The Future of the Labour Market in OECD Countries: How Societies & Governments should react to the upcoming wave of Service Automation

Thomas Boulben Meyer - 21 July 2023

Presentation Plan

- 1. Introduction & Motivation
- 2. OECD & Data
- 3. Artificial intelligence & Large language models
- 4. Literature: Automation
- 5. The SANF & SAF Models
- 6. Policy Review
- 7. Discussion & Conclusion

(1.) Introduction & Motivation

- Work in Developed Societies is Changing
  - Human & Work ? Culminating point ? End of Scarcity ?
- AI & Large Language Models (LLMs) Revolution
- Understand the current/future trends on Work & Automation,
- Explore & Educate AI in the labour market

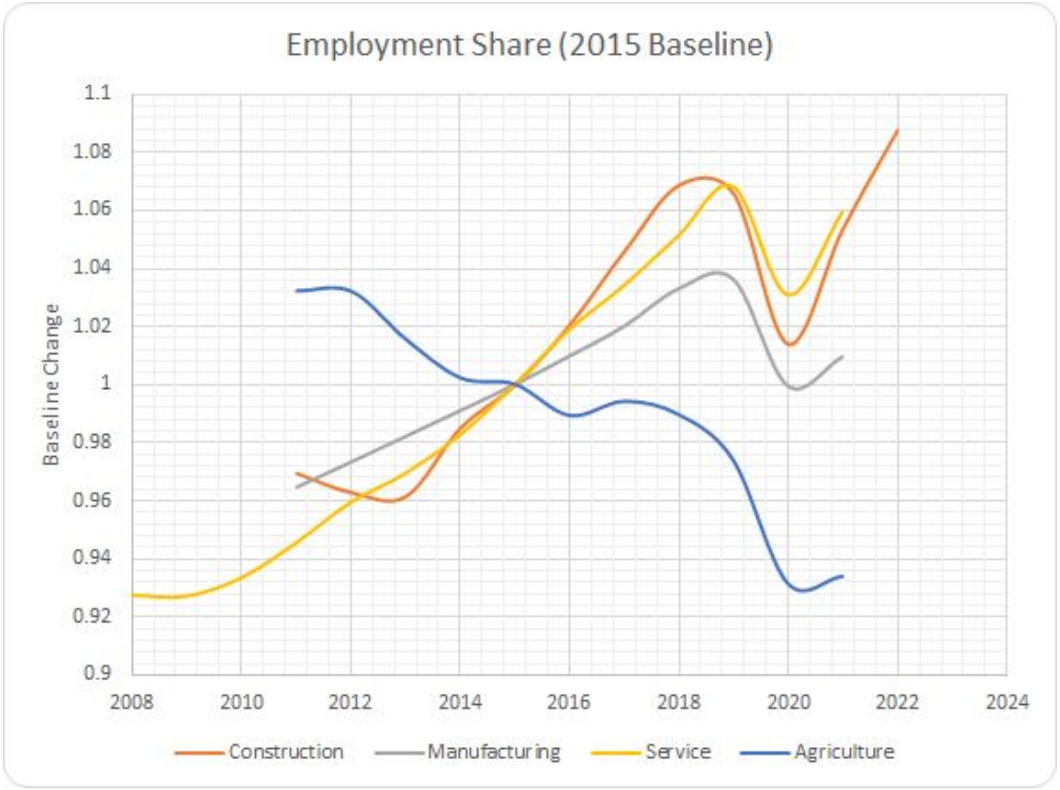
(1.) Research Question

Considering the **potential surge in service automation** due to advances in AI, given the **heavy reliance** of developed societies on the service sector, how can developed countries' labor markets **prepare to manage this transition** and **safeguard the welfare of their citizens?**

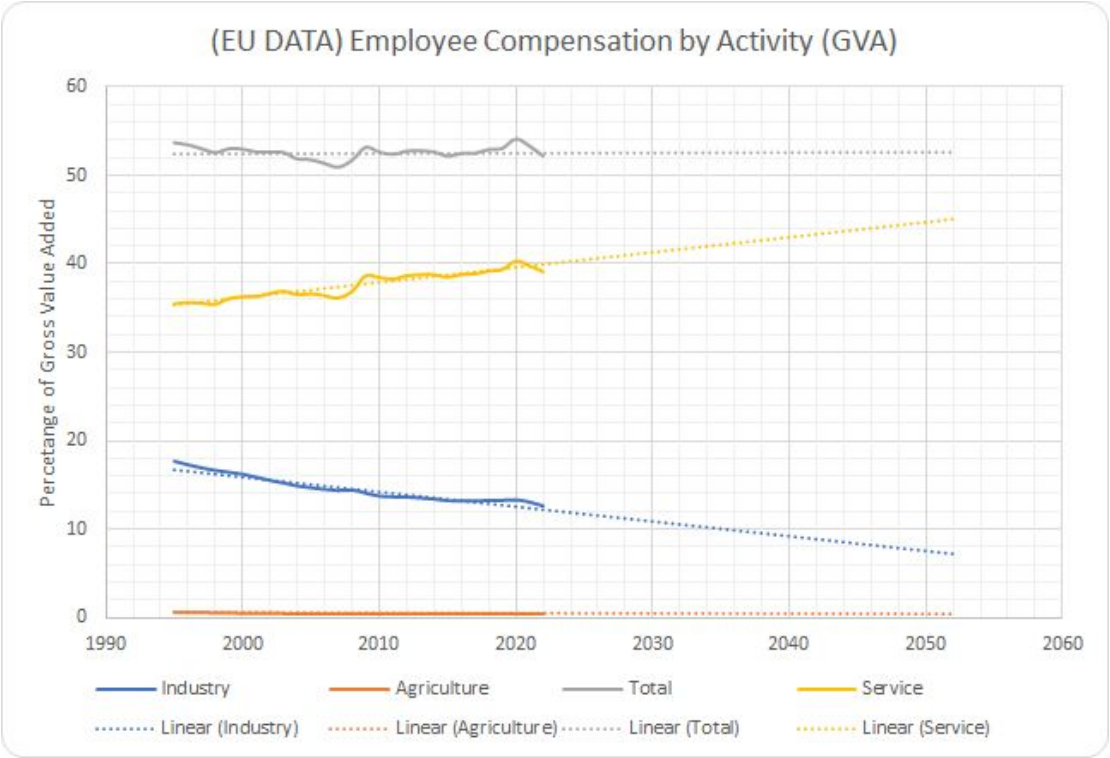
(2.) OECD Countries

- 37 OECD countries
  - 6 developing
  - 31 developed (+80%)
- ⅗ world GDP & ¾ of world trade
- Overall good data, but short data range

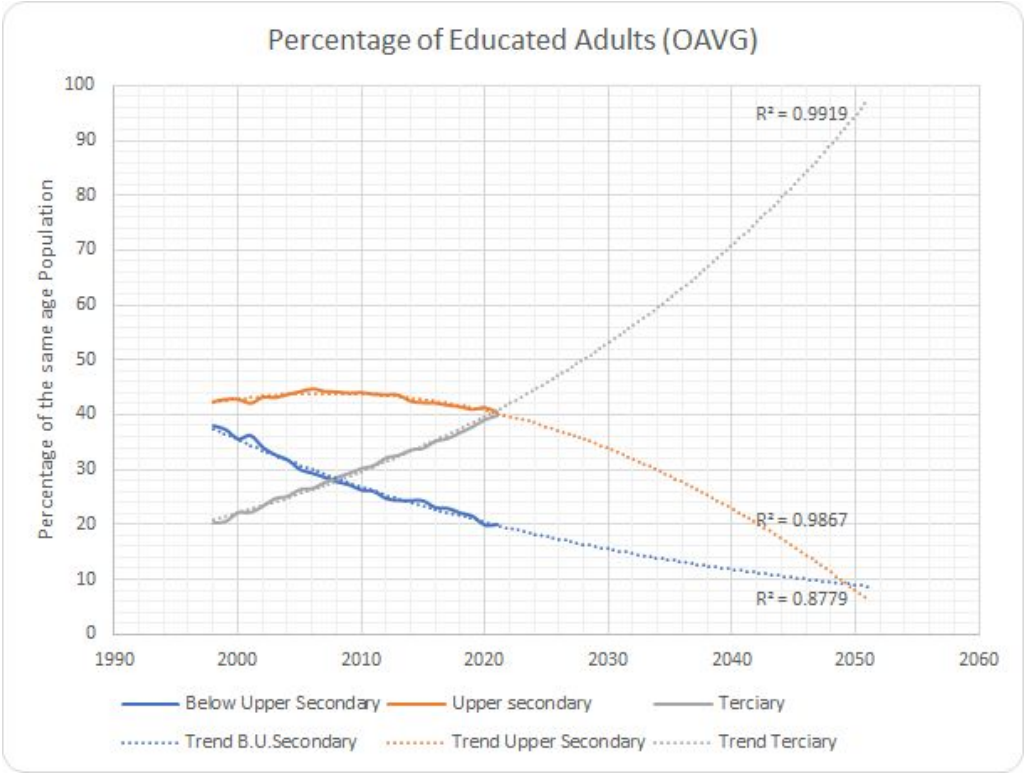
(2.) Employment by Sector



(2.) Compensation by Activity



(2.) Population Education



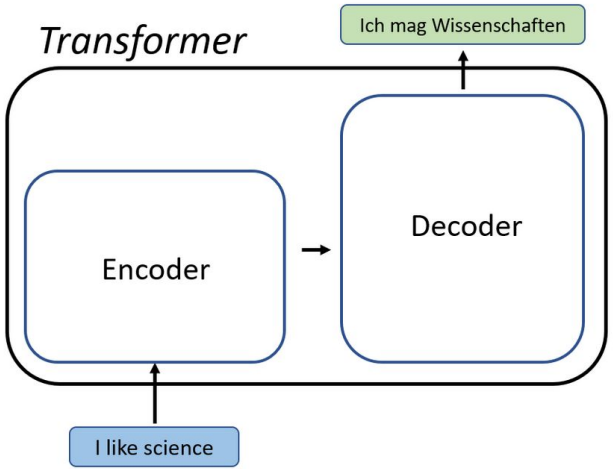
(2.) Conclusion on OECD Data

- Labour share has **decreased** and productivity have been **anemic** in the past decades for developed countries
- Young people joining **later**, old people staying **longer in the workforce**
- Service Sector at **risk**, because of strong **dependency** (+70%)
- Tertiary level education is **rising**, which tend to be **service sector jobs**
- Compensation **is increasing in service sector jobs** while decreasing in others
- People **work less hours**, which automation will inevitably further reduce
- The effect of employment is different **between** genders

(3.) Artificial Intelligence & Large Language Models (LLMs)

- The T in chat GPT stands for **transformer**, it's a type of neural network that can process data, either text or images by analysing the difference elements on a sequence all at once. This is a technique called attention.

- **LLMs ("Attention is all you need", 2017)**
  - They are pre-trained in a **unsupervised** manner with a large dataset, and fined tuned in a **supervised training manner** to increase performance
  - Does not process data in order, they use "**attention**", attempt to identify context and meaning of the sentence.
  - self-attention mechanism that allows it to **weigh** the relevance of words in an input sequence when generating an output sequence.



(4.) Literature Review Automation

- Division of Tasks (**Routine** & **Non-Routine**) : Substitution (RT) & Complementarity (NR) Effect through computerization (Autor, Levy & Murnane, 2003)
- Automation → **Productivity effect**
- **Displacement Effect** + **Reinstatement Effect** = 0
- Automation affects **Task Content of Production** → From Labour to Capital

(4.) Literature Review Automation

- Occupational vs Task Based Approach (Disagreement in the literature)
  - **9% are at high risk** of being automatable (Artnz & al, 2016) - Task Based
  - **47% are at high risk** of being automatable (Frey & Osborne, 2017) - Occupation Base

- Jobs at risks =/= Jobs lost (Task substitution rather than complete occupational disruptor)
  - 1) technological progress is not fully utilised as soon as it's available, technological adoption and utilisation **takes time** and is, in general, a slow process because of various **economic, legal, and societal issues. (Friction)**
  - 2) Developed countries workers have **more tools to adapt to increase productivity**
  - 3) **Technology can create jobs**, innovation and competitiveness increase.

(4.) Literature Review Automation

- Automation and AI have significant implications for **labour demand**, **wages**, and **employment**.
- **Displacement effect** of automation reduces the demand for labour and wages.
- However, the **productivity effect**, driven by cost savings and increased efficiency, can counterbalance this by creating new labour demand in non-automated tasks.
- The **deepening of automation** and **capital accumulation** further increase the demand for labour.
- Automation tends to reduce the **share of labour in national income**.
- The creation of **new labour-intensive tasks** plays a crucial role in offsetting displacement effects.
- **Mismatch between technology and skills**, which hinders labour adjustment, exacerbates inequality, and limits the productivity gains of automation and new tasks.

(5.) Automation Friction Models

- Understand **how automation** and more specifically LLM Artificial Intelligence **will affect the labour market in the next 30 years.**

- **30-year** period to allow a **full generation of workers** to experience these scenarios during their working lives (from 30 years old to 60 years old).

- **(SAF) 3 different speeds of development of automation.**
  These are fast, medium and slow speeds.

TOT in Millions (Populati		0.60%
2007	1265.014336	
2008	1275.158995	0.008019402
2009	1284.417966	0.007261033
2010	1293.62546	0.007168612
2011	1300.343153	0.00519292
2012	1308.279449	0.006103232
2013	1315.850836	0.005787286
2014	1324.118928	0.006283457
2015	1332.408337	0.006260321
2016	1340.853656	0.006338386
2017	1348.503922	0.005705519
2018	1356.091105	0.005626371
2019	1363.576796	0.00552005
2020	1371.703863	0.005960109
2021	1374.719763	0.002198652

Labour Force in thousansac		0.66%
2007	602.9238	
2008	609.4878	0.010886948
2009	613.9418	0.007307775
2010	616.7987	0.004653373
2011	620.7932	0.006476181
2012	627.8618	0.0113864
2013	631.9451	0.006503501
2014	636.8384	0.007743236
2015	642.3706	0.008686976
2016	649.4793	0.011066353
2017	654.7323	0.008088018
2018	662.2333	0.011456591
2019	669.091	0.010355414
2020	656.8706	-0.01826418
2021	666.4569	0.014593894
2022	678.9779	0.018787411

Unemployment Rat		-1.18%
2005	6.863361	
2006	6.353157	-0.07434
2007	5.858229	-0.0779
2008	6.187845	0.056265
2009	8.313182	0.34347
2010	8.534652	0.026641
2011	8.126883	-0.04778
2012	8.10759	-0.00237
2013	8.013531	-0.0116
2014	7.455067	-0.06969
2015	6.888383	-0.07601
2016	6.470102	-0.06072
2017	5.940654	-0.08183
2018	5.491814	-0.07555
2019	5.418824	-0.01329
2020	7.164883	0.322221
2021	6.163188	-0.13981
2022	5.002881	-0.18826

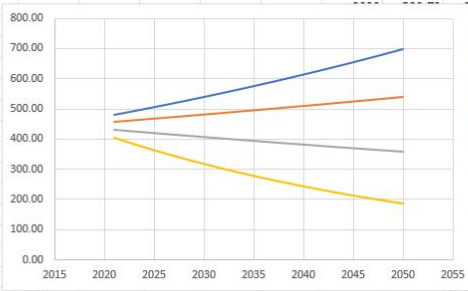
Working Population	
2007	575.5815
2008	570.7661
2009	577.9757
2010	578.6322
2011	569.1855
2012	574.276
2013	580.5877
2014	585.2062
2015	590.894
2016	601.0602
2017	609.6318
2018	619.3861
2019	629.3426
2020	620.7965
2021	630.3428
2022	630.3299

WO.Ag Pop 15-64 (MM)	
2007	822.259
2008	828.853
2009	834.872
2010	840.857
2011	845.223
2012	850.382
2013	855.303
2014	860.677
2015	866.065
2016	871.555
2017	876.528
2018	881.459
2019	886.325
2020	891.608
2021	893.568

% of Labour Force		0.02%
2009	0.477992224	
2010	0.476798516	-0.00249734
2011	0.477407213	0.001276632
2012	0.479914135	0.00525112
2013	0.480255879	0.000712094
2014	0.480952569	0.001450664
2015	0.482112414	0.002411558
2016	0.484377469	0.004698188
2017	0.485524951	0.002368982
2018	0.48833983	0.005797601
2019	0.490688168	0.004808819
2020	0.47887202	-0.02408077
2021	0.484794733	0.012368049

	Service Sctr (MM)	LOW.A	MID.A	HIGH.A
	448.25			
2021	460.61	480.17	456.5327	431.8778	405.121191
2022	466.58	486.40	459.1792	429.1471	394.366737
2023	472.63	492.70	461.841	426.4337	383.897774
2024	478.75	499.08	464.5183	423.7374	373.706723
2025	484.95	505.55	467.2111	421.0582	363.786206
2026	491.24	512.10	469.9195	418.3959	354.129042
2027	497.60	518.73	472.6437	415.7504	344.72824
2028	504.05	525.46	475.3836	413.1217	335.576993
2029	510.58	532.26	478.1394	410.5096	326.668678
2030	517.20	539.16	480.9111	407.914	317.996846
2031	523.90	546.15	483.699	405.3348	309.555218
2032	530.69	553.22	486.503	402.7719	301.337684
2033	537.56	560.39	489.3232	400.2253	293.338295
2034	544.53	567.65	492.1598	397.6947	285.551259
2035	551.59	575.01	495.0129	395.1801	277.97094
2036	558.73	582.46	497.8824	392.6815	270.591851
2037	565.97	590.01	500.7687	390.1986	263.408649
2038	573.31	597.65	503.6716	387.7314	256.416133
		.40	506.5914	385.2799	249.609243
		.24	509.5281	382.8438	242.983051
		.19	512.4818	380.4231	236.532759
		.23	515.4527	378.0178	230.253698
		.39	518.4407	375.6276	224.141323
		.65	521.4461	373.2526	218.191209
		.01	524.469	370.8925	212.399047
		.49	527.5093	368.5474	206.760647
		.07	530.5673	366.2172	201.271924
		.77	533.643	363.9016	195.928907
		.57	536.7365	361.6007	190.727727
		.50	539.8479	359.3144	185.664618

Employed in the Service Sector	LOW	MID	HIGH
0	95.75%	95.75%	95.75%
1	95.08%	94.60%	93.80%
2	94.40%	93.46%	91.90%
3	93.74%	92.33%	90.03%
4	93.07%	91.22%	88.19%
5	92.42%	90.12%	86.40%
6	91.76%	89.04%	84.64%
7	91.11%	87.96%	82.92%
8	90.47%	86.90%	81.23%
9	89.83%	85.86%	79.58%
10	89.20%	84.82%	77.96%
11	88.57%	83.80%	76.37%
12	87.94%	82.79%	74.82%
13	87.32%	81.79%	73.29%
14	86.70%	80.81%	71.80%
15	86.09%	79.83%	70.34%
16	85.48%	78.87%	68.91%
17	84.88%	77.92%	67.51%
18	84.28%	76.98%	66.13%
19	83.68%	76.05%	64.79%
20	83.09%	75.14%	63.47%
21	82.50%	74.23%	62.18%
22	81.92%	73.34%	60.91%
23	81.34%	72.45%	59.67%
24	80.76%	71.58%	58.46%
25	80.19%	70.72%	57.27%
26	79.63%	69.87%	56.10%
27	79.06%	69.02%	54.96%
28	78.50%	68.19%	53.84%
29	77.95%	67.37%	52.75%
30	77.40%	66.56%	51.67%



n;'t go through the working age popualtio because of the 15-64 years of age indicator and not 25-64

	Speed of Automation
1.5	Fertility Rate
0.6	Population Growth Rate
100.66%	Growth Rate of the labour force in OECD countries
1.5	Fertility Rate
0.07	Average Unemployment Rate of the last 20y
1.29573%	Service Sector GR per year
0.696	Working population Ratio (REAL RATIO 2022)

Variable

6.820616

0.18	Self Employment Rate
0.05	Baseline Automation

Per 100J

LOW	MID	HIGH	
10	25	50	
0.1	0.25	0.5	
0.33%	0.83%	1.67%	Occupational Swap
0.65			Working Age population 15-64
1.006642			Growth Rate of the labour force in OECD countries
72.38744			Labour Force Participation Rate 15-64 (2021)
0.001643			15-65 Labour Force Participation Avg GR P.C19
0.012957			Service Sector GR (P.C19)
-0.00941			GR Unemployment Rate 25-74
4.246631			Unemployment Rate 2022
0.006315			Job Creation Rate (GR SS - GR LF OECD)
0.01			External Factors

(5.1) Objectives of the SANF Model

- The **transition** from workers to cyborgs
- The **equilibrium** of the gains from automation through UBI
- **Capital allocation** needs division software and workers

→ Where does AI (LLMs) fit in economic equations ?

(5.1) Objectives of the SANF Model

Assumptions

- Follows all the assumptions of the baseline **Solow-Swan Model**
- **No friction** in terms of politics or regulatory issues
- No gap between the adoption of technology and its utilisation:

  → **Innovation = Usage & Adoption**

(5.1) Objectives of the SANF Model

Capital Allocation (Ks, Kw)

Capital allocation decisions are based purely on **expected returns**. However, given that a **company' output is directly affected by UBI**, efficient use of capital until a certain point involves the **allocation of capital towards workers (Kw)**

Labour (Lc, Lh)

As technological advancements occur, there is an **expected decrease in Lh and an increase in Lc**. The extent to which workers can move from Lh to Lc is determined by **multiple factors**, one being the **adoption levels of technology**, the **allocation of Capital to workers** and the **speed of development (SD)** in AI and automation software.

Automation (Technology) Development Speed (AD)

An increase in AD directly leads to a **1-to-1 increase in productivity**, an increase in AD r**educes capital allocation towards labour** and increases **UBI need** due to its negative effect on unemployment.

(5.1) Model & Equations

1. **Output function:**

$$Y = A \cdot (K_s^{\alpha}) \cdot ((L_c \cdot K_w)^{(1-\alpha)}) - \text{UBI}$$

Where:

- Y is the maximum output per country level.
- A is the technology level.
- K_s is the capital allocated to software.
- K_w is the capital allocated to workers (for training and reskilling).
- L_c is the labor performed by competitive workers using technology.
- α is a constant.
- UBI is the Universal Basic Income, a necessary social welfare expense that covers those who don't work, can't retrain, and will never join the workforce again. It is a fraction of Y, hence subtracted from Y.

2. **Technology level function:**

$$A = A_0 \cdot \text{AD}$$

Where:

- A is the technology level.
- A_0 is the initial technology level.
- AD is the speed of automation development.

3. **Speed of automation development function:**

$$\text{AD} = \lambda \cdot K_s$$

Where:

- AD is the speed of automation development.
- K_s is the capital allocated to software.
- λ is a constant.

4. **Reinstatement Effect function:**

$$\mathrm{RE} = \delta \cdot K_w$$

Where:

- RE is the reinstatement effect of retraining displaced workers.
- K_w is the capital allocated to workers (for training and reskilling).
- δ is a constant.

5. **Productivity Effect function:**

$$\mathrm{PE} = \gamma \cdot (K_s + K_w)$$

Where:

- PE is the productivity effect from capital investment in technology.
- K_s is the capital allocated to software.
- K_w is the capital allocated to workers (for training and reskilling).
- γ is a constant.

6. **Labour force transition functions:**

$$\frac{dL_c}{dt} = \text{RE} \cdot L_h - \text{DE} \cdot L_c$$

$$\frac{dL_h}{dt} = \text{DE} \cdot (L_c + L_h) - \text{RE} \cdot L_h$$

Where:

- L_c is the labor performed by competitive workers using technology.
- L_h is the labor performed by workers who are not competitive.
- RE is the reinstatement effect of retraining displaced workers.
- DE is the displacement effect.

7. **Universal Basic Income function:**

$$\text{UBI} = \theta \cdot Y + \mu \cdot U$$

Where:

- UBI is the Universal Basic Income.
- Y is the maximum output per country level.
- θ is the portion of the output Y directed towards UBI.
- U is the unemployment rate.
- μ is the portion of the unemployment rate U directed towards UBI.

(5.2) SAF Model : Main Ideas & Scenarios

- Players in the Game:
  - **The government & institutions (regulators)**

    → Increase total welfare while keeping societal stability
  - **The Service Sector companies**

    → Seeking profit maximisation, need for automation influenced by the industry and by the market (other companies/competitors)
  - **Employees & Citizens**

    → Seeks welfare stability, job security and a future guarantee for his children.

(5.2) SAF Model : Main Ideas & Scenarios

- **The Cautious March** - Low Speed of AI Development Scenario (LSD)
  - **AGI is not achieved in the next 30 years (until 2050) - No need for adaptation**
- **The Technological Sunrise** - Medium Speed of AI Development (MSD)
  - **AGI discovery & commercial use starts in 2040 - Government can adapt to the AGI revolution**
- **The Blitz of Intelligence** - High Speed development of AI Scenario (HSD)
  - **AGI discovery & commercial use starting in 2030 - Government can't adapt**
- **Why do I Use AGI ?**

(5.2) SAF Model : Main Ideas & Scenarios

- 1. Dimensions Exploration (Societal, Economic, Financial, Political, Aditional & Personal)

Dimensions	Variables	Factors	Detailed Trends in the Long Term
Societal Dimension	Demographics	Age distribution	Aging population
	Demographics	Population growth rate	Population decline
	Demographics	Migration patterns	Increased immigration
	Social norms	Gender roles	Gender equality
	Social norms	Social etiquettes	Changing cultural norms
	Social norms	Norms around family structure	Nontraditional family setups
	Cultural values	Individualism vs. collectivism	Shift towards individualism
	Cultural values	Attitudes towards authority	Increased questioning of authority
	Cultural values	Cultural diversity acceptance	Embracing multiculturalism
	Technological adoption	Technology access and usage	Universal access to technology
	Technological adoption	Digital literacy	Increased digital skills
	Technological adoption	Adoption of emerging technologies	Integration of AI and robotics
	Environmental impact	Pollution levels	Stricter environmental regulations
	Environmental impact	Resource consumption	Shift towards sustainable practices
	Environmental impact	Ecological footprint	Conservation and preservation
	Urbanization	Rate of urban growth	Rapid urbanization
	Urbanization	Urban infrastructure development	Smart city initiatives
	Urbanization	Urban planning policies	Sustainable urban planning
	Infrastructure	Transportation networks	Improved transportation systems

(5.2) SAF Model : Main Ideas & Scenarios

- 2. Dimensions Selection
  - GDP growth → Consumer spending → *Slow & Fast Automation?*
  - Interest Rates → CB Policies → *Slow & Fast Automation?*

Societal Dimension	Factor	Fast Automation Development	Slow Automation Development	Economic Dimension	Factor	Fast Automation Development	Slow Automation Development	Financial Dimension	Factor	Fast Automation Development	Slow Automation Development
Demographics	Age Distribution	Automation can potentially alleviate the issues tied to an aging population by supplementing or even replacing human labor.	Aging population remains a challenge; manual labor demand remains high.	GDP Growth	Investment Levels	Rapid increase due to attraction of hightech and AI industries.	Steady increase due to balanced investment activities.	Interest Rates	Central Bank Policies	Quick monetary policy adjustments due to dynamic financial environment.	Gradual monetary policy adjustments in response to slower changes.
	Population Growth Rate	Automation might contribute to population decline if the economy becomes more techfocused and less laborintensive.	Population decline continues at a slower pace; there might be more need for labor in the economy.		Consumer Spending	Potential increase due to productivity gains and cost reductions from automation.	Steady growth in consumer spending tied to income growth.		Monetary Policy Tools	More frequent finetuning of interest rates to manage economic effects of rapid automation.	Gradual finetuning of interest rates.
	Migration Patterns	Potential decrease in immigration due to less demand for foreign labor.	Increased immigration continues as foreign labor still in high demand.		Export Performance	Improved due to enhanced competitiveness from automation.	Slow and steady improvement in export performance.		Borrowing Costs	Potential decrease due to technologyenhanced lending practices.	Steady borrowing affordability.
Social Norms	Gender Roles	Greater gender equality as automation can remove physical labor constraints.	Progress towards gender equality continues but might be slower due to persistent labor constraints.		Government Policies	Increased focus on tech and AI policies to support automation.	Continued diverse economic policies.	Stock Market Performance	Stock Indices	Possible increase in volatility due to rapid tech sector growth and adjustments in other sectors.	Steady stock market volatility.
	Social Etiquettes	Changing cultural norms accelerate due to technologyenabled communication and interaction.	Changes in cultural norms progress but at a slower pace.		Technological Advancements	Rapid GDP growth due to direct impact of tech advancements.	Steady GDP growth influenced by incremental technological advancements.		Market Capitalization	High growth in tech sector, potential decline in other sectors.	Steady growth in market valuation.
	Norms Around Family Structure	More nontraditional family setups due to flexibility offered by automation.	Slow change towards nontraditional family setups.		Labor Market Conditions	Significant changes in workforce dynamics due to automation.	Gradual change in workforce dynamics.		Investor Sentiment	High confidence due to opportunities in tech sector, may be offset by worries about other sectors.	Steady investor confidence and sentiment.

(5.2) SAF Model : Main Ideas & Scenarios

- 3. The 30 Topics Creation (Brainstorm)

1	Workforce Transition Challenge	Discuss how various aspects of society and individual's lives, such as education and income levels, would need to adapt to the changing nature of jobs.
2	Retraining & Reskilling	Talk about the necessity and strategies of retraining and reskilling the workforce, focusing on the aspects of personal education and the role of public and private investment.
3	Job Displacement & Creation	(Reinstatment Effect) Highlight the potential effects of automation on job displacement and creation, considering economic, technological, and financial dimensions.
4	Private & Public Investment	Discuss how private and public investments could shape the speed and implications of automation, with a particular focus on the economic and financial dimensions.
5	Job Stagnation	Consider the potential for job stagnation under various scenarios, examining aspects from the personal, economic, and financial dimensions.
6	Strain on the Labour Market Adaptation	Analyze the pressure on the labour market to adapt quickly to technological changes, and how this might be influenced by societal, personal, and political factors.
7	Technological Inequality	Discuss the risks and implications of inequality in access to and benefits from technology, particularly in relation to AI and automation.
8	Access to AI	Examine the potential barriers to accessing AI and how they might be overcome, considering aspects from all dimensions.
9	Gains from Automation	Explore the potential gains from automation across various dimensions, including improved productivity, economic growth, and societal benefits.
10	Job Polarisation	Discuss the risk of job polarization due to automation, considering aspects from the personal, economic, and societal dimensions.
11	Legal Issues	Discuss the legal challenges posed by fast and slow automation, focusing on the political dimension and its interaction with technological and economic factors.
12	Regulatory Gaps	Analyze the potential gaps in regulation as automation progresses, focusing on the political and technological dimensions.
13	Universal Basic Income (UBI)	Explore the concept of UBI as a potential response to job displacement caused by automation, and discuss the implications across all dimensions.

(5.2) SAF Model : Main Ideas & Scenarios

- 4. Cross Matrix Relationship Between the best 9/30 topics.

	Legal	Investment	Access	Labour Market
Legal		How might legal issues affect investment in AI technology?	How do legal regulations shape access to and utilization of AI?	What are the legal impacts on labor market reactions?
Investment	How might investment in AI technology affect legal issues?		How does investment shape access to AI?	What is the impact of investment on the labor market?
Access	How does access to AI relate to legal issues?	How does access to AI depend on investment?		How does access to AI affect labor market reactions?
Labour Market	How does the labour market influence legal issues?	How does the labour market react to investment?	How does the labour market benefit from access to AI?	

(5.2) SAF Model : Main Ideas & Scenarios

- 5. The 6 Topics of scenario creation

1- Legal & Government	2 - Technology & Access	3 - Worker
Legal Issues, Regulatory and responsibility of LLMs, Market competition policies, Government Policies & Intervention, Trade Agreements and protection	Future of AI & AGI, tools of automation, Technological, Control, Access & utilisation of AI (LLMs)	Reskilling & Retraining, Job Displacement & Creation, Skill Gap increase
4 - Labour Market	**5 - Economy**	**6 - Society**
Labour Market Reactions, Inequality	Gains from Automation, Inequality, productivity levels, public & Private Investment	Ethical Concerns, Public reaction & Adoption, Trust in Governments

(5.2) SAF Model : Main Ideas & Scenarios

- 6. Topic Exploration depending on the speed of automation

Theme	High Speed Automation Development	Medium Speed Automation Development	Low Speed Automation Development
Legal Issues, Regulatory and responsability of LLMs, market competition policies	There are no legal issues associated with automation development due to comprehensive regulations and legislation in place.	There are occasional legal challenges and debates regarding the implementation and regulations of automation technologies.	There are significant legal challenges and hurdles associated with automation development due to limited regulations and legislation. to protect the consumer governments will force companies and business to distribute the gains service automation. companies that do not comply will be forced to relocate or adapt the operations.
Private & Public Investment on AI Technology,	Private companies and investors heavily invest in automation technologies, driving rapid advancements and innovation.	Private capital and investment in automation are present but not as substantial as in highspeed development, leading to slower progress.	Private capital investment in automation is absent, and the government assumes complete control over its development, including financial backing.
Control & Access to AI	There is a robust control framework in place for OPEN AI, ensuring responsible and ethical utilization of AI technologies. Governments and international bodies collaborate to monitor and address any potential misuse of AI. Government lacks speed in terms of retraining programs and The speed of retraining & job creation doesn't match the speed of job displacement.	Governments take measures to address the riskiest AI applications and establish institutions to monitor and regulate AI usage, albeit with some limitations in scope and effectiveness. Access to AI is not fully monitored: Although there is some monitoring, AI usage is not comprehensively regulated, allowing for organic innovation and profitseeking companies to participate in the development process.	The government exerts complete control over AI usage and development, establishing a centralized entity or institution to oversee and regulate global or national AI activities.
Labour Market Reactions, labour stagnation, cost of living, wealth distribution, Poverty Rates	IN THESIS	IN THESIS	IN THESIS
Gains from Automation, productivity levels,	Profit seeking enterprises appear everywhere but not all are good and seek social welfare increase.	Profit from Automation is somehow redistributed through some sort of taxation system of usage of AI and automation.	The gains derived from automation are wholly owned and controlled by the government, which redistributes them to benefit society at large.

(5.3) Conclusion of Friction Models

- ➔ Goal of the friction model is to understand **how we should create and apply friction to automation.**

- ➔ Understand the importance of the **quality** and **timing** of this friction that will allow societies to **reap the rewards from AGI/AI automation without suffering from it.**

- ➔ Next steps is to create **better economic models** incorporating AI & LLMs into the known equations as well as the possible solutions.

(6.) Policy Recommendation

- **Education & Reskilling**
  - promote a **high degree of digital AI literacy** across all levels of education.
  - Every single worker that wants to remain **relevant & Competitive** for the future, the concept of lifelong learning needs to be ingrained in societies

- **Regulation & Legislation → Deployment**
  - An implementation of a comprehensive globally agreed regulation needs to be discussed & implemented as soon as possible. Unite countries in developing standardised AI practices and policies.

(6.) Policy Recommendation

❖ Transparency in AI implementation

- ➢ Draft **clear** and **constantly** updated public guidelines to ensure communication about **AI accessibility to the general public**
- ➢ Systems/institutions distinguishes between human-created and AI created-content.

❖ Stimulating the AI Economy

- ➢ **Recognize** the transformative power of AI and align policies to **harness** its potential while **mitigating** its disruptive impact. → UBI
- ➢ **One person businesses** in developed countries.

❖ Public Engagement & Protection

- ➢ To enjoy the **gains from automation** and remain competitive with other nations, the government and institutions must cultivate **public understanding and acceptance of service automation**.

(7.) Discussion & Conclusion

- **COVID-19**
- **Alignment Problem**
- **Population Collapse**
- **Personal Opinion on Service Automation**

Questions & Answers

Thank you for your Attention

(3.) Artificial Intelligence & Large Language Models (LLMs)

- **Artificial Intelligence & Field:**
  - Creation of systems capable of performing tasks that **require human intelligence**

- **LLM in the labour market**
  - Automation of tasks, New job creation, Improvement of existing job, Ethical considerations

(4.) Literature Review Automation

- Division of Tasks (Routine & Non-Routine) : Substitution (RT) & Complementarity (NR) Effect through computerization
- Productivity effect, Displacement Effect & Reinstatement Effect
- Task Content of Production → Automation moves tasks from labour to capital
- Robot Adoption, Late Adopters,
  - Increase use & adoption of robots may increase employment
  - Densification of robots in industries leads to an increase in the total factor of productivity, wages and reduces output prices.
  - French manufacturing firms who adopted robots reduced their labour share and share of production workers, and increased their productivity but this effect was completely offset by the declines in competitors' employment
  - strong worker protections, which tend to be developed countries, an increase in use and adoption is not associated with falling employment and may lead to a rise in employment
- Wage inequality
  - high-skill workers with tertiary education were more likely to use computers while working, suggesting that computer technology is complementary to human capital
  - a significant portion of the rise in U.S wage inequality over the last four decades has been driven by automation, which displaces certain worker groups from employment opportunities for which they had a comparative advantage"
  - As a matter of fact, "50-70% of the changes in the U.S wage structure between 1980 & 2016 are accounted for by the relative wage declines of worker groups specialised in routine tasks in industries experiencing rapid automation
  - Routine tasks workers saw the strongest wage inequality effects from automation
- Occupational vs Task Based Approach
  - 9% are at high risk of being automatable (Artnz & al, 2016) - Task Based
  - 47% are at high risk of being automatable (Frey & Osborne, 2017) - Occupation Based
- Jobs at risks =/= Jobs lost
  - technological progress is not fully utilised as soon as it's available, technological adoption and utilisation takes time and is, in general, a slow process because of various economic, legal, and societal issues. Especially in developing countries where labour and worker protection are high and technological progress can't move forward on a steady path.
  - Developepd countries worekrs have more tools to addapt to increase productivity
  - Technology can create jovbs, innovation and competitiveness increase.
  - necessity to view automation and technological change as a task substitution or replacement disruptor rather than a complete occupational labour disruptor.
- Education & Skill Demand
  - One of the ideas is that low-skilled workers are likely the ones that will suffer the adjustment cost simply because the degree of automatability of their jobs is higher compared to high-skilled workers. These adjustment costs, depending on the institution's strength and worker protection law will have different effects in developed countries. To limit this almost guaranteed rise in wage inequality companies and governments need to ensure that there is "sufficient re-training
  - in an attempt to quantify the occupational risk of automation, created an indicator called ARI (Automation Risk Index) by studying almost 1000 occupations which assesses the risk of a job being automated by a robot
  - This indicator is based on the idea of the ability (skill level), the number of tasks a robot can perform in each occupation and to what degree those tasks are important for that occupation. This indicator allows us to have an overview of how difficult it is for a person to switch occupations without the need for considerable retraining. In addition to this, they computed a resilience index (RI) which attempts to figure out how to properly compare existing jobs, "which measures how feasible (in terms of retraining effort) and how convenient (in terms of ARI) is to switch from one job to another" according to the researchers. With these two indexes, these economists did the first steps to help, assess & understand the overall risk in the employment of the working population and to aid future economists like myself to think about the possible solutions and effects of automation in the working population.

(4.) Literature Review Automation

- ➔ Rise of Service Occupations
  - There is an exceptional rise in employment and earnings within service occupations compared to low-skill jobs in the last 25 years
  - Because computer technology became progressively cheaper, routine tasks saw a decrease in wages which led low-skill workers to redirect towards service occupations which are challenging to automate because they rely on dexterity, flexible interpersonal communication, and direct physical proximity (Autor & Dorn, 2013).
  - t a critical role for changes in labour specialisation, driven by the automation of routine task activities, as a significant factor behind the rise in employment and wage polarisation in the United States, and potentially in other countries as well."
  - He expects a strong mid-skill job stratum resilience that will combine vocational skills coming from a well-founded and supportive US educational system that acknowledges the risks of automation. AUtor. 2015)
- ➔ Low skill vs High skill automation
  - automation does indeed displace the labour it directly affects, depressing the wages and creating ripple effects that may end up affecting other types of labour. (A & R 2018)
  - Automation generally produces a positive productivity effect that raises the overall price of factors of production (Acemoglu & Restrepo, 2018b)
  - the effects of automation on wages are potentially ambiguous, we also establish that it always has an unambiguous impact on inequality. In particular, low-skill automation always increases wage inequality, whereas high-skill automation always reduces it." (Acemoglu & Restrepo, 2018b).
- ➔ AI & Automaotin
  - These various sectors are in need of AI workers, however, these establishments that adopt AI technology, reduce the hiring of non-AI positions while changing the skill requirement of the remaining occupations towards a more AI-oriented skill set (Autor, Hazell & Restrepo, 2022).
  - "the aggregate impacts of AI-labour substitution on employment and wage growth in more exposed occupations and industries is too small to be detectable"