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Designing Ethical Urban Economies: A Dual-Phase Framework for Neurorights, Duty Vectors, and Civic Accountability

Foundational Principles: The Dual-Phase Methodology and Core Concepts

The development of a fair and AI-aligned smart-city economics requires a robust architectural blueprint that moves beyond abstract ethical principles to concrete, verifiable mechanisms. This framework is built upon a dual-phase methodology and two consistent but contextually adaptable core concepts: Neurorights and Duty Vectors. The methodology prioritizes theoretical rigor before empirical application, ensuring that any proposed system has mathematically defined boundaries of acceptable behavior before it is ever tested in the real world. This approach is designed to prevent hidden abuse channels and unintended consequences, thereby building a foundation of trust and accountability. The core concepts provide the vocabulary and metrics to operationalize complex ethical ideals like cognitive protection and social contribution, making them enforceable within the city's digital economy.

The proposed dual-phase methodology consists of a sequential process: starting with formal mathematical frameworks and followed by tightly coupled empirical validation pathways [148]. The first phase, establishing formal frameworks, involves translating desired properties of the economic system into rigorous mathematical constructs. These include optimization constraints that define desirable outcomes, monotonicity conditions that ensure behaviors do not regress over time, and verifiable corridor envelopes that bound acceptable performance within specified limits [120][157]. By defining what "good" must mathematically mean upfront, this phase provides a set of unambiguous, provable invariants. This is a critical step because it codifies protections directly into the protocol itself, moving beyond aspirational goals to enforceable rules. For instance, instead of vaguely stating that a system should not increase user stress, a formal constraint would specify a maximum allowable threshold for cognitive load that no monetary rule can exceed. This preemptive structuring prevents the emergence of covert control mechanisms or exploitative features that could otherwise be introduced under the guise of efficiency or convenience [14]. The concept of "corridor envelopes," mentioned in several topics, is particularly powerful as it mathematically enforces bounds on permissible behavior rather than aiming for a single optimal state, allowing for flexibility within safe boundaries [158].

Once a formal model is established, the second phase—empirical validation—is initiated. This phase involves deploying the system in controlled civic pilots, conducting randomized A/B tests, and establishing continuous feedback loops with citizens and auditors [44] [59]. The purpose of this empirical testing is twofold: first, to validate whether the abstract mathematical models behave as intended in the complex and dynamic reality of human and ecological systems; and second, to ensure the models remain calibrated and relevant over time, preventing them from drifting away from actual human needs and environmental limits. For example, a formal constraint might define a "safe" cognitive load, but an empirical pilot using physiological monitoring devices could measure whether citizens *actually* experience less stress when using the system. This iterative cycle of theory and practice creates a virtuous loop where formal theory provides the guardrails for responsible experimentation, and empirical results provide the crucial data needed to refine and improve the theory. This entire process embodies a cybernetic principle: designing a system to regulate itself towards a desired state based on feedback from its environment.

Central to this framework are two core concepts that provide the substance for the formal constraints and empirical measurements. The first is **Neurorights**, defined consistently across all topics as a bundle of fundamental protections encompassing five key dimensions: protection against covert control, the right to bounded cognitive load, the right to informed consent, the right to revocability, and the right to auditability [14] [89]. This definition is grounded in emerging legal precedents and scholarly discourse. Protection against covert control aligns with efforts to combat manipulative AI, as seen in the EU AI Act's focus on high-risk systems [4], and is explicitly mandated by Chile's constitutional amendment prohibiting the influence of conduct without consent [14]. The right to bounded cognitive load is a critical component, not merely to prevent overload but to preserve the capacity for reflection and coherent intent, a concept known as cognitive sovereignty [2]. The extensive body of research on measuring cognitive load—from physiological signals like EEG and heart rate variability to subjective questionnaires like the NASA-TLX—provides a rich toolkit for operationalizing this right [113][122][181][184]. Finally, the procedural rights of informed consent, revocability, and auditability are essential for transparency and agency. The Chilean framework's requirement for specific, written consent for commercial neurotechnology use serves as a powerful model [14], while the Emotiv Inc. court case highlighted the inadequacy of consent obtained through adhesion contracts [89]. Verifiable audit trails, potentially supported by blockchain technology, are crucial for providing non-hearsay digital records that can be used in forensic investigations, ensuring that promises made by the system are kept [37] [78] [158].

The second core concept is the **Duty Vector**, a novel abstraction designed to quantify a citizen's net beneficial contribution to society and the environment. It is defined as a multi-dimensional measure that captures actions across four primary domains: ecological repair, caregiving, safety contributions, and knowledge creation [5] [216]. This concept acts as a counterweight to traditional GDP-centric metrics by seeking to internalize positive externalities. The dimension of **ecological repair** can be operationalized using existing Environmental, Social, and Governance (ESG) reporting standards [177]. Metrics could include quantifiable improvements such as carbon sequestration rates, increases in local biodiversity, or reductions in air and water pollution, which could be measured via satellite data, IoT sensors, or even analysis of social media data [46] [141]. The dimension of **caregiving** is more complex but equally vital. It encompasses a wide range of often undervalued activities, from caring for children and the elderly to supporting friends and neighbors [130][200]. Operationalizing this requires moving beyond simple time-tracking to incorporate qualitative assessments, validated burden indices like the Caregiver Burden Index (CareBI) [208], or proxy measures such as reduced hospital readmission rates for care recipients [131]. The dimensions of **safety** and **knowledge contribution** are more straightforward to quantify. Safety contributions could be measured by participation in community policing initiatives, road safety education programs [35], or the use of active vehicle safety systems in transportation [133]. Knowledge contribution could be tracked through verifiable outputs like open-source code commits, academic publications, or hours spent in quality apprenticeships, which are recognized as valuable for workforce development [26]. Together, these two core concepts—Neurorights providing a cognitive constitution and Duty Vectors quantifying net beneficial action—form the bedrock upon which the ten specific research topics are built, providing both a defensive shield against harm and an offensive mechanism for promoting collective well-being.

Core Concept	Dimension / Component	Description	Key Operationalization Methods & Sources
Neurorights	Protection Against Covert Control	Prohibits the use of technology to manipulate human conduct without explicit consent.	Legal frameworks (Chilean Constitution [14]), regulation of algorithmic bias [4].
Neurorights	Bounded Cognitive Load	Ensures users have sufficient mental bandwidth for reflection and decision-making, protecting cognitive sovereignty [2].	Physiological monitoring (EEG, HRV) [122125], subjective scales (NASA-TLX [185]), behavioral metrics [180].
Neurorights	Informed Consent, Revocability, Auditability	Guarantees user agency, the ability to withdraw consent, and verifiable oversight of system operations.	Specific written consent for commercial use [14], adhesion contract invalidity [89], blockchain-based audit trails [37] [158].
Duty Vectors	Ecological Repair	Measures actions that restore, maintain, or enhance ecosystems.	ESG/Sustainability metrics (carbon capture, biodiversity) [5] [177], remote sensing, IoT data [141].
Duty Vectors	Caregiving	Quantifies the provision of support and care to others, addressing caregiver burden [130].	Time tracking, validated burden indices (CareBI [208]), financial impact surveys [200], proxy health outcomes [131].
Duty Vectors	Safety Contribution	Measures participation in activities that enhance community and individual safety.	Participation in road safety programs [35], workplace risk assessments [6], use of active safety systems [133].
Duty Vectors	Knowledge Contribution	Tracks the creation and dissemination of useful information and skills.	Open-source contributions, publication metrics, verified apprenticeship hours [26], teaching evaluations.

Economic Protocols and AI Alignment

The first cluster of topics focuses on redesigning the fundamental rules of the city's digital economy to embed fairness, prevent misuse of AI, and create new forms of value. These topics form the foundational layer of the framework, establishing protocols that govern monetary transactions, AI agent behavior, and the allocation of capital based on ethical principles. They are designed to move beyond traditional market mechanisms, which often fail to account for cognitive harm and ecological damage, and instead create a system where ethical considerations are encoded as enforceable constraints. This cluster includes Neurorights-indexed monetary protocols, anti-weaponization filters for AI agents, a consentful attention-economy tax, and a knowledge-factor liquidity model. Each topic addresses a different aspect of the digital economy, collectively working to build a more resilient and equitable financial architecture.

Neurorights-Indexed Monetary Protocols (Topic 1) serves as the foundational constraint for all other economic mechanisms. Its goal is to tie every monetary rule—such as fees, transaction limits, and sanctions—to explicit neurorights constraints, ensuring that no feature of the payment logic can increase cognitive load, coercion, or mental harm beyond mathematically bounded thresholds [14]. This formalizes the principle that "no economic feature may weaponize stress or attention" into a verifiable invariant within the protocol itself [89]. Operationally, this would involve creating a formal model where each potential monetary rule is evaluated against a set of mathematical inequalities derived from the neuroright to bounded cognitive load. For example, a fee for late payment might be modeled to ensure it does not trigger a spike in cognitive load that impairs a person's ability to make sound decisions about their finances [152]. The formal framework would need to integrate models of cognitive load, drawing from fields like Cognitive Load Theory (CLT) [114][116], and link them to the parameters of the monetary rule. Empirically, this would be validated through pilot studies measuring physiological and self-reported cognitive states of users interacting with different fee structures, comparing those that comply with the neurorights-indexed model against standard ones. The anchoring in municipal policy contexts, such as welfare or mobility budgets, makes this topic particularly urgent, as punitive fees in these areas can disproportionately harm vulnerable populations [150].

Anti-Weaponization Filters for Monetary AI Agents (Topic 5) extends the principle of formal constraints to the autonomous agents that will increasingly manage financial transactions. The research aims to develop rigorous filters that prevent these AI agents from being repurposed for war, surveillance, or repression [20]. This is achieved by binding each AI agent to a signed "corridor envelope" that specifies allowed energy use, acceptable levels of risk, and, critically, a cap on cognitive load it can impose on individuals [14]. If the agent's behavior violates these predefined mathematical bounds, it is programmed for an automatic shutdown. The key challenge is to design these constraints so that they cannot be silently overridden by a change in governance. This resilience is crucial for maintaining ethical integrity in the face of political shifts. Operationally, this involves creating a formal verification process where the agent's decision-making algorithms are proven to operate within the corridor envelope before deployment. Blockchain technology could play a role here, providing a tamper-evident log of the agent's operations and its adherence to the envelope [158]. Empirical validation would involve adversarial testing, where researchers attempt to induce the agent to violate its constraints, and monitoring its behavior in live environments to confirm that auto-shutdowns occur as expected.

Consentful Attention-Economy Tax (Topic 8) introduces a market-based intervention to address the widespread problem of extractive monetization of human attention. This topic investigates an "attention tax" that would penalize platforms and services that use dark patterns, infinite scroll, and other manipulative techniques to maximize engagement at the expense of user well-being [109]. The revenue generated from this tax would then be automatically redistributed to citizens and public-good projects, effectively creating a financial disincentive for exploitative business models and a direct incentive for services that respect users' cognitive bandwidth [100]. The formal framework would define the "attention tax" as a function of measurable exploitation metrics, such as the density of dark patterns or the average time spent in a state of compulsive scrolling. Empirical validation would require a multi-faceted approach. First, A/B tests could be conducted on different platform designs to quantify the correlation between specific features and reduced mental health indicators, such as anxiety or reduced life satisfaction [159]. Second, longitudinal studies would track changes in community-supportive activities (e.g., volunteering, local events) following the implementation of the tax, to measure the societal benefit of reclaimed cognitive resources. The success of Barcelona's Decidim platform, which fosters participatory democracy, suggests that citizens are willing to engage with platforms that prioritize deliberation over pure engagement metrics [84] [85].

Finally, **Knowledge-Factor Liquidity (Topic 4)** proposes a radical shift in how research and development are funded. It seeks to extend the idea of a "knowledge factor"—a measure of how useful a contribution is—in the context of public good research into a real liquidity model [31]. In this system, researchers whose work demonstrably reduces harm or increases fairness would unlock more compute, storage, and AI assistance for themselves and their city. This creates a virtuous cycle where high-value public goods attract more resources, shifting investment away from speculative ventures or harmful applications. The formal framework would define a "knowledge factor" metric, likely a composite score based on peer review, citation impact, and quantitative measures of societal benefit. This score would then determine the "interest rate" or "credit limit" a researcher receives from the city's liquidity pool. Empirical validation would involve a long-term study comparing the output and societal impact of projects funded through this model versus those funded through traditional grant mechanisms. Success would be measured by the volume and type of public goods produced, such as open-source tools for climate modeling or transparent AI auditing software. This approach draws inspiration from open data initiatives, which have demonstrated significant impacts on innovation and policy by making data freely available [52] [88].

Valuing Non-Market Contributions and Citizen Well-being

A central challenge for modern economies is the undervaluation of non-market activities that are essential for social cohesion and ecological sustainability. This second cluster of topics directly confronts this issue by proposing mechanisms to formally recognize, measure, and compensate contributions that fall outside traditional wage labor. These topics—Duty-Weighted Income, Biosafe Incentives, and Augmented-Citizen Apprenticeship Income—are designed to shift the basis of economic security and opportunity from market productivity alone to a broader measure of a citizen's net beneficial action. They operationalize the "duty vector" concept, aiming to create a more holistic and resilient economic system that rewards care, repair, and knowledge sharing. This cluster is deeply intertwined with the neurorights framework, as many of these proposals are motivated by a desire to protect citizen well-being, particularly cognitive health, in an increasingly technologized world.

Duty-Weighted Income for Care and Repair Work (Topic 2) is the most direct application of the duty vector concept, proposing a partial income calculation based on a citizen's measured contributions to ecological repair, caregiving, mentoring, or safety [216]. The core research goal is to empirically prove that directing more budget toward high-duty vectors leads to measurable improvements in long-term social and ecological stability. Operationally, this requires developing robust metrics for each dimension of the duty vector. For ecological repair, this could involve linking payments to verifiable data from environmental monitoring, such as tree planting verified by satellite imagery or reduction in local pollution levels detected by IoT sensors [46]. For caregiving, it is more complex, as the quality and intensity of care vary widely. Measurement could involve a combination of self-reported hours, validated caregiver burden indices like the Caregiver Burden Index (CareBI) [208], and qualitative assessments from care recipients. The empirical pathway for this topic would be a large-scale, longitudinal pilot program in one or more municipalities. Data would be collected on participants' income, well-being, and the impact of their work on community and environmental health indicators. The ultimate validation would come from demonstrating a statistically significant correlation between higher duty-weighted income and improved outcomes, such as lower rates of elder neglect, increased neighborhood green space, or enhanced community resilience during crises.

Biosafe Incentives for Augmented-Citizen Health (Topic 6) focuses on the unique challenges posed by human augmentation technologies. It proposes defining monetary incentives that reward citizens for staying within formally verified "health corridors" for their augmentation, such as duty cycles, stimulation intensity, and workload [14]. This directly operationalizes the neuroright to bounded cognitive load by replacing vague wellness scores with precise, medically-defined thresholds. The formal framework would involve creating a system of "health corridors" based on medical and physiological research. For example, a corridor for cognitive stimulation might define safe upper and lower limits for neural activity based on EEG data, derived from studies on fatigue and burnout [112][122]. The research would show how aligning rewards with stable physiological ranges can reduce long-term morbidity and burnout in augmented populations [115]. Empirical validation would require a pilot program involving augmented citizens who receive incentives for maintaining their biometrics within the healthy corridors. The study would track key outcomes, including reported stress levels, incidence of burnout symptoms, and long-term health markers. This topic draws on extensive literature regarding the measurement of cognitive load, which provides numerous methods—including wearable sensors and machine learning classifiers—that could be used to create the objective, real-time monitoring required for the system [128][195][196]. The success of virtual health programs like Enhancing Minds in Motion® demonstrates the feasibility of delivering effective health interventions remotely, a prerequisite for scaling such a system [25].

Augmented-Citizen Apprenticeship Income Streams (Topic 10) explores a model where citizens who are augmented can earn structured "apprenticeship income" while training AI systems in safe, non-extractive ways . This model formalizes the training of AI as a valuable public service, directly connecting the creation of a powerful public good with tangible benefits for the individuals who contribute to it. The research goal is to establish formal safeguards against the exploitation of these trainers. The formal framework would need to define strict operational rules for the apprenticeship process. This includes capping cognitive load to prevent exhaustion, guaranteeing mandatory periods of rest, and ensuring that participants retain durable benefits—such as rights, priority access to services, or ongoing dividends—from the models they help train [26]. The operationalization would involve creating a marketplace where organizations needing training data can request specific types of expertise from a pool of augmented citizens. The system would monitor the cognitive load of each participant in real-time, using the same kind of physiological monitoring developed for Topic 6. If a participant approaches their cognitive load threshold, the system would automatically pause their work. Empirical validation would involve a pilot program where augmented citizens participate in AI training. Researchers would measure not only the quality of the training data produced but also the well-being of the participants, comparing them to a control group not receiving apprenticeship income. The framework would also need to explore governance models for the ownership and licensing of the trained models, ensuring that the public benefits are maximized while respecting the intellectual and personal contributions of the trainers.

Governance, Transparency, and Inter-City Cooperation

The third and final cluster of topics addresses the structural and procedural requirements for implementing and sustaining the proposed economic framework. Without robust mechanisms for governance, transparency, and cooperation, even the most sophisticated formal models and empirical validations would lack legitimacy and scalability. This cluster focuses on three critical areas: making resource allocation conditional on ecological benefit (Eco-Monotone Compute Credits), creating a permanent, verifiable record of fairness claims (City-Scale Evidence-Ledger), and fostering collaborative solutions to regional ecological challenges (Cross-City Cooperative Grants). These topics are designed to build the institutional and technical infrastructure necessary to anchor the framework in democratic accountability and collective responsibility, moving beyond isolated municipal actions to address interconnected urban and environmental systems.

Eco-Monotone Compute Credits (Topic 3) introduces a powerful systemic feedback loop that directly links access to a key driver of the modern economy—computational power—to the imperative of ecological repair. The research aims to design a credit system where any increase in computational power available to a citizen or lab must be matched by evidence of an equal or greater ecological benefit [216]. This operationalizes the "ecological repair" dimension of the duty vector at a systemic level. Formally, this would be governed by a hard mathematical "eco-monotonicity" constraint. For instance, if a research lab requests a 10% increase in its compute allocation, it must provide verifiable proof that its associated project will result in at least a 10% equivalent improvement in some ecological metric, such as reforestation, air-quality improvement, or flood-risk reduction. The formal framework would involve creating a standardized unit of ecological benefit, perhaps measured in "tonnes of CO_2 equivalent sequestered" or "quality-adjusted habitat gained." The empirical validation pathway would involve a city-wide pilot program. The city's AI system would monitor compute usage and require labs and citizens to submit regular reports with their ecological impact data. Over time, the system would analyze whether the eco-monotonicity rule has statistically prevented net planetary damage from increased computation, or if it has successfully spurred innovative projects that deliver both computational and ecological gains.

City-Scale Evidence-Ledger for Fairness Claims (Topic 7) is the cornerstone of the framework's commitment to transparency and accountability. It proposes building a public, machine-readable ledger where any claim about the "fairness" of an AI monetary policy must be backed by a bundle of checkable evidence [44]. This evidence would include the underlying datasets, the formal proofs of compliance with constraints, and falsifiable metrics logged over time. The purpose is to enable auditors, civic organizations, and ordinary citizens to independently verify fairness claims without having to trust marketing materials or political rhetoric [59]. The design of schemas for this ledger is a major technical and social challenge, requiring careful consideration of data privacy, interoperability, and usability. Drawing parallels from successful open data initiatives, such as those in Barcelona, which have enabled developers to create innovative urban solutions, highlights the importance of accessible and well-documented data [85] [88]. The formal framework would define the structure of an "evidence bundle," specifying the required components for different types of fairness claims (e.g., demographic equity, cognitive load impact). The empirical validation pathway would begin with a small-scale pilot in a single city department. Researchers would assess the feasibility of generating and logging the required evidence and evaluate the usability of the ledger interface for non-expert users. Success would be measured by the degree to which the ledger allows for independent verification of claims and builds public trust in the city's AI systems.

Cross-City Cooperative Grants for Ecological Restoration (Topic 9) extends the logic of cooperation beyond municipal boundaries to tackle shared ecological problems that no single city can solve alone. The research task is to design grant protocols where AI systems can detect interconnected ecological issues—such as transboundary air or water pollution, shared heat islands, or fragmented wildlife corridors—and propose cooperative funding flows between cities [146]. This moves away from competitive, siloed funding models toward collaborative solutions for regional ecosystems. The formal framework would involve an AI system that integrates data from multiple city sensors and management plans to identify co-beneficial projects. For example, an AI might propose that City A fund a large-scale urban greening project, which would simultaneously reduce heat island effects in City A and improve air quality for City B downwind. The system would then generate a proposal with clear, algorithmically determined benefit-sharing rules, ensuring that all participating cities see a net positive outcome. The empirical validation pathway would involve creating a consortium of neighboring cities willing to participate in a pilot program. The cities would share anonymized environmental data and use the AI-driven platform to propose and fund joint projects. The evaluation would measure the effectiveness of this cooperative model compared to traditional, isolated funding approaches, assessing metrics such as cost-effectiveness, ecological impact, and the level of inter-municipal trust and collaboration fostered by the process. This approach is aligned with global efforts to achieve the Sustainable Development Goals (SDGs) and adapt to climate change, which inherently require multi-level and multi-jurisdictional cooperation [140][175][216].

Synthesis and Implementation Pathways

The ten proposed topics, though distinct in their specific focus, constitute a cohesive and mutually reinforcing socio-technical ecosystem. They are not a collection of isolated ideas but a comprehensive framework designed to reshape the economic foundations of a smart city. The synthesis of these topics reveals a powerful synergy: the formal mathematical constraints provide the rigid, ethical guardrails; the empirical validation pathways ensure these guards are tested and calibrated against reality; and the core concepts of Neurorights and Duty Vectors provide the substance for both theory and practice. The framework's strength lies in its integrated nature, where a violation of a neuroright in one domain (e.g., high cognitive load from a monetary rule) is met with a corresponding mechanism for compensation or correction (e.g., biosafe incentives or duty-weighted income). Similarly, an ecological benefit measured in one system (e.g., carbon sequestered via an eco-monotonicity credit) becomes a valid currency for unlocking another resource (e.g., compute power). This interconnectedness creates a resilient system where progress in one area reinforces the objectives of others, driving the city toward a state of enhanced social, ecological, and cognitive well-being.

However, realizing this vision requires navigating significant implementation challenges. The transition from legacy systems to this new framework within municipal and cooperative contexts will be complex. A clear, phased implementation pathway is necessary. The immediate next step should be the development of a prototype for the **City-Scale Evidence-Ledger (Topic 7)**. This component is foundational to the framework's credibility, as it establishes a baseline of transparency and accountability. By creating a publicly accessible, auditable record of fairness claims and their supporting evidence, the project can demonstrate its commitment to verifiability from the outset. This ledger can then serve as the verification backbone for the other nine topics as they mature from formal models to empirical pilots. The technical design of the ledger schema, drawing on best practices from open government data portals [54] and secure data sharing platforms [43], will be a critical early milestone.

A critical challenge throughout the implementation will be the operationalization of subjective concepts. Dimensions like the quality of caregiving, the extent of community well-being, or the "fairness" of an AI model are inherently nuanced. The framework must grapple with how to incorporate qualitative data, expert judgment, and participatory democratic processes into its quantitative models without sacrificing verifiability. The participatory design methods employed by Barcelona's Decidim platform, which allows citizens to co-create policy proposals, offer a powerful model for integrating community input into the calibration of the system's metrics and constraints [84] [85]. Furthermore, the entire framework's success hinges on the availability of high-quality, interoperable, and trustworthy data. Topics relying on environmental monitoring, cognitive load measurement, or duty vector tracking will face significant hurdles related to data collection, privacy, and potential biases. Establishing a federated data system, similar to the EU's vision for a corporate-driven but GDPR-compliant Digital Single Market, could provide a viable architectural solution for managing data access and privacy across different jurisdictions and stakeholders [102].

Finally, the framework must anticipate and provide governance mechanisms for resolving conflicts. There may be situations where enforcing one neuroright comes into tension with fulfilling a duty vector. For example, a citizen's right to autonomy might lead them to engage in a high-cognitive-load entrepreneurial venture that conflicts with an eco-monotonicity constraint. Or, a city's duty to provide universal broadband access might compete with the ecological costs of powering the necessary infrastructure. The framework needs a clear, deliberative process for resolving such trade-offs, likely involving a hybrid of algorithmic mediation and citizen juries or assemblies. Drawing on OECD guidelines for better regulation practices, which emphasize considering impacts on various facets of people's lives, can inform the development of these conflict-resolution protocols [188]. Ultimately, the path forward requires a commitment to iterative development, deep stakeholder engagement, and a steadfast adherence to the dual-phase methodology. By first rigorously defining the mathematics of a good system and then relentlessly testing it against the complexities of civic life, this framework offers a strategic pathway toward building smart cities that are not just efficient, but truly fair and aligned with human flourishing.

Reference

1. Paradigm Shift in Global Governance of Medical Brain ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12665245/

2. Cognitive sovereignty and neurocomputational harm in ... https://link.springer.com/article/10.1007/s10676-025-09873-y
3. (PDF) The Impact of Artificial Intelligence on Human Thought https://www.researchgate.net/publication/394942120_The_Impact_of_Artificial_Intelligence_on_Human_Thought
4. Cognitive freedom and legal accountability: Rethinking the ... https://www.cambridge.org/core/journals/cambridge-forum-on-ai-law-and-governance/article/cognitive-freedom-and-legal-accountability-rethinking-the-eu-ai-acts-theoretical-approach-to-manipulative-ai-as-unacceptable-risk/45F379C0707D7A415C042BB08088F88F
5. 2024 Environmental Social and Governance Report https://www.petrochina.com.cn/ptr/xhtml/images/shyhj/2024esgen.pdf
6. revolutionizing health and safety: https://www.ilo.org/sites/default/files/2025-04/ILO_Safeday25_Report_r8%2B%282%29%20FULL%20%281%29.pdf
7. Is the Ecological and Environmental Protection Supervision ... https://www.mdpi.com/2071-1050/17/24/11014
8. Industrial Policy for the Sustainable Development Goals https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/09/industrial-policy-for-the-sustainable-development-goals_e022729a/2cad899f-en.pdf
9. CONTENTS https://www.undp.org/sites/g/files/zskgke326/files/2025-12/undp-rbap-the-next-great-divergence-background-papers.pdf
10. The Sustainable Development Goals Report 2019 https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf
11. UNITED NATIONS SUSTAINABLE DEVELOPMENT ... https://unece.org/sites/default/files/2025-12/UNSDCF%20Kazakhstan%20final%20ENG.pdf
12. 2025-26 Bulletin: WashU Public Health https://bulletin.wustl.edu/grad/Bulletin_2025-26_Public_Health.pdf
13. World Social Protection Report 2024–26 https://www.ilo.org/sites/default/files/2024-09/WSPR_2024_EN_WEB_1.pdf
14. Neurorights in the Constitution: from neurotechnology to ethics ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11491849/
15. (PDF) Journal of Digital Technologies and Law, 2024, 2(1) ... https://www.researchgate.net/publication/379181469_Journal_of_Digital_Technologies_and_Law_2024_21_eISSN_2949-2483
16. Challenging Cognitive Load Theory: The Role of Educational ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11852728/

17. Measure, Manage and Maximise Your Impact (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/measure-manage-and-maximise-your-impact_e7b1099d/2238c1f1-en.pdf
18. Interoperability in AI Safety Governance https://www.arxiv.org/pdf/2601.06153
19. OECD Report on Public Communication https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/12/oecd-report-on-public-communication_b74311bc/22f8031c-en.pdf
20. Trustworthy agentic AI systems: a cross-layer review ... https://f1000research.com/articles/14-905
21. A systematic review of multi-factor authentication in digital ... https://www.sciencedirect.com/science/article/pii/S1383762125000748
22. IMF GLOSSARY https://www.elibrary.imf.org/downloadpdf/display/book/9781589066946/9781589066946.pdf
23. Leveraging Blockchain for Ethical AI: Mitigating Digital ... https://www.mdpi.com/1999-5903/17/7/309
24. (PDF) A Quantum-Safe, Interoperable, and Decentralized ... https://www.researchgate.net/publication/394174336_A_Quantum-Safe_Interoperable_and_Decentralized_Payment_Infrastructure_for_the_Post-Classical_Era_as_a_Strategic_Framework_for_Secure_Global_Transactions
25. Enhancing Minds in Motion® as a virtual program delivery ... https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291166
26. Quality Apprenticeships Recommendation, 2023 (No. 208) https://www.ilo.org/sites/default/files/2024-12/1684_SKILLS_Quality_Apprenticeships_WEB.pdf
27. Development of a framework of potential adverse effects of ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12676117/
28. Innovating Assessments to Measure and Support Complex ... https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/04/innovating-assessments-to-measure-and-support-complex-skills_b0255009/e5f3e341-en.pdf
29. Convention on the Rights of Persons with Disabilities https://docs.un.org/en/crpd/c/can/2-3
30. Operational Framework for Primary Health Care - IRIS https://iris.who.int/bitstream/handle/10665/337641/9789240017832-eng.pdf?sequence=1
31. 2nd Country Programme (2021-2025) Evaluation Report https://www.unfpa.org/sites/default/files/board-documents/Serbia_CPE.pdf
32. Environmental-and-Social-Management-Framework. ... https://documents1.worldbank.org/curated/en/336061556558792021/Environmental-and-Social-Management-Framework.docx

33. ENVIRONMENTAL, SOCIAL, AND CLIMATE ... https://www.aiib.org/en/projects/details/2023/_download/Cambodia/CAM_P000452_ESCMP_Outapong_Irrigation_System_Subproject.pdf
34. CLIMATE CHANGE https://www.ilo.org/sites/default/files/2025-05/Addressing-occupational-safety-and-health-challenges-linked-to-climate-change-in-the-agricultural-supply-chains-in-Viet-Nam-WEB-DEF.pdf
35. Applying the multiphase optimization strategy to evaluate the ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11223427/
36. (PDF) Audit Trails and Logging Biometric Authentication for ... https://www.researchgate.net/publication/381727039_Audit_Trails_and_Logging_Biometric_Authentication_for_Data_Security_in_Banking_Using_Reporting_Tools
37. BEATS: Practical Audit Trail in Blockchain Systems https://ieeexplore.ieee.org/iel8/6287639/10820123/11048856.pdf
38. BCDAS: Blockchain-assisted Classifiable Data Auditing ... https://www.sciencedirect.com/science/article/pii/S209672092500034X
39. Towards Compliant and Trustworthy Data Markets ... https://dl.acm.org/doi/10.1145/3772429.3772497
40. Blockchain technology in the banking sector: a content ... https://www.frontiersin.org/journals/blockchain/articles/10.3389/fbloc.2025.1667848/full
41. Decentralized Content Rights in the Age of Generative AI https://arxiv.org/html/2503.14519v3
42. Technology Landscape for Digital Identification https://documents1.worldbank.org/curated/en/199411519691370495/Technology-Landscape-for-Digital-Identification.pdf
43. D1.2 Technical requirements for EOSC secure data sharing and ... https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5146a988a&appId=PPGMS
44. CEC 2025 Annual Report https://www.nyc.gov/assets/civicengagement/downloads/pdf/CEC-2025-Annual-Report-Final.pdf
45. Understanding Support for Municipal Political Parties https://pmc.ncbi.nlm.nih.gov/articles/PMC11315630/
46. Social media data for environmental sustainability https://www.sciencedirect.com/science/article/pii/S259033222300088X
47. How We Might Further Integrate Considerations of ... https://www.mdpi.com/1660-4601/19/19/12017
48. A new environmental public health practice to manage current ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11627177/

49. The Ecology of Engagement: Fostering cooperative efforts ... https://hal.science/hal-04818415v1/file/Health%20Expectations%20-%202022%20-%20Boivin%20-%20The%20Ecology%20of%20Engagement%20%20Fostering%20cooperative%20efforts%20in%20health%20with%20patients%20and.pdf
50. Impact assessment of cooperative intelligent transport systems ... https://link.springer.com/article/10.1186/s12544-024-00702-9
51. Exploring individual and organizational factors influencing ... https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2025.1465057/full
52. Rethinking the impact of open data https://data.europa.eu/sites/default/files/report/Rethinking%20impact%20of%20open%20data.pdf
53. OpenComm: Open community platform for data integration ... https://www.sciencedirect.com/science/article/pii/S2210670722001858
54. Assessment of Open Government Data Initiative https://inria.hal.science/hal-01768497/file/978-3-319-68557-1_15_Chapter.pdf
55. Open data, workplace relations law compliance, and digital ... https://www.cambridge.org/core/journals/data-and-policy/article/open-data-workplace-relations-law-compliance-and-digital-regulation/712B3D37781B6C58D2712FDD203C86D7
56. Comprehensive Evaluation of Government Economic ... https://pmc.ncbi.nlm.nih.gov/articles/PMC9526593/
57. Enhancing Access to and Sharing of Data https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/11/enhancing-access-to-and-sharing-of-data_070835df/276aaca8-en.pdf
58. Open Data as a Condition for Smart Application Development https://www.mdpi.com/2071-1050/14/19/12014
59. Digital era open government and democratic ... https://onlinelibrary.wiley.com/doi/10.1111/capa.12356
60. Az EP Think Tankje kiadványainak jegyzéke https://www.europarl.europa.eu/thinktank/hu/research/advanced-search/pdf?keywords=6411
61. Cambodia's NDC 3.0 https://unfccc.int/sites/default/files/2025-08/Cambodia-NDC%203.0_0.pdf
62. The Impact of Education and Training - Cedefop https://www.cedefop.europa.eu/files/3036_en.pdf
63. AI Standards for Global Impact: From Governance to Action https://www.itu.int/dms_pub/itu-t/opb/ai4g/T-AI4G-AI4GOOD-2025-4-PDF-E.pdf
64. China CITIC Bank C orporation Limited Sustainability ... https://www.citicbank.com/esgzqen/bgzl/kcxfzbg/202506/P020250611503519246235.pdf

65. World Bank Document https://documents1.worldbank.org/curated/en/806231468327365321/pdf/608080PUB0Infl10Box358332B01PUBLIC1.pdf
66. Cabo Verde Nationally Determined Contribution 3.0 (NDC) https://unfccc.int/sites/default/files/2025-11/NDC%203.0%20Cabo%20Verde.pdf
67. Suicide assessment and feasible evidence-based treatments ... https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0330847
68. Role of Environmental Contaminants in the Etiology of ... https://pmc.ncbi.nlm.nih.gov/articles/PMC4428475/
69. bit20231215_s1a.htm https://www.sec.gov/Archives/edgar/data/1980994/000143774923034772/bit20231215_s1a.htm
70. october-2019-990-index.csv https://www.irs.gov/pub/irs-tege/october-2019-990-index.csv
71. President Wolfensohn - Legislators https://thedocs.worldbank.org/en/doc/088031025160661022-0560011996/original/WorldBankGroupArchivesfolder30484508.pdf
72. A comprehensive review on key technologies toward smart ... https://link.springer.com/article/10.1007/s10462-025-11342-3
73. A Wandering Detection Method Based on Processing GPS ... https://www.mdpi.com/2220-9964/12/9/379
74. Systems Engineering Approach to Modeling and Analysis of ... https://pubs.acs.org/doi/10.1021/acsomega.3c00854
75. Oral Presentations - PMC - PubMed Central - NIH https://pmc.ncbi.nlm.nih.gov/articles/PMC12099168/
76. Manual for the Evaluation of Costs and Benefits of ... https://publications.iadb.org/publications/english/document/Manual-for-the-Evaluation-of-Costs-and-Benefits-of-Cooperative-Compliance-Programs-.pdf
77. FRAMEWORK SERVICE CONTRACT - European Commission https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/tender-details/docs/c3f56f7f-2645-4530-be7e-b3eee90ea3a1-CN/Draft%20Framework%20contract%20Lot%202_V1.pdf
78. A privacy preserving and auditable blockchain framework ... https://www.nature.com/articles/s41598-025-17958-3.pdf
79. Analyzing-Banking-Risk-A-Framework-for-Assessing- ... https://documents1.worldbank.org/curated/en/403931618461962435/txt/Analyzing-Banking-Risk-A-Framework-for-Assessing-Corporate-Governance-and-Risk-Management-Fourth-Edition.txt
80. Leveraging-technology-in-internal-audit-processes-for- ... https://www.researchgate.net/profile/Courage-Oko-Odion/publication/

387368809_Leveraging_technology_in_internal_audit_processes_for_streamlined_management_and_risk_oversight/links/676b04efc1b0135465f26b0f/Leveraging-technology-in-internal-audit-processes-for-streamlined-management-and-risk-oversight.pdf

81. Transformation of External Auditors in Audit Practices ... https://www.sciencedirect.com/org/science/article/pii/S2156183425000063
82. English Text (766.25 KB) https://openknowledge.worldbank.org/bitstreams/52c04927-2116-49fd-85a3-7cf2802e0992/download
83. Annual monitoring and evaluation report on the Barcelona ... https://unhabitat.org/sites/default/files/2022-07/barcelona_2021_en.pdf
84. Governing intersectional climate justice: Tactics and ... https://onlinelibrary.wiley.com/doi/full/10.1002/eet.2075
85. Smart Cities That Reprogram Themselves Based on ... https://www.linkedin.com/pulse/smart-cities-reprogram-themselves-based-citizen-andre-apgwe
86. How can OECD countries empower children to be more ... https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/11/how-can-oecd-countries-empower-children-to-be-more-physically-active_29e50115/f534b2d0-en.pdf
87. SMART CITIES: DIGITAL SOLUTIONS FOR A MORE ... https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/smart%20cities%20digital%20solutions%20for%20a%20more%20livable%20future/mgi-smart-cities-full-report.pdf
88. Global Models of Smart Cities and Potential IoT Applications https://pdfs.semanticscholar.org/f02a/ce5771114b5c6801d93b526488ed4a90cbb4.pdf
89. Chilean Supreme Court ruling on the protection of brain ... https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1330439/full
90. 2025 session laws - the Washington State Legislature https://leg.wa.gov/media/rnfdhzo5/2025pam2.pdf
91. Iowa Administrative Code Supplement https://www.legis.iowa.gov/docs/aco/supplement/03-19-2025.pdf
92. eighty sixth day, april 4, 2023 https://leg.wa.gov/media/p4eb5q2p/hj_23_086.pdf
93. Operational Research: Methods and Applications1footnote ... https://arxiv.org/html/2303.14217v3
94. OECD Regulatory Policy Outlook 2025 https://www.oecd.org/en/publications/oecd-regulatory-policy-outlook-2025_56b60e39-en.html
95. Framework for Anticipatory Governance of Emerging ... https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/framework-for-anticipatory-governance-of-emerging-technologies_14bf0402/0248ead5-en.pdf

96. OECD Regulatory Policy Outlook 2025 (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/04/oecd-regulatory-policy-outlook-2025_a754bf4c/56b60e39-en.pdf
97. Issues in neurotechnology governance https://www.oecd.org/en/publications/issues-in-neurotechnology-governance_c3256cc6-en.html
98. Policy Framework on Sound Public Governance https://www.oecd.org/en/publications/policy-framework-on-sound-public-governance_c03e01b3-en.html
99. EU Open Data Days 2025 | data.europa.eu https://data.europa.eu/en/euopendatadays
100. Open data work for empowered deliberative democracy https://www.sciencedirect.com/science/article/pii/S0740624X23001028
101. Best practices for studies using digital data donation - PMC https://pmc.ncbi.nlm.nih.gov/articles/PMC11971172/
102. a data commoning proposition for the EU's citizen-centric ... https://link.springer.com/article/10.1007/s00146-023-01743-9
103. Can we trust trust-based data governance models? https://www.cambridge.org/core/journals/data-and-policy/article/can-we-trust-trustbased-data-governance-models/A611C1C5EB7BA012396316FC6229A714
104. Legal frictions for data openness: Reflections from a case- ... https://hal.science/hal-05009616v1/file/Legal-frictions-for-data-openness-open-web-and-AI-RC-2025-final.pdf
105. Edge Computing https://intech-files.s3.amazonaws.com/a043Y000011KFf3QAG/0015642_Authors_Book%20%282024-12-23%2014%3A42%3A43%29.pdf
106. (PDF) Ethical banking in practice: a closer look at the Co- ... https://www.researchgate.net/publication/295101450_Ethical_banking_in_practice_a_closer_look_at_the_Co-operative_Bank_UK_PLC
107. Lebanon Systematic Country Diagnostic https://documents1.worldbank.org/curated/en/099092024170038879/pdf/BOSIB-db926353-0dae-4bb9-b68b-6e8047550793.pdf
108. National Strategies for Financial Education https://www.oecd.org/content/dam/oecd/en/publications/reports/2015/11/national-strategies-for-financial-education-oecd-infe-policy-handbook_8a22c019/a8916d0e-en.pdf
109. CHI 2020 Free Proceedings https://chi2020.acm.org/chi-2020-free-proceedings/
110. A Digital Tool for Assessing Well-Being at the Workplace ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12374142/
111. An assessment on a sector base with multi-criteria decision ... https://www.sciencedirect.com/science/article/pii/S209044792300312X

112. Analysis of the Cognitive Load of Employees Working from ... https://www.mdpi.com/2071-1050/14/18/11722
113. Role, Methodology, and Measurement of Cognitive Load in ... https://ieeexplore.ieee.org/iel8/6287639/10380310/10786995.pdf
114. (PDF) Cognitive Load Theory: Implications for Instructional ... https://www.researchgate.net/publication/390000832_Cognitive_Load_Theory_Implications_for_Instructional_Design_in_Digital_Classrooms
115. the mediating role of digital cognitive load | BMC Nursing https://link.springer.com/article/10.1186/s12912-025-03655-z
116. Cognitive load-based multi-level annotation model for ... https://www.nature.com/articles/s40494-025-02133-8
117. Shaping a rights-oriented digital transformation (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/06/shaping-a-rights-oriented-digital-transformation_30378a18/86ee84e2-en.pdf
118. The Journal of Digital Technologies and Law is an peer ... https://www.researchgate.net/publication/385980583_The_Journal_of_Digital_Technologies_and_Law_is_an_peer-reviewed_periodical_scientific_and_practical_journal_devoted_to_the_study_of_the_synergy_of_digital_technologies_and_law_as_well_as_possible_risk
119. (PDF) Modern Crimes. The case of digital identity protection https://www.academia.edu/122243699/Modern_Crimes_The_case_of_digital_identity_protection
120. Operational Research: methods and applications https://www.tandfonline.com/doi/full/10.1080/01605682.2023.2253852
121. (PDF) Bottlenecks and Detours: A Geometric Method for ... https://www.researchgate.net/publication/396137819_Bottlenecks_and_Detours_A_Geometric_Method_for_Designing_Safe_Efficient_Economies_From_ancient_trade_corridors_to_digital_platforms_and_from_infrastructure_to_law_and_engineering_management
122. Measuring cognitive load in augmented reality with ... https://onlinelibrary.wiley.com/doi/10.1111/jcal.12882
123. Cognitive load classification during online shopping using ... https://www.sciencedirect.com/science/article/pii/S2590005625002966?dgcid=rss_sd_all
124. Human-Centric Cognitive State Recognition Using ... https://www.mdpi.com/1424-8220/25/13/4207
125. Physiological analysis of cognitive load variations during ... https://link.springer.com/article/10.1186/s12544-024-00692-8

126. CogWatch: An open-source platform to monitor physiological ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11220525/
127. Cognitive load classification of mixed reality human ... https://www.nature.com/articles/s41598-025-98891-3
128. MOCAS: A Multimodal Dataset for Objective Cognitive ... https://arxiv.org/html/2210.03065v2
129. Recruitment of family caregivers of persons with dementia https://pmc.ncbi.nlm.nih.gov/articles/PMC10083411/
130. Full article: Caregiver burden among dementia ... https://www.tandfonline.com/doi/full/10.1080/13607863.2025.2462110
131. Dementia care in a rapidly aging society - Eggleston - 2025 https://alz-journals.onlinelibrary.wiley.com/doi/10.1002/alz.70268
132. Development and two-phased pilot RCT of a foster/kinship ... https://www.sciencedirect.com/science/article/abs/pii/S0190740920322994
133. Evaluating the effectiveness of active vehicle safety systems https://www.sciencedirect.com/science/article/abs/pii/S0001457517300404
134. Control Transitions in Level 3 Automation: Safety ... https://www.mdpi.com/2313-576X/10/1/1
135. Modelling and simulation of (connected) autonomous vehicles ... https://ietresearch.onlinelibrary.wiley.com/doi/10.1049/itr2.12337
136. Platooning in Connected Vehicles https://hal.science/hal-04755422v1/file/Platooning%20in%20Connected%20Vehicles%20-%2025072024-%20Clean%20version.pdf
137. Design and Evaluation of V2X Communication Protocols for ... https://link.springer.com/chapter/10.1007/978-3-031-60494-2_6
138. Communicating with two vehicles immediately ahead ... https://www.nature.com/articles/s44172-025-00500-8
139. Waymo simulated driving behavior in reconstructed fatal ... https://www.sciencedirect.com/science/article/abs/pii/S0001457521004851
140. OECD Contributions to the 2030 Agenda and Beyond https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/07/oecd-contributions-to-the-2030-agenda-and-beyond_018cc789/69c94bd4-en.pdf
141. Scaling Up Biodiversity-Positive Incentives https://www.oecd.org/en/publications/scaling-up-biodiversity-positive-incentives_19b859ce-en/full-report/biodiversity-offsets_01412516.html

142. Frameworks to Measure Sustainable Development https://www.oecd.org/content/dam/oecd/en/publications/reports/2000/02/frameworks-to-measure-sustainable-development_g1ghg252/9789264180635-en.pdf
143. Global Urban Monitoring Framework https://unhabitat.org/sites/default/files/2022/08/the_global_urban_monitoring_framework_metadata.pdf
144. Building data together (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/06/building-data-together_431b6387/725f7274-en.pdf
145. Regulating for the planet: OECD Regulatory Policy Outlook ... https://www.oecd.org/en/publications/oecd-regulatory-policy-outlook-2025_56b60e39-en/full-report/regulating-for-the-planet_a5fdd03c.html
146. Cities and Climate Action https://unhabitat.org/sites/default/files/2024/11/wcr2024_-_full_report.pdf
147. environmental protection authority/ministry of ... https://documents1.worldbank.org/curated/en/099073125195539789/pdf/P171933-915f0fd8-542d-47d6-9ca0-2357b435f2d9.pdf
148. The 2024 Conference on Empirical Methods in Natural ... https://aclanthology.org/events/emnlp-2024/
149. World Water and Climate Economics Research and Analytics https://documents1.worldbank.org/curated/en/099030325192025178/pdf/P178647-628d4b48-9288-4a79-a4ac-db02eb95a8f3.pdf
150. ECB Annual Report 2021 https://www.ecb.europa.eu/pub/pdf/annrep/ecb.ar2021~14d7439b2d.en.pdf
151. Mastercard Sustainability Report 2021 https://www.mastercard.com/content/dam/mccom/shared/for-the-world/corporate-impact/pdfs/mastercard-sustainability-report-2021.pdf
152. Understanding Workers' Well-Being and Cognitive Load in ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12423613/
153. Impact of work instruction difficulty on cognitive load and ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11958653/
154. Systematic review of measurement tools to assess ... https://pmc.ncbi.nlm.nih.gov/articles/PMC5878696/
155. FORM F-1/A https://www.sec.gov/Archives/edgar/data/1855612/000119312522008252/d260181df1a.htm
156. POLICY MANUAL https://cjtc.wa.gov/sites/default/files/2024-06/2024-wscjtc-policy-manual---rev-2-29-2024.pdf
157. Operational Research: Methods and Applications https://www.researchgate.net/profile/Bo-Chen-74/publication/

369557413_Operational_Research_Methods_and_Applications/links/64eb1b56434d3f628c506728/Operational-Research-Methods-and-Applications.pdf

158. Policy-Based Smart Contracts Management for IoT Privacy ... https://www.mdpi.com/1999-5903/16/12/452
159. How's Life? - MEASURING WELL-BEING https://unstats.un.org/unsd/broaderprogress/pdf/How's%20life%20-%20Measuring%20well-being.pdf
160. Document of - The World Bank https://documents1.worldbank.org/curated/en/416621468047735186/pdf/531240PRSP0COR10IDA1SecM20101008211.pdf
161. Indicators https://unfccc.int/sites/default/files/resource/Final%20indicator%20compilation%2001.xlsx
162. THE CITY OF NEW YORK ACTION PLAN ... https://www.nyc.gov/assets/cdbgdr/documents/amendments/2025.07.24_Action%20Plan%201-26_HUD%20approved.pdf
163. Compact City Policies (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2012/05/compact-city-policies_g1g191f1/9789264167865-en.pdf
164. Smart City Data Governance (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/smart-city-data-governance_fc19e878/e57ce301-en.pdf
165. Built Environment through a Well-being Lens https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/11/built-environment-through-a-well-being-lens_deb96f05/1b5bebf4-en.pdf
166. Building digital public infrastructure for cities and ... https://www.itu.int/dms_pub/itu-t/opb/tut/t-tut-smartcity-2025-9-pdf-e.pdf
167. Artificial Intelligence for Advancing Smart Cities https://www.oecd.org/content/dam/oecd/en/about/programmes/cfe/the-oecd-programme-on-smart-cities-and-inclusive-growth/Issues-Note-AI-for-advancing-smart-cities.pdf
168. Digital Public Infrastructure https://www.undp.org/sites/g/files/zskgke326/files/2023-08/undp-g20-accelerating-the-sdgs-through-digital-public-infrastructure.pdf
169. The Sustainable Development Goals Report 2025 https://unstats.un.org/sdgs/report/2025/The-Sustainable-Development-Goals-Report-2025.pdf
170. Estimation of the severity of safety critical events https://www.researchgate.net/publication/225057766_Estimation_of_the_severity_of_safety_critical_events
171. Applications of artificial intelligence in air operations https://www.sciencedirect.com/science/article/pii/S2590123024019856
172. Consultation Feedback on the Draft AI Ethics Guidelines ... https://ec.europa.eu/futurium/en/system/files/ged/consultation_feedback_on_draft_ai_ethics_guidelines_9.pdf

173. Int. J. Environ. Res. Public Health, Volume 22, Issue 8 ... https://www.mdpi.com/1660-4601/22/8
174. Europe´s environment and climate - Main report https://circulareconomy.europa.eu/platform/sites/default/files/2025-09/TH-01-25-025-EN-N%20Europes%20environment%20and%20climate%20LR_2.pdf
175. Climate policy impact assessment https://unfccc.int/sites/default/files/resource/04c-%20Draft%20policy%20brief%20impacts%20on%20gender%20local%20communities%20and%20Indigenous%20Peoples.pdf
176. GRI Index 2022 https://documents1.worldbank.org/curated/en/099520002102336911/pdf/IDU0820f7dbf0ff2c04b44089e903ba771483e5e.pdf
177. Environmental, social and governance review https://www.hsbc.com/-/files/hsbc/investors/hsbc-results/2024/annual/pdfs/hsbc-holdings-plc/250227-esg-review-2024.pdf
178. Sustainability Report 2024 - Digital Asset Management https://assets.new.siemens.com/siemens/assets/api/uuid:32a7154d-edba-47bc-8e9b-9761617ba774/sustainability-report.pdf
179. Scaling Impact in a Changing World https://media-publications.bcg.com/2024-Annual-Sustainability-Report-May-2025.pdf
180. Measuring Cognitive Load to Test the Usability of Web Sites https://www.researchgate.net/publication/253713707_Measuring_Cognitive_Load_to_Test_the_Usability_of_Web_Sites
181. Comprehensive Systematic Literature Review on Cognitive ... https://ietresearch.onlinelibrary.wiley.com/doi/full/10.1049/cim2.70025
182. Should we use the NASA-TLX in HCI? A review of ... https://www.sciencedirect.com/science/article/pii/S1071581925000722
183. Characterisation of Cognitive Load Using Machine Learning ... https://pmc.ncbi.nlm.nih.gov/articles/PMC10611194/
184. Cognitive Workload Paper Library https://www.thomaskosch.com/cl-paper-library/
185. (PDF) NASA TLX: Software for assessing subjective mental ... https://www.researchgate.net/publication/23964010_NASA_TLX_Software_for_assessing_subjective_mental_workload
186. OECD Development Co-operation Peer Reviews https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/12/oecd-development-co-operation-peer-reviews-european-union-2025_fb8d017f/7adcf387-en.pdf
187. Findings: OECD Development Co-operation Peer Reviews https://www.oecd.org/en/publications/oecd-development-co-operation-peer-reviews-european-union-2025_7adcf387-en/full-report/findings_d4c34cb5.html

188. Better Regulation Practices across the European Union 2025 https://www.oecd.org/en/publications/better-regulation-practices-across-the-european-union-2025_6f007516-en/full-report/putting-people-at-the-core-of-regulatory-design_0462a0b4.html

189. Data and technology governance: fostering trust in the use ... https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en/full-report/data-and-technology-governance-fostering-trust-in-the-use-of-data_171e56b9.html

190. Data https://www.oecd.org/en/data.html

191. The Path to Becoming a Data-Driven Public Sector (EN) https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/11/the-path-to-becoming-a-data-driven-public-sector_9ed7e867/059814a7-en.pdf

192. Privacy and Data Protection by Design - ENISA https://www.enisa.europa.eu/sites/default/files/publications/Privacy%20and%20Data%20Protection%20by%20Design.pdf

193. Detection of Pilots' Psychological Workload during Turning ... https://pmc.ncbi.nlm.nih.gov/articles/PMC11359754/

194. A critical analysis of cognitive load measurement methods ... https://arxiv.org/pdf/2402.11820

195. A Cognitive Load Assessment Method for Airtight Cabin ... https://doi.org/10.3390/sym17060915

196. Headphone EEG for Cognitive Load Detection in Lab and ... https://dl.acm.org/doi/abs/10.1145/3712283

197. (PDF) Heart rate variability based assessment of cognitive ... https://zenodo.org/records/14339068/files/fulltext.pdf?download=1

198. Engagement and cognitive load of upper‑year medical ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12592906/

199. The Sustainability Spillover - PubMed Central - NIH https://pmc.ncbi.nlm.nih.gov/articles/PMC11887036/

200. Caregiving Intensity, Duration, and Subjective Financial ... https://www.mdpi.com/2227-9032/12/22/2260

201. Rural Family Caregiving: A Closer Look at the Impacts of ... https://www.mdpi.com/2227-9032/10/7/1155

202. Caregiver Contribution to Self-Care of Chronic Illness ... https://www.mdpi.com/2039-4403/15/2/42

203. Publication: Particulate Matter and Labor Supply https://openknowledge.worldbank.org/entities/publication/f38ec7bd-1d96-5c52-98a1-c91440dab6fd

204. new york state department of transportation - nysdot https://www.dot.ny.gov/portal/pls/portal/MEXIS_APP.BC_CONSULTING_NONAE_ADMIN.VIEWFILE?p_file_id=42386
205. Form F-1 https://www.sec.gov/Archives/edgar/data/1855612/000119312521370586/d260181df1.htm
206. Caregiver Burden Is Reduced by Social Support Services for ... https://pmc.ncbi.nlm.nih.gov/articles/PMC9603317/
207. https://open.alberta.ca/api/3/action/package_show?... https://open.alberta.ca/api/3/action/package_show?id=52358a8f-4545-4d1c-8f60-9949c8b03b56
208. Development of the Caregiver Burden Index (CareBI) using ... https://arxiv.org/abs/2510.21630
209. Assessing Readiness and Sustainability for Integrated Care in ... https://pmc.ncbi.nlm.nih.gov/articles/PMC12315677/
210. Caregiver Burden Is Reduced by Social Support Services ... https://www.researchgate.net/publication/364589178_Caregiver_Burden_Is_Reduced_by_Social_Support_Services_for_Non-Dependent_Elderly_Persons_Pre-Post_Study_of_569_Caregivers
211. CSA Methodology Handbook 2025 https://portal.s1.spglobal.com/survey/documents/CSA_Methodology%20Handbook_BTC.pdf
212. Corporate Social Responsibility Report https://www.bonduelle.com/app/uploads/2025/11/Bonduelle_Rapport_de_responsabilite_societale_24-25_EN_OPTI.pdf
213. 2024 Sustainability Disclosure - BlackRock https://www.blackrock.com/corporate/literature/continuous-disclosure-and-important-information/blackrock-sustainability-disclosure.pdf
214. New York State Department of State - NY.Gov http://dos.ny.gov/april-4-2018vol-xl-issue-14
215. COMMUNITY HEALTH ASSESSMENT https://health.clintoncountyny.gov/pdf%20files/CHA2025-2027.pdf
216. 2025 VOLUNTARY LOCAL REVIEW https://www.nyc.gov/assets/international/downloads/pdf/2025-voluntary-local-review-vlr-final.pdf