# Sustainable and Trustworthy Digital and Data Ecosystems for Societal Transformation

Anastasija Nikiforova
University of Tartu, Estonia
anastasija.nikiforova@ut.ee

Daniel Staegemann
Otto-von-Guericke University Magdeburg, Germany
daniel.staegemann@ovgu.de

Asif Gill
University of Technology Sydney, Australia
asif.gill@uts.edu.au

## Abstract

*Digital transformation increasingly unfolds through digital and data ecosystems - interconnected socio-technical systems of infrastructures, organizations, governance mechanisms, and practices that create, share, and govern data across sectoral and societal boundaries. Advances in Artificial Intelligence (AI), and data architectures (centralized, decentralized and federated) accelerate these developments, yet innovation must be balanced with responsibility by design, embedding ethical, sustainable, and trustworthy principles. This mini-track on Sustainable and Trustworthy Digital and Data Ecosystems examines systems resilience to shocks, adaptability across technological generations, and legitimacy to diverse stakeholders. By integrating insights from information systems, AI governance, and digital ethics, the mini-track explores how infrastructures, governance mechanisms, and human–AI collaboration can co-evolve to ensure ecosystems are not only innovative but also sustainable, socially transformative, resilient, and trustworthy. Drawing on interdisciplinary evidence, we propose a research agenda identifying key clusters and questions to guide future research.*

**Keywords:** data ecosystem; digital ecosystem; sustainability; trustworthy AI; governance.

## 1. Introduction

Digital transformation is no longer confined to single organizations - it increasingly emerges through interconnected *data ecosystems* that operate across institutional, sectoral, and national boundaries. These ecosystems underpin today's digital economies and services, from industrial data spaces to government data collaborations. Technological advances, incl. Artificial Intelligence (AI) and data architectures (e.g., data lakehouses, data meshes to name a few) are reshaping how data is produced, exchanged, and governed.

However, the growing interdependence and integration of technology, institutions, and human actors expose systemic vulnerabilities such as bias, opacity, fragmented accountability, and environmental cost. Normative and ethical scholarship consistently highlights these risks, pointing to governance gaps, human–AI misalignment, and competing value systems. The challenge is to create ecosystems that are not only technologically robust but also *socially legitimate and sustainable*.

This need motivates the concept of *Sustainable and Trustworthy Digital and Data Ecosystems* — ecosystems designed to align innovation with accountability, integrate human oversight with AI augmentation, and balance economic value with ethical responsibility. This is from where the idea of this HICSS-59 mini-track emerges, seeking to provide a platform for advancing interdisciplinary research and design approaches that enable sustainable, trustworthy, and transformative data-driven systems.

## 2. Background

Over the past decade, data ecosystems have become a central construct across information systems, digital governance, and innovation research. A data ecosystem can be understood as *"a system of people, practices, values, and technologies in a particular environment"* (Nardi & O'Day, 1999), where data producers, users, and intermediaries collaborate through shared infrastructures and governance frameworks. Technically, such ecosystems are distributed, (often) open and adaptive data spaces, employing interoperable standards and governance mechanisms to enable *safe, standardized, and transparent* data exchange (Petersen et al., 2019) and are characterized by self-organization, scalability, and sustainability (Geisler et al., 2022).

Unlike business or software ecosystems, data ecosystems depend on a broad and heterogeneous set of actors, such as governments, firms, civil society, and AI systems, each playing multiple, evolving roles in producing, consuming, and managing data (Oliveira et al., 2019). Their interactions can sometimes be characterized by *coopetition*, where cooperation and competition coexist (Gelhaar et al., 2021; Ghanbari et al., 2025; Ritala et al., 2024), and by continuous

URI: https://hdl.handle.net/10125/112178
978-0-9981331-9-5
(CC BY-NC-ND 4.0)

adaptation as technologies, institutions, and policies evolve. Data ecosystems are therefore best understood as *multi-layered socio-technical systems*, composed of: (1) **infrastructure** – the technical layer comprising interoperable, privacy-preserving, and resilient architectures, which in addition to traditional data architectures increasingly include more advanced architectures such as data spaces, meshes, zero copy and lakehouses that enable secure and sustainable data use and flows across boundaries; (2) **governance** – the institutional and normative arrangements that define roles (e.g., trustees, stewards), rules, accountability, auditability, and ethical, incl. AI-assisted oversight; (3) **human–AI and organizational systems** – the social and behavioural dimension encompassing trust, human–AI collaboration, equitable participation, and context-sensitive ethics. Across and within these layers, ecosystems evolve through *meta-characteristics* (Kernstock et al., 2024; Nikiforova et al., 2025) - components and relationships, stakeholders, actor roles, data types, and processes. Each interacts dynamically with the others, leading to *co-evolution* - a recursive process in which technological, institutional, and human changes reshape the entire system (Chae, 2019). What matters most is *sustainability*, *trustworthiness* and *inclusivity* of individual constituents and ecosystems as a whole to ensure long-term societal and organizational value.

## 3. Papers in the minitrack

This minitrack accepted three papers reflecting some of the themes across these layers.

*"Decision Criteria for Selecting Data Infrastructure Design Options in the Private Sector"* by Nils Jahnke and Maik Mannsfeld focuses on the infrastructure layer, proposing 24 decision criteria for designing private-sector data infrastructures that support inter-organizational data sharing spanning *business*, *organizational*, and *technological* dimensions, and emphasizing aspects such as *data sovereignty*, *interoperability*, *transparency*, and *cybersecurity* to name a few. The study also distinguishes private data infrastructures from general software systems, offering actionable guidance for practitioners.

*"What does a Data Trustee actually do? Specifying Subfunctions of a Data Trustee in Data Ecosystems"* by Sven Kurrle, Julian Hoffmann, and Patrick Weber, focuses on governance and intermediaries' layer, exploring how data trustees can enable value creation in inter-organizational data sharing. Through 12 expert interviews, the authors identify 49 subfunctions across main functions of data trustees - *provider of a trusted infrastructure*, *trust anchor*, and *ecosystem promoter*, clarifying their roles and responsibilities. They not only refine the conceptual understanding of data trustees, but also provide practical guidance for designing sustainable, value-creating data trustee models in various sectors.

*"Navigating the Generative AI Adoption Dilemma: Pathways and trade-offs through a data ecosystem perspective"* by Reza Toorajipour, Haiat Perozzo, Aurelio Ravarini, Ben Eaton, and Marwan Ajami focuses on strategic decision-making for GenAI adoption, conceptualizing the *GenAI adoption dilemma* of choosing between external solutions (outsourcing) or secure, internal alternatives. Drawing on 46 interviews, the study identifies three adoption pathways -*internal*, *external*, and *hybrid*- and evaluates them across *time to market*, *risk*, *cost*, *internal data ecosystem integration*, and *competitiveness*. Findings frame GenAI adoption as a systemic organizational decision, linking it to governance, infrastructure, and stakeholder considerations, and offer actionable guidance for decision-makers navigating this challenge.

These studies form an arc - *design* to *governance* to *strategic application*, capturing the multi-dimensional scope of sustainable and trustworthy data ecosystems.

## 4. Research Agenda and Call for Action

Building on interdisciplinary evidence and recent conceptual advances, this editorial aims not only to introduce the minitrack but also to outline a *research roadmap* for scholars interested in sustainability, trustworthiness, and governance of digital and data ecosystems. Sustainable and trustworthy digital and data ecosystems are living socio-technical systems that evolve through the interplay of *technology*, *governance*, and *human agency*. Their development follows an evolutionary logic of variation and selective retention (Campbell, 1974; Nikiforova et al., 2025), where new structures, practices, and norms emerge and adapt over time through feedback and learning. To advance understanding and practice, we identify *key research clusters* and corresponding research questions (Table 1).

These clusters emphasize that sustainability and trust cannot be engineered through technology alone - they must emerge through co-evolution among infrastructures, governance mechanisms, and human practices. I.e., ecosystems thrive when they are treated as *dynamic infrastructures of trust, collaboration, and value co-creation, where technological innovation aligns with societal goals and ethical accountability*. Accordingly, this mini-track invites and will continue inviting conceptual, empirical, and design science research that integrates organizational systems, AI governance, digital ethics, and socio-technical innovation to understand how infrastructures, governance mechanisms, incentives, and human–AI

collaboration co-evolve to produce ecosystems that are not only technologically advanced but also sustainable, trustworthy, and transformative for society.

**Table 1. Research clusters with associated research questions.**

| Research cluster | Research questions |
|---|---|
| Governance and trust | (1) How can multi-layered and real-time governance frameworks be developed and remain legitimate and accountable as ecosystems evolve? (2) Which intermediary roles (trustees, stewards, auditors) most effectively sustain trust and transparency? (3) How can adaptive regulatory sandboxes balance innovation with accountability? |
| AI-Augmented governance | (4) When does AI genuinely enhance governance, decision quality, or compliance, and when does automation erode human agency? (5) How can ecosystems mitigate dark-side risks such as algorithmic capture and surveillance creep? |
| Human–AI collaboration | (6) What collaboration modes (assistive, advisory, supervisory, autonomous) best foster trust, performance, and responsibility? (7) How can data and AI literacies be strengthened across diverse stakeholder groups? (8) How do accountability and competence evolve when AI becomes a co-governor? |
| Coopetition and value co-creation incentives | (9) How can data ecosystems balance competition and cooperation, ensure equitable value distribution, and prevent market capture? (10) Which mechanisms support fair and sustainable innovation (and accountability among coopetitors)? |
| Resilience and sustainability | (11) Which design principles and metrics predict ecosystem sustainability? (12) How can energy-efficient architectures, green data infrastructures, and SDG-aligned governance frameworks be operationalized? |
| Interoperability and ethical pluralism | (13) How can cross-border and cross-sector ecosystems align regulatory and ethical frameworks while maintaining interoperability and local sovereignty? (14) How can local norms coexist within global data governance standards? |
| Human-centric innovation and participation | (15) How can participatory design, collaborative policymaking, and social innovation strengthen legitimacy and public value? |

## 5. References


Campbell, D.T., 1974. Evolutionary epistemology. *The philosophy of Karl R. Popper*.

Chae, B.K., 2019. A General framework for studying the evolution of the digital innovation ecosystem: The case of big data. *International Journal of Information Management*, *45*, pp.83-94.

Geisler, S., Vidal, M.E., Cappiello, C., Lóscio, B.F., Gal, A., Jarke, M., Lenzerini, M., Missier, P., Otto, B., Paja, E. and Pernici, B., 2021. Knowledge-driven data ecosystems toward data transparency. *ACM Journal of Data and Information Quality (JDIQ)*, *14*(1), pp.1-12.

Gelhaar, J., Groß, T. and Otto, B., 2021. A taxonomy for data ecosystems. In *Proceedings of the 54th Hawaii International Conference on System Sciences.*

Ghanbari, H., Tuunanen, T., & Kazan, E. (2025). Towards competition and collaboration: a mid-range design theory for designing coopetitive news platforms. *European Journal of Information Systems*, 1-28.

Kernstock, P.; König, F.; Böttcher, T. P.; Hein, A.; and Krcmar, H., "The Anatomy of Data Ecosystems: Identifying and Analyzing Archetypes" (2024). *AMCIS 2024 Proceedings*. 3.

Nardi, B. A., & O'Day, V. (2000). *Information ecologies: Using technology with heart*. MIT Press.

Nikiforova, A., Lnenicka, M., Luterek, M., Milic, P. and Rodríguez, M.P.B., 2025. Theorizing the evolution of public data ecosystems: An empirically grounded multi-generational model and future research agenda. Government Information Quarterly, 42(3), p.102062.

Oliveira, M.I.S., Barros Lima, G.D.F. and Farias Lóscio, B., 2019. Investigations into data ecosystems: a systematic mapping study. *Knowledge and information systems*, *61*(2), pp.589-630.

Petersen, S.A., Pourzolfaghar, Z., Alloush, I., Ahlers, D., Krogstie, J. and Helfert, M., 2019, August. Value-added services, virtual enterprises and data spaces inspired Enterprise architecture for smart cities. In *Working conference on virtual enterprises* (pp. 393-402). Cham: Springer International Publishing.

Ritala, P., Keränen, J., Fishburn, J., & Ruokonen, M. (2024). Selling and monetizing data in B2B markets: Four data-driven value propositions. *Technovation*, *130*, 102935