me look at the third section? What is this?
<b>Interviewee:</b> 你可以追蹤你購買過的其他...喔，投資他們喔！ 他在推薦我要可以投資哪些環保企業，這樣嗎？	<b>Interviewee:</b> You can track other... oh, invest in them! Is it recommending which environmental companies I can invest in, like that?
<b>Interviewer:</b> 你最近有投資過嗎？	<b>Interviewer:</b> Have you invested recently?
<b>Interviewee:</b> 沒有沒有。	<b>Interviewee:</b> No, no.
<b>Interviewer:</b> 沒有投資？ 你沒有買過股票？	<b>Interviewer:</b> No investment? You haven't bought stocks?
<b>Interviewee:</b> 沒有，還沒有。	<b>Interviewee:</b> No, not yet.
<b>Interviewer:</b> 那你有興趣嗎？ 投資？	<b>Interviewer:</b> Are you interested? Investing?
<b>Interviewee:</b> (Looks) 推薦投資他嗎？ 可是他不是不好嗎？ 所以我應該不會想投資他。	<b>Interviewee:</b> (Looks) Recommend investing in it? But isn't it bad? So I probably wouldn't want to invest in it.
<b>Interviewer:</b> 所以你覺得賣東西跟投資有什麼關係嗎？ 還是是完全不一樣的？	<b>Interviewer:</b> So do you think selling things and investing have any relationship? Or are they completely different?
<b>Interviewee:</b> 會有關係。就是...應該說投資會...就是等於是給那間公司更多的支持，不是嗎？ 對我來說解釋是這樣子。	<b>Interviewee:</b> There would be a relationship. Just... should say investing would... just means giving that company more support, doesn't it? To me, the explanation is like that.
<b>Interviewer:</b> 所以如果今天那個公司，它是不優的，那它當然就不要去投資它了。	<b>Interviewer:</b> So if today that company, it's not good, then of course one shouldn't invest in it.
<b>Interviewee:</b> 所以如果它的商品很好，你比較會想要投資嗎？	<b>Interviewee:</b> So if its products are very good, you'd be more inclined to invest?
<b>Interviewer:</b> 對對對。哦...就是支持他們。對，支持他們。對對對。	<b>Interviewer:</b> Yes yes yes. Oh... just supporting them. Yes, supporting them. Yes yes yes.
<b>Interviewee:</b> 好的。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 好。那那個卡片上可以幫我寫這個綠色的號碼？ 後面...	<b>Interviewer:</b> Okay. Then on the card, can you help me write this green number? Later...
<b>Interviewee:</b> 9J 的那個嗎？	<b>Interviewee:</b> The 9J one?
<b>Interviewer:</b> 對對對。好。那可以幫我講出來？	<b>Interviewer:</b> Yes yes yes. Okay. Can you help me say it out loud?
<b>Interviewee:</b> 9J97Q。	<b>Interviewee:</b> 9J97Q.

**Interviewer:** 好的。那這樣就可以了。好。然後卡片上也上了QR。這個嗎？所以是要填這個？而且我現在泳裝也不太好，我只有泳帽。對對對。

**Interviewer:** Okay. Then that's fine. Okay. And on the card, there's also a QR code. This one? So I need to fill this out? And my swimsuit isn't great right now, I only have a swim cap. Yes yes yes. [Seems like off-topic chat at the end]

### 16.1.30 Transcript 2025-03-19 - Tainan (CJCU) - 9J97Q

**Source Files:** \* 2025-03-19 - Tainan (CJCU) - 9J97Q.json \* 2025-03-19 - Tainan (CJCU) - 9J97Q.txt

**Ziran ID Code:** 9J97Q

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 首先我要問你，我可以錄影我們的對話嗎？	<b>Interviewer:</b> First, I want to ask you, can I record our conversation?
<b>Interviewee:</b> 嗯嗯。可以。	<b>Interviewee:</b> Mhm. Yes.
<b>Interviewer:</b> 好。那可以大聲一點講，哈？因為這裡有很多人。	<b>Interviewer:</b> Okay. Can you speak a bit louder, ha? Because there are many people here.
<b>Interviewee:</b> 我要對著他嗎？	<b>Interviewee:</b> Do I need to face it?
<b>Interviewer:</b> 這樣可以吧。好。那第一個問題是，你平常會...你平常會網路上買東西嗎？	<b>Interviewer:</b> This should be fine. Okay. So the first question is, do you usually... do you usually buy things online?
<b>Interviewee:</b> 很常。	<b>Interviewee:</b> Very often.
<b>Interviewer:</b> 很常。那你通常使用什麼品牌呢？	<b>Interviewer:</b> Very often. What platforms [brands intended] do you usually use?
<b>Interviewee:</b> 蝦皮比較多。	<b>Interviewee:</b> Mostly Shopee.
<b>Interviewer:</b> 那其他的有用過嗎？	<b>Interviewer:</b> Have you used others?
<b>Interviewee:</b> momo 偶爾，不常。	<b>Interviewee:</b> momo occasionally, not often.
<b>Interviewer:</b> 嗯。好，不好意思。那如果你買東西，你喜歡買什麼樣的東西？	<b>Interviewer:</b> Um. Okay, excuse me. If you buy things, what kind of things do you like to buy?
<b>Interviewee:</b> 衣服，衣服比較多，還有飾品那種類型。	<b>Interviewee:</b> Clothes, mostly clothes, and also accessories, that type of thing.
<b>Interviewer:</b> momo 也有買過衣服嗎？	<b>Interviewer:</b> Have you bought clothes on momo too?
<b>Interviewee:</b> momo 是買那種小傢具那種。	<b>Interviewee:</b> On momo, I buy small furniture, that kind of thing.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好的。那你目前有什麼東西想要買嗎？	<b>Interviewer:</b> Okay. Is there anything you want to buy right now?
<b>Interviewee:</b> 螢幕上的嗎？	<b>Interviewee:</b> On the screen?
<b>Interviewer:</b> 對。momo。	<b>Interviewer:</b> Yes. momo.
<b>Interviewee:</b> 這個應該也是看...我比較喜歡買衣服，在網路上買。	<b>Interviewee:</b> This probably also depends... I prefer buying clothes, buying online.
<b>Interviewer:</b> 好。那你可以幫我找一個你想買的商品嗎？	<b>Interviewer:</b> Okay. Can you help me find a product you want to buy?
<b>Interviewee:</b> 好啊。(Searches)	<b>Interviewee:</b> Okay. (Searches)
<b>Interviewer:</b> (Waits) 還沒有注意，呵呵。	<b>Interviewer:</b> (Waits) Haven't noticed yet, hehe.
<b>Interviewee:</b> 啊...這個是注意...欸...哦...哦...等一下。隨便找一個嗎？	<b>Interviewee:</b> Ah... this is note... eh... oh... oh... wait a moment. Just pick one randomly?
<b>Interviewer:</b> 可以啊。	<b>Interviewer:</b> Yes, you can.
<b>Interviewee:</b> (Selects product)	<b>Interviewee:</b> (Selects product)
<b>Interviewer:</b> 那但是你先幫我講出來，你在找什麼？	<b>Interviewer:</b> But first, help me say it out loud, what are you looking for?
<b>Interviewee:</b> 外套。	<b>Interviewee:</b> Jacket.
<b>Interviewer:</b> 外套，好。那你之前在網路上有買過外套嗎？	<b>Interviewer:</b> Jacket, okay. Have you bought jackets online before?
<b>Interviewee:</b> 有。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那你有什麼特別喜歡的品牌嗎？	<b>Interviewer:</b> Okay. Do you have any particularly favorite brands?
<b>Interviewee:</b> 沒有呢，我都是看好看就買。	<b>Interviewee:</b> Not really, I usually buy whatever looks good.
<b>Interviewer:</b> 好。那這裡有什麼你喜歡的嗎？	<b>Interviewer:</b> Okay. Is there anything here you like?
<b>Interviewee:</b> 這裡有...應該會想要選一個羽絨吧。	<b>Interviewee:</b> Here has... I'd probably want to choose a down jacket.
<b>Interviewer:</b> 好。Giordano 的那個？	<b>Interviewer:</b> Okay. The Giordano one?
<b>Interviewee:</b> 我要點進去嗎？	<b>Interviewee:</b> Should I click into it?
<b>Interviewer:</b> 對。你剛剛選哪一個品牌？	<b>Interviewer:</b> Yes. Which brand did you just choose?
<b>Interviewee:</b> 這個。	<b>Interviewee:</b> This one.
<b>Interviewer:</b> 為什麼這個？	<b>Interviewer:</b> Why this one?
<b>Interviewee:</b> 因為...因為知名的，然後他的品質應該也是有保障的。	<b>Interviewee:</b> Because... because it's well-known, and its quality should also be guaranteed.
<b>Interviewer:</b> 好。但是那個...這個品牌你有買過嗎？	<b>Interviewer:</b> Okay. But that... have you bought this brand before?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 好。那你關於這個品牌有什麼想法嗎？	<b>Interviewer:</b> Okay. Do you have any thoughts about this brand?
<b>Interviewee:</b> 對這個品牌嗎？ 嗯..沒。嗯...都感覺是媽媽類型會買的，不像年輕人會買的。	<b>Interviewee:</b> About this brand? Um.. no. Um... it feels like the type mothers would buy, not like what young people would buy.
<b>Interviewer:</b> 哦。那但是你喜歡嗎？	<b>Interviewer:</b> Oh. But do you like it?
<b>Interviewee:</b> 對對對。我喜歡，但是沒買過。	<b>Interviewee:</b> Yes yes yes. I like it, but haven't bought it.
<b>Interviewer:</b> 那你覺得這個網頁上對你來說有什麼重要的嗎？ 這個最重要的地方在哪裡？	<b>Interviewer:</b> Then on this webpage, is there anything important to you? Where is the most important part?
<b>Interviewee:</b> 什麼意思？	<b>Interviewee:</b> What do you mean?
<b>Interviewer:</b> 最重要？ 就是你會特別注意到就是什麼？	<b>Interviewer:</b> Most important? Like, what would you specifically notice?
<b>Interviewee:</b> 哟...價錢。	<b>Interviewee:</b> Oh... price.
<b>Interviewer:</b> 價錢。好。然後？	<b>Interviewer:</b> Price. Okay. And then?
<b>Interviewee:</b> 跟它的款式。	<b>Interviewee:</b> And its style.
<b>Interviewer:</b> 好。還有？	<b>Interviewer:</b> Okay. Anything else?
<b>Interviewee:</b> 還有顏色之類的。	<b>Interviewee:</b> And color, things like that.
<b>Interviewer:</b> 好。還有其他的嗎？	<b>Interviewer:</b> Okay. Are there others?
<b>Interviewee:</b> 噛...還有評論。	<b>Interviewee:</b> Um... and reviews.
<b>Interviewer:</b> 它有評論嗎？ 這個...	<b>Interviewer:</b> Does it have reviews? This one...
<b>Interviewee:</b> 我可以看評論？ 好像沒有。	<b>Interviewee:</b> Can I see reviews? Seems like no.
<b>Interviewer:</b> 好像有？ 有有？	<b>Interviewer:</b> Seems like yes? Yes yes?
<b>Interviewee:</b> 哟，有有有。就是價錢跟款式跟評論。	<b>Interviewee:</b> Oh, yes yes yes. So price, style, and reviews.
<b>Interviewer:</b> 好。還有？	<b>Interviewer:</b> Okay. Also?
<b>Interviewee:</b> 規格啦。我會看它的 size，有沒有我的 size。	<b>Interviewee:</b> Specifications. I'll look at its size, whether my size is available.
<b>Interviewer:</b> 哟。好。那最上面剛剛你有看到什麼新的嗎？ 之前有看過的嗎？	<b>Interviewer:</b> Oh. Okay. At the very top just now, did you see anything new? Anything you've seen before?
<b>Interviewee:</b> 新的...嗯嗯嗯...有嗎？ 沒有新的。	<b>Interviewee:</b> New... mhm mhm... is there? Nothing new.
<b>Interviewer:</b> 沒有這麼多。好。那這個黃色的部分呢？ 這是什麼？ 你覺得呢？	<b>Interviewer:</b> Not that much. Okay. What about this yellow section? What is this? What do you think?
<b>Interviewee:</b> 這是什麼...廣告嗎？	<b>Interviewee:</b> What is this... an advertisement?
<b>Interviewer:</b> 不是呢。	<b>Interviewer:</b> No.

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 噢？ 這是它的...它的品牌的 一些環保的資訊？	<b>Interviewee:</b> Eh? Is this its... its brand's environmental information?
<b>Interviewer:</b> 這是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 就表示他的社會責任不是很 高？ 優質這樣子嗎？ 環保的意識不是很 高？ 這家公司？	<b>Interviewee:</b> Does it mean its social responsibility isn't very high? Good quality like this? Environmental awareness isn't very high? This company?
<b>Interviewer:</b> 這個會影響你嗎？	<b>Interviewer:</b> Would this affect you?
<b>Interviewee:</b> 這個...可能...這個應該會。 我應該會想要去...就是因為也不是一定要 選他，所以我可以選...呃...整體分數可以 比較高的。因為我也不是說一定要買他，那 如果他的這個分數比較低的話，那我可能 會選其他分數比較高的。	<b>Interviewee:</b> This... maybe... this probably would. I'd probably want to... because it's not like I absolutely have to choose it, so I can choose... uh... one with a higher overall score. Because it's not like I have to buy it either, so if its score is lower, then I might choose others with higher scores.
<b>Interviewer:</b> 好。那，呃，這裡有兩個按 鈕，你想要按一個嗎？	<b>Interviewer:</b> Okay. Then, uh, there are two buttons here, do you want to press one?
<b>Interviewee:</b> 嗯。(Clicks) 尋找替代的。	<b>Interviewee:</b> Um. (Clicks) Find Alternatives.
<b>Interviewer:</b> 好。然後他跟你說什麼？	<b>Interviewer:</b> Okay. What does it tell you?
<b>Interviewee:</b> 哦，快時尚，聽說人家不是很 建議買快時尚的產品，這樣是嗎？	<b>Interviewee:</b> Oh, fast fashion. I heard people don't really recommend buying fast fashion products, is that right?
<b>Interviewer:</b> 那你覺得這個系列有用嗎？	<b>Interviewer:</b> Do you think this series [feature/information] is useful?
<b>Interviewee:</b> 有，有用。他還推薦我一些 品牌。	<b>Interviewee:</b> Yes, useful. It also recommended some brands to me.
<b>Interviewer:</b> 哟。這些其他的品牌你知道 嗎？ 有買過嗎？	<b>Interviewer:</b> Oh. Do you know these other brands? Have you bought them?
<b>Interviewee:</b> 有，UNIQLO 應該是 UNIQLO 的意思。	<b>Interviewee:</b> Yes, UNIQLO should mean UNIQLO.
<b>Interviewer:</b> 哟。	<b>Interviewer:</b> Oh.
<b>Interviewee:</b> (Points) U N I Q L O 。	<b>Interviewee:</b> (Points) U N I Q L O .
<b>Interviewer:</b> 好。那你有什麼問題想要問他 嗎？ 你可以直接打字，還是可以按...直接 按嗎？	<b>Interviewer:</b> Okay. Do you have any questions you want to ask it? You can type directly, or you can press... press directly?
<b>Interviewee:</b> 可以啊。好。我想要問他，我 要怎麼接受亂買。	<b>Interviewee:</b> Yes. Okay. I want to ask it, how do I accept [stop intended] impulse buying.
<b>Interviewer:</b> 啊？ 你剛剛有按嗎？	<b>Interviewer:</b> Ah? Did you press it just now?
<b>Interviewee:</b> 沒有，我還沒有按。	<b>Interviewee:</b> No, I haven't pressed it yet.
<b>Interviewer:</b> 那你按。好。	<b>Interviewer:</b> Then press it. Okay.
<b>Interviewee:</b> (Clicks button) 我愛你。	<b>Interviewee:</b> (Clicks button) I love you. [likely misinterpretation or playful interaction with AI]

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 你剛剛問什麼？	<b>Interviewer:</b> What did you just ask?
<b>Interviewee:</b> 我怎麼減少亂買。	<b>Interviewee:</b> How do I reduce impulse buying.
<b>Interviewer:</b> 好。那你覺得跟你說的內容有什麼有用的嗎？	<b>Interviewer:</b> Okay. Do you think the content it told you is useful in any way?
<b>Interviewee:</b> 呃...我覺得可能制定購物清單，就是...我有時候會看一看，然後就很想要，但是其實也不是那麼想要，就是腦波太弱了，看到廣告很吸引人就想要買。那制定購物清單就可以讓我三思而後行。	<b>Interviewee:</b> Uh... I think maybe making a shopping list, because... sometimes I look around, and then I really want something, but actually I don't want it that much, just my brain waves are too weak, I see an attractive ad and want to buy. So making a shopping list can make me think twice before acting.
<b>Interviewer:</b> 好。那你還有什麼其他的問題想問他嗎？	<b>Interviewer:</b> Okay. Do you have any other questions you want to ask it?
<b>Interviewee:</b> 在下面的嗎？	<b>Interviewee:</b> The ones below?
<b>Interviewer:</b> 你要...可以可以在其他...	<b>Interviewer:</b> You want... yes, you can in other...
<b>Interviewee:</b> 車...也可以什麼都可以玩。	<b>Interviewee:</b> ...car... can also play anything. [likely misunderstanding context]
<b>Interviewer:</b> 如果沒有也沒問題。	<b>Interviewer:</b> If not, that's okay too.
<b>Interviewee:</b> 啊...我沒有耶。	<b>Interviewee:</b> Ah... I don't.
<b>Interviewer:</b> 好。那你幫我換一下 momo 那邊？ 啊，最最上面？ 還有上面一點？ 還有兩個部分可以幫我開...第二個？ 儲蓄？ 你覺得這個是什麼？	<b>Interviewer:</b> Okay. Can you help me switch back to the momo page? Ah, the very very top? Also up a bit? There are two more sections, can you help me open... the second one? Savings? What do you think this is?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 儲蓄？ 這個是什麼意思？	<b>Interviewer:</b> Savings? What does this mean?
<b>Interviewee:</b> 是透過買環保的產品來降低對環境的影響，這樣嗎？	<b>Interviewee:</b> Is it about reducing environmental impact by buying eco-friendly products, like that?
<b>Interviewer:</b> 呃，你覺得嗎？	<b>Interviewer:</b> Uh, do you think so?
<b>Interviewee:</b> (Looks closely)	<b>Interviewee:</b> (Looks closely)
<b>Interviewer:</b> 為什麼會有這些其他的品 牌？ 這是他推薦的嗎？	<b>Interviewer:</b> Why are there these other brands? Are these its recommendations?
<b>Interviewee:</b> 這是他推薦的品牌嗎？	<b>Interviewee:</b> Are these brands it recommended?
<b>Interviewer:</b> 如果你是這樣覺得，可以。	<b>Interviewer:</b> If you think so, yes.
<b>Interviewee:</b> 哟呵呵，應該是他推薦的 品牌。	<b>Interviewee:</b> Oh haha, they should be brands it recommended.
<b>Interviewer:</b> 好。那為什麼他會推薦這些 品牌？	<b>Interviewer:</b> Okay. Why would it recommend these brands?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 因為他的...他的那些減...呃...製造出來的產品比 Giordano 還要好？是這樣嗎？	<b>Interviewee:</b> Because its... its those reduc... uh... the products manufactured are better than Giordano's? Is that it?
<b>Interviewer:</b> 好。那這些品牌你有看過嗎？	<b>Interviewer:</b> Okay. Have you seen these brands?
<b>Interviewee:</b> 沒有呢，也都沒有看過。所以我一開始不知道它是品牌。	<b>Interviewee:</b> No, haven't seen any of them. That's why I didn't know they were brands at first.
<b>Interviewer:</b> OK。那你幫我看第三個部分？ 這個是什麼呢？	<b>Interviewer:</b> OK. Can you help me look at the third section? What is this?
<b>Interviewee:</b> 你可以追蹤你購買過的其他...喔，投資他們喔！ 他在推薦我要可以投資哪些環保企業，這樣嗎？	<b>Interviewee:</b> You can track other... oh, invest in them! Is it recommending which environmental companies I can invest in, like that?
<b>Interviewer:</b> 你最近有投資過嗎？	<b>Interviewer:</b> Have you invested recently?
<b>Interviewee:</b> 沒有沒有。	<b>Interviewee:</b> No, no.
<b>Interviewer:</b> 沒有投資？ 你沒有買過股票？	<b>Interviewer:</b> No investment? You haven't bought stocks?
<b>Interviewee:</b> 沒有，還沒有。	<b>Interviewee:</b> No, not yet.
<b>Interviewer:</b> 那你有興趣嗎？ 投資？	<b>Interviewer:</b> Are you interested? Investing?
<b>Interviewee:</b> 推薦投資他嗎？ 可是他不是不好嗎？ 所以我應該不會想投資他。	<b>Interviewee:</b> Recommend investing in it? But isn't it bad? So I probably wouldn't want to invest in it.
<b>Interviewer:</b> 所以你覺得賣東西跟投資有什麼關係嗎？ 還是是完全不一樣的？	<b>Interviewer:</b> So do you think selling things and investing have any relationship? Or are they completely different?
<b>Interviewee:</b> 會有關係。就是...應該說投資會...就是等於是給那間公司更多的支持，不是嗎？ 對我來說解釋是這樣子。	<b>Interviewee:</b> There would be a relationship. Just... should say investing would... just means giving that company more support, doesn't it? To me, the explanation is like that.
<b>Interviewer:</b> 所以如果今天那個公司，它是...	<b>Interviewer:</b> So if today that company, it is...
<b>Interviewee:</b> 不優的，那它當然就不要去投資它了。	<b>Interviewee:</b> ...not good, then of course one shouldn't invest in it.
<b>Interviewer:</b> 所以如果它的商品很好，你比較會想要投資嗎？	<b>Interviewer:</b> So if its products are very good, you'd be more inclined to invest?
<b>Interviewee:</b> 對對對。哦...就是支持他們。對，支持他們。對對對。	<b>Interviewee:</b> Yes yes yes. Oh... just supporting them. Yes, supporting them. Yes yes yes.
<b>Interviewer:</b> 好的。好。那那個卡片上可以幫我寫這個綠色的號碼？ 後面...	<b>Interviewer:</b> Okay. Okay. Then on the card, can you help me write this green number? Later...

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 9J 的那個嗎？	<b>Interviewee:</b> The 9J one?
<b>Interviewer:</b> 對對對。好。那可以幫我講出來？	<b>Interviewer:</b> Yes yes yes. Okay. Can you help me say it out loud?
<b>Interviewee:</b> 9J97Q。	<b>Interviewee:</b> 9J97Q.
<b>Interviewer:</b> 好的。那這樣就可以了。好。然後卡片上也有上了 QR。這個嗎？ 所以是要填這個？	<b>Interviewer:</b> Okay. Then that's fine. Okay. And on the card, there's also a QR code. This one? So I need to fill this out?
<b>Interviewee:</b> 而且我現在泳裝也不太好，我只有泳帽。對對對。	<b>Interviewee:</b> And my swimsuit isn't great right now, I only have a swim cap. Yes yes yes. [Seems like off-topic chat at the end]

### 16.1.31 Transcript 2025-03-19 - Tainan (CJCU) - APNOO

**Source Files:** \* 2025-03-19 - Tainan (CJCU) - APNOO.json \* 2025-03-19 - Tainan (CJCU) - APNOO.txt

**Ziran ID Code:** APNOO

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 首先，我...我可以錄影我們的對話嗎？	<b>Interviewer:</b> First, I... can I record our conversation?
<b>Interviewee:</b> 可以。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。那我介紹一下，我是建功大學專業設計所的學生，然後這個是我的論文的部分，一個環保的軟體。那等一下你可以幫我測試這個軟體嗎？	<b>Interviewer:</b> Okay. Let me introduce myself. I'm a student from the Professional Design Institute at Jian Gong University, and this is part of my thesis, an environmental software. Then later, can you help me test this software?
<b>Interviewee:</b> 好。	<b>Interviewee:</b> Okay.
<b>Interviewer:</b> 好。那第一個問題是，你網路上會買東西嗎？	<b>Interviewer:</b> Okay. So the first question is, do you buy things online?
<b>Interviewee:</b> 會。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 你平常使用什麼平台呢？	<b>Interviewer:</b> What platforms do you usually use?
<b>Interviewee:</b> 品牌嗎？ Apple 的可以嗎？	<b>Interviewee:</b> Brands? Is Apple okay?
<b>Interviewer:</b> 都可以。Apple？ 啊...	<b>Interviewer:</b> Anything is fine. Apple? Ah...
<b>Interviewer:</b> 那你有用過其他的嗎？	<b>Interviewer:</b> Have you used others?
<b>Interviewee:</b> 其他東西可以嗎？	<b>Interviewee:</b> Are other things okay?

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 我是說那個平台，那個網頁，你不需要上來...	<b>Interviewer:</b> I mean the platform, the webpage, you don't need to come up...
<b>Interviewee:</b> 喔，蝦皮。	<b>Interviewee:</b> Oh, Shopee.
<b>Interviewer:</b> 蝦皮。好。那蝦皮的之外還有其他的嗎？	<b>Interviewer:</b> Shopee. Okay. Besides Shopee, are there any others?
<b>Interviewee:</b> 淘寶。	<b>Interviewee:</b> Taobao.
<b>Interviewer:</b> 好。那 momo 你有使用過嗎？	<b>Interviewer:</b> Okay. Have you used momo?
<b>Interviewee:</b> 目前沒有。	<b>Interviewee:</b> Not currently.
<b>Interviewer:</b> 好。那那先...先今天的第一次使用。好。那你最近有什麼產品你想要買嗎？	<b>Interviewer:</b> Okay. Then then first... first time using it today. Okay. Is there any product you want to buy recently?
<b>Interviewee:</b> 想要買捲頭髮的。	<b>Interviewee:</b> Want to buy a hair curler.
<b>Interviewer:</b> 好。那你可以幫我找這個這個產品嗎？	<b>Interviewer:</b> Okay. Can you help me find this product?
<b>Interviewee:</b> 有注音嗎？ 等一下，我不會用。	<b>Interviewee:</b> Is there Zhuyin input? Wait, I don't know how to use it.
<b>Interviewer:</b> 好。你想要寫什麼？	<b>Interviewer:</b> Okay. What do you want to write?
<b>Interviewee:</b> 電捲棒。電捲棒。好。	<b>Interviewee:</b> Curling iron. Curling iron. Okay.
<b>Interviewer:</b> (Waits)	<b>Interviewer:</b> (Waits)
<b>Interviewee:</b> 等一下。	<b>Interviewee:</b> Wait a moment.
<b>Interviewer:</b> 這樣嗎？ 還不是？	<b>Interviewer:</b> Like this? Not yet?
<b>Interviewee:</b> (Continues searching)	<b>Interviewee:</b> (Continues searching)
<b>Interviewer:</b> 第二個？	<b>Interviewer:</b> The second one?
<b>Interviewee:</b> 第二個。	<b>Interviewee:</b> Second one.
<b>Interviewer:</b> 這個嗎？	<b>Interviewer:</b> This one?
<b>Interviewee:</b> 對對對。	<b>Interviewee:</b> Yes yes yes.
<b>Interviewer:</b> 那這裡有你想要喜歡的嗎？	<b>Interviewer:</b> Is there one here that you like?
<b>Interviewer:</b> 你有什麼特別喜歡的...呃...商品還是品牌嗎？	<b>Interviewer:</b> Do you have any particularly favorite... uh... products or brands?
<b>Interviewee:</b> 這兩個感覺不錯。	<b>Interviewee:</b> These two feel pretty good.
<b>Interviewer:</b> 你幫我講出來一下？ 為什麼這些？	<b>Interviewer:</b> Help me say it out loud briefly? Why these?
<b>Interviewee:</b> 因為它可以自動捲髮。	<b>Interviewee:</b> Because it can automatically curl hair.
<b>Interviewer:</b> 好。就是要按嗎？	<b>Interviewer:</b> Okay. Just need to press it?
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 那剛剛你說有兩個？ 第二個為什麼？	<b>Interviewer:</b> You just said there were two? Why the second one?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 這個...因為它們都是...兩個是自動捲髮。好。然後因為這個比較便宜一點。嗯。	<b>Interviewee:</b> This one... because they are both... the two are automatic curlers. Okay. And because this one is a bit cheaper. Um.
<b>Interviewer:</b> 對。那你幫我選一個？這個？打開。	<b>Interviewer:</b> Yes. Can you choose one for me? This one? Open it.
<b>Interviewee:</b> (Selects product)	<b>Interviewee:</b> (Selects product)
<b>Interviewer:</b> 你最近有買過這個品牌嗎？	<b>Interviewer:</b> Have you bought this brand recently?
<b>Interviewee:</b> 沒有，但是最近有在考慮想要買。	<b>Interviewee:</b> No, but recently I've been considering buying it.
<b>Interviewer:</b> 哦，所以你看過這個品牌？	<b>Interviewer:</b> Oh, so you've seen this brand?
<b>Interviewee:</b> 嗯。	<b>Interviewee:</b> Um.
<b>Interviewer:</b> 好。那你你關於這個品牌有什麼樣的想法？	<b>Interviewer:</b> Okay. So, what are your thoughts about this brand?
<b>Interviewee:</b> 品牌嗎？感覺很不錯，因為是可以上市，應該就是不錯。然後它有國際電壓，嗯，就是可以...感覺就是可以帶出國，然後不用再特別用轉接頭，所以是對女孩子來說很方便。	<b>Interviewee:</b> The brand? Feels pretty good, because it can be listed [publicly traded], it should be good. And it has international voltage, um, which means you can... feels like you can take it abroad, and don't need a special adapter, so it's very convenient for girls.
<b>Interviewer:</b> 是蠻貼心的。嗯。好。那這裡，這個網頁上最重要的地方在哪裡？	<b>Interviewer:</b> That's quite thoughtful. Um. Okay. So here, on this webpage, where is the most important part?
<b>Interviewee:</b> 最重要...這邊？	<b>Interviewee:</b> Most important... here?
<b>Interviewer:</b> 你幫我講出來，為什麼這邊？	<b>Interviewer:</b> Help me say it out loud, why here?
<b>Interviewee:</b> 因為這樣我就可以知道我要怎麼用它。然後因為它也是要插電的，這樣它有寫出來我就會比較知道說要怎麼使用才會比較安全。	<b>Interviewee:</b> Because this way I can know how to use it. And because it also needs to be plugged in, having it written out like this makes me understand better how to use it more safely.
<b>Interviewer:</b> 好。那第二個重要的部分？	<b>Interviewer:</b> Okay. What's the second important part?
<b>Interviewee:</b> 這邊。嗯。	<b>Interviewee:</b> Here. Um.
<b>Interviewer:</b> 這是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 第一個是他的品牌的介紹，然後第二個是寫他詳細的產品資訊。	<b>Interviewee:</b> The first is the introduction of its brand, and the second writes its detailed product information.
<b>Interviewer:</b> 噢。那這個資訊裡面的重點在哪裡？	<b>Interviewer:</b> Um. Then what's the main point within this information?
<b>Interviewee:</b> 噢...製造國家是...然後它的使用材質是陶瓷塗層、PTC 導熱體。	<b>Interviewee:</b> Um... manufacturing country is... and its material used is ceramic coating, PTC heating element.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 嗯。那這個資訊會影響你的想法嗎？	<b>Interviewer:</b> Um. Would this information affect your thoughts?
<b>Interviewee:</b> 嗯...不...有可能會。	<b>Interviewee:</b> Um... no... possibly yes.
<b>Interviewer:</b> 為什麼？	<b>Interviewer:</b> Why?
<b>Interviewee:</b> 因為國家是中國，會有點擔心，還是會有一點擔心安全的問題。	<b>Interviewee:</b> Because the country is China, I'd be a little worried, still a bit worried about safety issues.
<b>Interviewer:</b> 好。那網頁上第三個重要的地方呢？	<b>Interviewer:</b> Okay. Then the third important place on the webpage?
<b>Interviewee:</b> 第三個嗎？沒了。	<b>Interviewee:</b> The third? Gone.
<b>Interviewer:</b> 還要嗎？如果沒有也可以。	<b>Interviewer:</b> Do you want more? If not, that's fine too.
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 沒有。好的。那可以幫我去上面一點？啊，第二個，可以幫我打開第二個部分？	<b>Interviewer:</b> No. Okay. Can you help me go up a bit? Ah, the second one, can you help me open the second section?
<b>Interviewee:</b> 這個嗎？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 嗯。	<b>Interviewer:</b> Um.
<b>Interviewee:</b> (Clicks)	<b>Interviewee:</b> (Clicks)
<b>Interviewer:</b> 這個是什麼？	<b>Interviewer:</b> What is this?
<b>Interviewee:</b> 這是什麼...他的品牌建議？碳排？環保的感覺。	<b>Interviewee:</b> What is this... its brand recommendation? Carbon emissions? Feels environmental.
<b>Interviewer:</b> 是在講環保？	<b>Interviewer:</b> Is it talking about environmental protection?
<b>Interviewee:</b> 為什麼？因為現在溫室效應，所以碳排很重要。因為他有減少碳排放量30%。	<b>Interviewee:</b> Why? Because of the greenhouse effect now, so carbon emissions are very important. Because it has reduced carbon emissions by 30%.
<b>Interviewer:</b> 那作...別人的什麼事情？	<b>Interviewer:</b> Then do... what about others? [Referring to other brands listed]
<b>Interviewee:</b> 應該是其他品牌名稱嗎？我不太確定。	<b>Interviewee:</b> Should be other brand names? I'm not quite sure.
<b>Interviewer:</b> 這些其他的品牌你有看過嗎？	<b>Interviewer:</b> Have you seen these other brands?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那你還是會考慮其他的品脾嗎？	<b>Interviewer:</b> Would you still consider other brands?
<b>Interviewee:</b> 或許會考慮 Dyson。	<b>Interviewee:</b> Maybe I would consider Dyson.
<b>Interviewer:</b> 那如果你考慮其他的，你想要有什麼樣的資訊呢？	<b>Interviewer:</b> If you consider others, what kind of information would you want?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 嗯...想要的資訊...他的製造國家，然後怎麼設計，然後它是用什麼材質做的，我要怎麼用它會比較安全，有沒有保固。	<b>Interviewee:</b> Um... information wanted... its manufacturing country, then how it's designed, then what material it's made of, how to use it more safely, whether there's a warranty.
<b>Interviewer:</b> 好。那為什麼你那麼擔心安全？	<b>Interviewer:</b> Okay. Why are you so worried about safety?
<b>Interviewee:</b> 因為畢竟是會靠近臉部、頭部，那如果萬一發生就是爆炸會很危險。	<b>Interviewee:</b> Because after all, it will be close to the face, head, so if by any chance an explosion happens, it would be very dangerous.
<b>Interviewer:</b> 嗯。好。那幫我看一個商品部分？ 上面一點？	<b>Interviewer:</b> Um. Okay. Help me look at one product section? Up a bit?
<b>Interviewee:</b> 這個？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 這個嗎？	<b>Interviewer:</b> This one?
<b>Interviewee:</b> 這個是什麼意思？	<b>Interviewee:</b> What does this mean?
<b>Interviewer:</b> 就是告訴我這個品牌，然後考慮...呃...再考慮他們其他的產品，這樣？	<b>Interviewer:</b> Just telling me this brand, then consider... uh... reconsider their other products, like that?
<b>Interviewee:</b> 我的解讀是這樣。	<b>Interviewee:</b> My interpretation is like that.
<b>Interviewer:</b> 所以...呃...你有這個跟投資有關係嗎？	<b>Interviewer:</b> So... uh... does this have anything to do with investing?
<b>Interviewee:</b> 你是說這個跟什麼有關係？我剛剛聽不太懂。就是跟...就是可以考慮他們其他的產品？	<b>Interviewee:</b> You mean this is related to what? I didn't quite understand just now. Like with... like you can consider their other products?
<b>Interviewer:</b> 哦，考慮他們其他的產品。	<b>Interviewer:</b> Oh, consider their other products.
<b>Interviewee:</b> 對。	<b>Interviewee:</b> Yes.
<b>Interviewer:</b> 好。呃...OK。那你可以幫我回那個這個部分那邊？ 第二個部分？ 第一個...第一個？ 第一個嗎？	<b>Interviewer:</b> Okay. Uh... OK. Can you help me go back to that section there? The second section? The first... first one? The first one?
<b>Interviewee:</b> 這個嗎？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 下面一點，還有兩個按鈕。你想要按一個嗎？	<b>Interviewer:</b> Down a bit, there are two more buttons. Do you want to press one?
<b>Interviewee:</b> 這個嗎？ (Clicks)	<b>Interviewee:</b> This one? (Clicks)
<b>Interviewer:</b> 你剛剛按什麼？ 幫我講出來。	<b>Interviewer:</b> What did you just press? Help me say it out loud.
<b>Interviewee:</b> 尋找替代產品。	<b>Interviewee:</b> Find Alternative Products.
<b>Interviewer:</b> 為什麼按這個呢？	<b>Interviewer:</b> Why press this one?
<b>Interviewee:</b> 為什麼按這個嗎？ 呃...也許其他品牌也更好，或者是更便宜。嗯。所以就可以考慮，就是要比較才會知道適合自己的東西是什麼。	<b>Interviewee:</b> Why press this one? Uh... maybe other brands are even better, or cheaper. Um. So one can consider, need to compare to know what suits oneself.
<b>Interviewer:</b> 那剛剛給你說的內容裡面有什麼有用的嗎？	<b>Interviewer:</b> Then in the content it gave you just now, was there anything useful?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 說這邊嗎？材料使用，然後環保特點。因為他們在環保方面有更好的表現。	<b>Interviewee:</b> You mean here? Material usage, then environmental features. Because they perform better environmentally.
<b>Interviewer:</b> 所以這些是什麼意思？	<b>Interviewer:</b> So what do these mean?
<b>Interviewee:</b> 這個是...這是 Dyson，應該是日本那個品牌。剩下兩個我不太曉得。	<b>Interviewee:</b> This is... this is Dyson, should be that Japanese brand. The remaining two I don't really know.
<b>Interviewer:</b> 那剛剛他是跟你講英文的品 牌，這裡是中文的，你覺得哪一個比較方便 看得懂？	<b>Interviewer:</b> Then just now it told you the brands in English, here it's in Chinese, which one do you think is more convenient to understand?
<b>Interviewee:</b> 中文。	<b>Interviewee:</b> Chinese.
<b>Interviewer:</b> 你有其他的問題想要問 他嗎？	<b>Interviewer:</b> Do you have other questions you want to ask it?
<b>Interviewee:</b> 沒有。	<b>Interviewee:</b> No.
<b>Interviewer:</b> 那幫我回那個第一個部分那 邊？momo 那邊？對。上面一點有一個綠 色的號碼。可以幫我講出來？	<b>Interviewer:</b> Then help me go back to that first section there? The momo page? Yes. Up a bit there's a green number. Can you help me say it out loud?
<b>Interviewee:</b> 這個嗎？APNOO。	<b>Interviewee:</b> This one? APNOO.
<b>Interviewer:</b> 好。那可以幫我寫卡片上嗎？ 這個號碼。	<b>Interviewer:</b> Okay. Can you help me write this number on the card?
<b>Interviewee:</b> (Writes code)	<b>Interviewee:</b> (Writes code)

### 16.1.32 Transcript 2025-03-19 - Tainan (CJCU) - CBYNQ

**Source Files:** \* 2025-03-19 - Tainan (CJCU) - CBYNQ.json \* 2025-03-19 - Tainan (CJCU) - CBYNQ.txt

**Ziran ID Code:** CBYNQ

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 對啊。我...我可以錄影我們的 對話嗎？	<b>Interviewer:</b> Right. I... can I record our conversation?
<b>Interviewee:</b> 可以呀。	<b>Interviewee:</b> Yes.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 可以。好。那我嗯，稍微介紹一下，我是長榮大學設計所有的時候...想...這個是我的論文的一個環保的 app。你可以幫我測試嗎？	<b>Interviewer:</b> Yes. Okay. Then I'll um, briefly introduce myself. I'm a student from the Design Institute at Chang Jung Christian University. This is an environmental app that's part of my thesis. Can you help me test it?
<b>Interviewee:</b> 所以...啊...	<b>Interviewee:</b> So... ah...
<b>Interviewer:</b> 那第一個問題是，你平常網路 上會買東西嗎？	<b>Interviewer:</b> So the first question is, do you usually buy things online?
<b>Interviewee:</b> 對。但比較少。	<b>Interviewee:</b> Yes. But relatively seldom.
<b>Interviewer:</b> 那你買東西是用...	<b>Interviewer:</b> Then when you buy things, you use...
<b>Interviewee:</b> 蝦皮。	<b>Interviewee:</b> Shopee.
<b>Interviewer:</b> 呃...其他的比較少？	<b>Interviewer:</b> Uh... others less often?
<b>Interviewee:</b> momo 最近想要買隨身的 包包。	<b>Interviewee:</b> momo, recently wanted to buy a portable bag.
<b>Interviewer:</b> 應該找得到？ 幫我...幫我查 一下。	<b>Interviewer:</b> Should be able to find it? Help me... help me search a bit.
<b>Interviewee:</b> 好。(Searches) 你好...	<b>Interviewee:</b> Okay. (Searches) Hello...
<b>Interviewer:</b> (Waits)	<b>Interviewer:</b> (Waits)
<b>Interviewee:</b> 哇，這沒有注音啊？ 應該 是...純吧？ 這可以用這個打嗎？	<b>Interviewee:</b> Wow, this doesn't have Zhuyin input? It should be... pure [Pinyin]? Can I use this to type?
<b>Interviewer:</b> 謝謝嘛？ 哦。	<b>Interviewer:</b> Thanks? Oh.
<b>Interviewee:</b> (Continues typing attempt) 哟 哦哦。	<b>Interviewee:</b> (Continues typing attempt) Oh oh oh.
<b>Interviewer:</b> 你幫我講出來就好。	<b>Interviewer:</b> Just help me say it out loud.
<b>Interviewee:</b> 包包。	<b>Interviewee:</b> Bag.
<b>Interviewer:</b> (Helps type) 男？	<b>Interviewer:</b> (Helps type) Male?
<b>Interviewee:</b> (Laughs) 已經送出去了。	<b>Interviewee:</b> (Laughs) Already sent it out.
<b>Interviewer:</b> 來不及了。正經講。	<b>Interviewer:</b> Too late. Seriously now.
<b>Interviewee:</b> (Looks at results)	<b>Interviewee:</b> (Looks at results)
<b>Interviewer:</b> 這邊有你喜歡的嗎？ 還在車 上啊？	<b>Interviewer:</b> Is there anything you like here? Still loading [on the car]?
<b>Interviewee:</b> 這個。(Points)	<b>Interviewee:</b> This one. (Points)
<b>Interviewer:</b> 那我要這個？ 你要這個嗎？	<b>Interviewer:</b> Then I want this one? Do you want this one?
<b>Interviewee:</b> 對。香奈兒經典經典鏈子皮夾 斜肩。	<b>Interviewee:</b> Yes. Chanel classic classic chain wallet crossbody.
<b>Interviewer:</b> 那幫我開...打開嗎？	<b>Interviewer:</b> Then help me open... open it?
<b>Interviewee:</b> 打開。	<b>Interviewee:</b> Open.
<b>Interviewer:</b> 對啊。為什麼你選這個呢？	<b>Interviewer:</b> Right. Why did you choose this one?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 因為我剛才第一眼看到他，我就覺得很好看，我也不知道為什麼。	<b>Interviewee:</b> Because when I first saw it just now, I thought it looked very good, I don't know why either.
<b>Interviewer:</b> 好。這個...這個品牌嗎？	<b>Interviewer:</b> Okay. This... this brand?
<b>Interviewee:</b> 沒有。沒有買過。	<b>Interviewee:</b> No. Haven't bought it.
<b>Interviewer:</b> 我覺得...	<b>Interviewer:</b> I think...
<b>Interviewee:</b> 他剛剛第一眼看起來，我覺得小而精美，然後看起來是我喜歡的類型。還有那個鏈子很加分，我很喜歡。	<b>Interviewee:</b> It just now at first glance, I felt it was small and exquisite, and looked like a type I like. Also that chain adds a lot of points, I really like it.
<b>Interviewer:</b> 好。那這個網頁上最重要...我覺得是...	<b>Interviewer:</b> Okay. Then on this webpage, the most important... I think it's...
<b>Interviewee:</b> ...特價？ 應該不是特價。然後還有一些什麼累積多少錢，然後有送什麼 momo 的幣給你。還有一些...就是它的介紹。	<b>Interviewee:</b> ...special price? Probably not a special price. And then there are some things like accumulate how much money, and then get some momo coins given to you. Also some... just its description.
<b>Interviewer:</b> 其他的重要的地方在哪裡？	<b>Interviewer:</b> Where are other important places?
<b>Interviewee:</b> 重要的地方嗎？ 是它的價錢嗎？	<b>Interviewee:</b> Important places? Is it its price?
<b>Interviewer:</b> 啊，可以。價錢多少？ 這個...這個可以嗎？	<b>Interviewer:</b> Ah, yes. How much is the price? This... is this okay?
<b>Interviewee:</b> (Looks at price)	<b>Interviewee:</b> (Looks at price)
<b>Interviewer:</b> 安安。所以這裡 momo 網頁上什麼你之前沒有看過的嗎？ 什麼新的？新的部分嗎？	<b>Interviewer:</b> Ann Ann [greeting]. So here on the momo webpage, is there anything you haven't seen before? Anything new? New sections?
<b>Interviewee:</b> 新的部分嗎？ 沒有呢。	<b>Interviewee:</b> New sections? No.
<b>Interviewer:</b> 好。那這個黃色的呢？ 你之前有看過嗎？	<b>Interviewer:</b> Okay. What about this yellow one? Have you seen it before?
<b>Interviewee:</b> 好...	<b>Interviewee:</b> Okay...
<b>Interviewer:</b> 你覺得這個是什麼？	<b>Interviewer:</b> What do you think this is?
<b>Interviewee:</b> 這個資訊還不錯欸。其實會告訴我不是這個牌子的，或是我買這個產品可能會有什麼問題。嗯。像他說這個就是曾經有商品不符合台灣安檢法規的問題。這個我可能確實就會考慮一下這個產品。	<b>Interviewee:</b> This information is quite good eh. Actually, it tells me it's not this brand, or what problems I might encounter if I buy this product. Um. Like it says this one has had issues where products didn't comply with Taiwan's safety regulations. This might indeed make me reconsider this product.
<b>Interviewer:</b> 嗯。那你想要看嗎？	<b>Interviewer:</b> Um. Do you want to look [further]?

Traditional Chinese Transcript	English Translation
<b>Interviewee:</b> 我看完了，我看完了啊。	<b>Interviewee:</b> I've finished looking, I've finished looking ah.
<b>Interviewer:</b> 不是，說它不是問你想要看看嗎？最下面？	<b>Interviewer:</b> No, didn't it ask if you wanted to take a look? At the very bottom?
<b>Interviewee:</b> 這個嗎？	<b>Interviewee:</b> This one?
<b>Interviewer:</b> 不是。嗯...你「想看看」嗎？	<b>Interviewer:</b> No. Um... "Want to take a look"?
<b>Interviewee:</b> 這個啥？但是我看到這種，我就不會選擇這個產品。	<b>Interviewee:</b> What's this? But when I see this kind of thing, I won't choose this product.
<b>Interviewer:</b> 好的。OK。那你幫我看那個最上面的，就是那個投資的部分？	<b>Interviewer:</b> Okay. OK. Can you help me look at the very top one, the investment section?
<b>Interviewee:</b> 投資？	<b>Interviewee:</b> Investment?
<b>Interviewer:</b> 對。那你之前有投資過嗎？	<b>Interviewer:</b> Yes. Have you invested before?
<b>Interviewee:</b> 哦，我之前有看過，但是他現在 AI 幫我列出來的這兩個我不知道。嗯。	<b>Interviewee:</b> Oh, I've seen it before, but these two that the AI listed for me now, I don't know them. Um.
<b>Interviewer:</b> 陳醫師？覺得這是什麼？	<b>Interviewer:</b> Dr. Chen? [Addressing someone else?] What do you think this is?
<b>Interviewee:</b> 他寫代號，應該是就是這間公司的代號，然後底下應該就是他列出來的股票的圖表。	<b>Interviewee:</b> It writes code, it should be the code for this company, and below should be the stock charts it listed.
<b>Interviewer:</b> 嗯。那你看到這個想要買這個股票嗎？	<b>Interviewer:</b> Um. Seeing this, do you feel like buying this stock?
<b>Interviewee:</b> 我想一下...我看一下...(Looks at chart)...我可能不會買，因為它的波動有點太大了。	<b>Interviewee:</b> Let me think... let me see... (Looks at chart)... I probably wouldn't buy, because its volatility is a bit too high.
<b>Interviewer:</b> 瞭。好。OK。那你可以幫我 screenshot 這些部分嗎？你覺得重要的部分。	<b>Interviewer:</b> Understood. Okay. OK. Can you help me screenshot these parts? The parts you think are important.
<b>Interviewee:</b> 嗯。(Takes screenshot) 這個產品要...要入鏡嗎？	<b>Interviewee:</b> Um. (Takes screenshot) Does the product need to... be in the shot?
<b>Interviewer:</b> 還是...對對，就是全部你覺得重要的。	<b>Interviewer:</b> Or... yes yes, just everything you think is important.
<b>Interviewee:</b> 可以直接選這裡？咦，但是我可能要先保存它一下，讓它消失。	<b>Interviewee:</b> Can I select directly here? Eh, but I might need to save it first, let it disappear.
<b>Interviewee:</b> (Takes another screenshot) 還有...嗯...	<b>Interviewee:</b> (Takes another screenshot) Also... um...
<b>Interviewer:</b> 剛剛那個另外一個產品也可以喔。	<b>Interviewer:</b> The other product from just now is also okay.
<b>Interviewee:</b> 好。嗯。(Takes screenshot) 這個...這邊加一張。好了。然後拍到的產品...這一個。	<b>Interviewee:</b> Okay. Um. (Takes screenshot) This one... add one here. Done. Then the product photographed... this one.

Traditional Chinese Transcript	English Translation
<b>Interviewer:</b> 那為什麼你選這些部分？	<b>Interviewer:</b> Why did you choose these parts?
<b>Interviewee:</b> �恩...欸？ 為什麼選這兩個產品嗎？	<b>Interviewee:</b> Um... eh? Why choose these two products?
<b>Interviewer:</b> 不是，就是你剛剛那個 screenshot，為什麼 screenshot 這個部分？	<b>Interviewer:</b> No, just the screenshot you took, why screenshot this part?
<b>Interviewee:</b> 呃...因為它有列出就是...就是重點，嗯，然後讓我在選擇可以依據它顯示的東西做一下判斷。	<b>Interviewee:</b> Uh... because it listed... just... the key points, um, and then it lets me make a judgment based on the things it displays when choosing.
<b>Interviewer:</b> 好。那最後面的部分，你可以幫我回那個第一個？ 然後最下面有兩個按鈕，你想要按一個嗎？	<b>Interviewer:</b> Okay. Then the last part, can you help me go back to the first one? Then at the very bottom, there are two buttons, do you want to press one?
<b>Interviewee:</b> 尋找替代上面？ 查看...嗯...這個。	<b>Interviewee:</b> Find alternatives above? View... um... this one.
<b>Interviewer:</b> 好好。為什麼按這個呢？	<b>Interviewer:</b> Okay okay. Why press this one?
<b>Interviewee:</b> 因為它好像說這是...他還有其他推薦的品牌？ 所以我選擇了...嗯，這個。	<b>Interviewee:</b> Because it seems to say this is... it has other recommended brands? So I chose... um, this one.
<b>Interviewer:</b> 那他剛剛跟你說什麼？	<b>Interviewer:</b> What did it tell you just now?
<b>Interviewee:</b> �恩...他這邊點開來說我們的...哦，它的替代品牌的比較。他有列出來除了我選的富麗森以外，他還有列其他...一二三...其他三種的品牌。	<b>Interviewee:</b> Um... here it opens up saying our... oh, a comparison of its alternative brands. It listed besides the Fujimori I chose, it also listed others... one two three... three other kinds of brands.
<b>Interviewer:</b> 那這些你有聽說過嗎？	<b>Interviewer:</b> Have you heard of these?
<b>Interviewee:</b> 有。飛利浦我有聽過，但印象好像也有，但是這個...不是。	<b>Interviewee:</b> Yes. Philips I've heard of, but Impression also seems familiar, but this one... no.
<b>Interviewer:</b> 那你覺得這些品牌怎麼樣？	<b>Interviewer:</b> What do you think of these brands?
<b>Interviewee:</b> �恩...這個品牌，我記得飛利浦的品牌我記得還不錯，但是它好像用在其他電器商品。對。然後印象...我忘記是哪一個商品。	<b>Interviewee:</b> Um... this brand, I remember the Philips brand, I remember it's quite good, but it seems to be used in other electrical appliances. Yes. Then Impression... I forgot which product it was.
<b>Interviewer:</b> �恩。好。嗯，OK。那你還有什麼問題你想要問 AI 嗎？	<b>Interviewer:</b> Um. Okay. Um, OK. Do you have any other questions you want to ask the AI?
<b>Interviewee:</b> 目前沒有。	<b>Interviewee:</b> Not at the moment.

**Interviewer:** 好。那就這樣就可以了。OK，  
謝謝。

**Interviewer:** Okay. Then this is fine. OK,  
thank you.

---

## 16.2 Appendix 2: College Students' Prototype Self-Testing Survey Data

Due to the large amount data captured by the survey (over 100 people self-tested the Green Filter app and 32 people filled out the survey after in-person testing was completed), I've chosen to exclude it from the PDF version of my thesis. The data is available upon request - and has also been published on Hugging Face as a public dataset here: <https://huggingface.co/datasets/krishaamer/taiwanese-college-students>

## 16.3 Appendix 3: Expert Interviews' Transcripts

Due to the already too long thesis, I've excluded the raw interview transcripts. The data is available upon request.

## 16.4 Appendix 4: College Students' Survey Data

Due to the large amounts of data captured by the initial survey (over 1600 people started the survey, after filtering, leading to over 800 Gen-Z current college students finished it fully), I've chosen to exclude it from the PDF version of my thesis. The data is available upon request - and has also been published on Hugging Face as a public dataset here: <https://huggingface.co/datasets/krishaamer/taiwanese-college-students>

## 16.5 Appendix 5: Research Tech Stack

For anyone who would like to repeat this research, here's a table with the software that this research project made use of.

Tool/Service	Category
Matplotlib	Data Visualization
NumPy	Scientific Computing
jupyter	Development Environment
seaborn	Data Visualization
Python	Programming Language
VSCode	Code Editor
GitHub	Version Control
fireflies.ai	AI Meeting Assistant
Google Meet	Communication
databricks	Data Platform
HuggingFace	Machine Learning

Tool/Service	Category
TypeScript	Programming Language
Tally	Form Builder
Zotero	Reference Manager
Quarto	Publishing/Documentation

Tool/Service	Category
Apache Parquet	Data Storage Format
Haystack	Search Framework
MongoDB	NoSQL Database
langchain	AI/ML Development
GitHub Copilot	AI Coding Assistant
Figma	Design Tool
Sketch	Design Tool
OpenAI ChatGPT	AI Assistant
Anthropic Claude	AI Assistant
Google Gemini	AI Assistant
Google Colab	Development Environment
Google Sheets	Spreadsheet
META Llama	AI Model
Mistral	AI Model
OpenAI API	API Service
Postman	API Testing Tool

Tool/Service	Category
Next.js	Web Framework
fullstory	Analytics
Polygon.io	Financial Data API
Hotjar	Behavior Analytics
Lottie	Animation Library
Docusaurus	Documentation
Google Analytics	Web Analytics
Google Maps	Maps/Location Service
vis.gl	Data Visualization Framework
Pinecone	Vector Database
Vercel	Deployment Platform
Vercel AI SDK	AI SDK
Radix UI	UI Library
highcharts	Data Visualization
React	Web Framework

Tool/Service	Category
Tailwind	CSS Framework
Markdown	Markup Language

## 16.6 Appendix 6: Further Reading

Some recommended books on the topics covered in this thesis include, but are not limited to:

- R. Buckminster Fuller “Operating Manual for Spaceship Earth”
- Victor Papanek “Design for the Real World”
- Jonathan Chapman “Emotionally Durable Design”
- Carlo Vezzoli “Product-Service System Design for Sustainability”
- Ezio Manzini “Design, When Everybody Designs”.