Informational Infrastructures for Impactful Mission-Oriented Innovation Policy

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Abstract

Missions aimed at addressing grand societal challenges are advancing more slowly than desired due to significant obstacles in coordination, decision-making, access to data, and the regulatory environment. This policy brief introduces informational infrastructures as a comprehensive policy framework designed to accelerate the development of solutions to these challenges. It articulates the rationale for policy actions that encourage the creation and innovation of informational infrastructures and offers specific recommendations for policymakers. These recommendations are based on insights from the IN2MISSION research project, funded by Business Finland, and aim to guide the strategic design and implementation of these policy tools.

Policy recommendations for informational infrastructures

- Provide directionality through adaptive data principles.
- Provide equal access and affordance.
- Clarify and harmonize data sharing rules.
- Standardize informational infrastructures.
- Improve data management practices.
- Encourage innovation-friendly legal interpretations.
- Explore business models for informational infrastructures.
- Make the value and design of informational infrastructures tangible.

Keywords: informational infrastructures, missions, innovation policy, grand challenges

Introduction

One of the motivations and rationales behind the use of 'missions' in public policy is the need to achieve better alignment and coordination to make policy delivery and problem-solving more effective and efficient, improving both the economic and functional impact of policies and collective problem-solving efforts.

However, mission-type initiatives that are geared towards solving societal grand challenges are not progressing at the desired pace, because there are increasing interdependencies and feedback loops between the complex social and environmental problems faced by societies. These challenges are for example sustainable finance, circular economy, and health data management challenges. The slow progress achieved has frustrated policymakers, the business community, the third sector, and citizens alike. Thus, it appears that high-level political and strategic commitments and shared agendas that reflect widely recognized goals, such as the World in 2050, the UN Sustainable Development Goals (SDGs), and EU and national level missions, are not working as efficiently as intended.

In this policy brief, we draw attention to a key reason for such ineffectiveness, namely the existence of several types of coordination failures that are rooted in change agents' need to liaise with a large number of disjointed actors across corporate, industrial, and international boundaries. Currently, mission-oriented initiatives implicitly recognize the need for coordinated and collaborative efforts but generally offer little dedicated action to address these needs, which could lead to more concerted efforts. In addition to shared goals, coordination will remain ineffective without collective situational awareness and knowledge (Håkonsson et al., 2023). However, with ongoing ubiquitous digitalization in society and industry, increased access to data in digital form, along with rapidly advancing analytical and generative computing technologies, innovation processes are increasingly drawing on information as well as directional inspiration from big data from users, stakeholders, technological progress, and environments (Luo 2022; Wang et al. 2022; Potts et al 2024).

We, therefore, believe that disjointed mission-oriented activities and policy coordination can be improved with the help of informational infrastructures because they can serve as a coordinating and enabling 'backbone' for international and intersectoral developmental organizational activities. This serving as a backbone eases the exchange of information, intelligent coordination, and pooling of data and digital tools, resulting in shared situational awareness. Thus, informational infrastructures can enable a better collective understanding of the broader ecosystem and its development towards shared mission goals.

We have identified several analytical perspectives and observations that center around the development and utilization of informational infrastructures. In the research team's work and discussions, particular attention has been given to public engagement and involvement of citizens and their various communities, from workplaces and business organisations to third – or even fourth-sector activities.

What are informational infrastructures?

Informational infrastructures are dynamic and evolving loosely coupled assemblies of data, software solutions, principles, rules, platforms, and standards, characterized by openness, stretched across both sectoral and technological domains, and geographical space. As such, they are also digital resources that different societal actors can leverage for several possibilities (Eaves, Mazzucato and Vasconcellos, 2024). However, informational infrastructures are not by default open, accessible, and shared but gain these properties when actors structure them in such ways, agree upon the operating principles, and are incentivised to act in prompted ways. Informational infrastructures are hence evolving and heterogeneous socio-technical systems that combine many kinds of digital elements, such as applications, platforms, and IT capabilities (Hanseth & Lyytinen, 2010). Informational infrastructures as socio-technical systems are critical in easing digital innovation, governance, coordination, and collaborative processes. When informational infrastructures are open and accessible, they offer valuable capabilities for users of the infrastructure (states, communities, organizations, and individuals), and private and public innovators.

There are two types of valuable capabilities that informational infrastructures provide to users and innovators. These are (1) enabling capabilities; and (2) supportive capabilities. Informational infrastructures enable users and innovators *to pool information* from many data sources to be further used, *share information* to users, innovators, digital devices, and software, *translate data into information,* and *structure information* from raw form to more usable forms. Informational infrastructure is also a supportive structure for anyone operating in the digital space. It provides users and innovators with resources and abilities for *data handling and storage, networking, and computing*. While these are well-developed and accessible to all, we find that the informational capabilities are less developed and accessible.

The enabling and supportive capabilities generated by informational infrastructures make them performative structures. This performativity means that informational infrastructures can directly affect the actions of users and innovators. For example, informational infrastructures can make users and innovators better informed about the pace and direction of change, help them innovate quicker and with less uncertainty, and facilitate collaboration. Informational infrastructures are hence active components of the innovation, (inter-)organizational, and economic space, and they can - when designed and operating well - steer private and public actors toward actions that align with mission goals and accelerate finding and developing solutions to grand societal challenges.

Other key components of informational infrastructures are data intermediaries and platforms. These can function as mediation structures for intelligent facilitation of the transition of existing solutions to novel solutions. i.e., smart data solution to decarbonize city infrastructure. Informational infrastructure components can also be envisioned to support the uptake and diffusion of solutions, i.e., systemic change investing and the catalyzation of large-scale investments in a circular economy. Informational infrastructures can enable independent producer models, transparency in production, service, and consumption, as well as targeted and coordinated mission-oriented activities.

Informational infrastructures can hence accelerate the system-level change of industries and society while simultaneously creating many opportunities for high-growth businesses. Informational infrastructures can also ease traditional market failures by allocating informational resources more efficiently or creating totally new markets for information, for example, information related to sustainability, climate change, clean seas, or cancer. This means that informational infrastructures shape markets for information as well as direct actors in the market. Informational infrastructures thus enable directionality, capabilities, coordination, and reputation and trust in markets.

To summarize, a well-working and transparent information infrastructure where data is pooled and used intelligently can thus importantly impact (1) mission-oriented work and activities' effectiveness, (2) the scale of activities, (3) interrelate activities, and (4) the speed of system-level transformations. Informational infrastructures can thus become, when operating well, a facilitating and enabling infrastructure of mission-oriented work that supports coordination, collaboration, and transparency of corporates and public sector actors at local, regional, national, and transnational (EU) levels.

What challenges do informational infrastructures address in mission activities?

Development and progress in missions are hampered due to non-aligned mission formulation and implementation, insufficient incentives, and impeded agency. Difficulties in localized goal setting prevent directing innovations, different visions hinder the definition of a common direction, and a lack of common understanding about what others plan and develop hinders mission formulation as our literature review and interview data show. Policy implementation difficulties again inhibit innovation by not guiding innovation activities or restricting innovation opportunities.

These challenges are all linked to various types of informational challenges. We identify five central informational challenges in mission-oriented activities.

Coordination challenges

Coordinating actions across various collaborative networks and policy levels faces significant difficulties in mission-oriented innovation activities, projects, and programs. The absence of robust support structures, such as management systems, hampers innovation. Moreover, the sheer scale and diversity of projects and programs, involving numerous stakeholders, complicates innovation efforts.

Coordination challenges extend to aligning local, regional, national, and international policies effectively. Delays emerge in the implementation of regional-level (EU) funding decisions, along with national and city-level initiatives, planning processes, and the time it takes to progress from invention to market, further impeding innovation. Additionally, the diverse objectives and rationales of multiple stakeholders generate tensions that hinder cross-sector collaboration. These coordination issues lead to technical, political, and economic uncertainties that ultimately diminish resources and investments dedicated to mission-oriented initiatives.

Data access and usability challenges

Innovation is often hindered by the lack of available, usable, and shareable data. Different actors employ diverse information infrastructures, such as knowledge bases and communication tools, which frequently lack compatibility. A common information infrastructure is crucial as it serves as a systemic technology that regulates communicative behavior (Monteiro & Hanseth, 1996). Managing the sheer volume of information can be overwhelming and inefficient. Additionally, there are constraints on the volume of information that can be collectively utilized among competitors, which impedes innovation (DiVito et al., 2021). The incompatibility and unreliability of data sources further prevent their effective use.

Moreover, inadequate information dissemination and delays in information delivery prolong the time required to implement changes. Digital platforms, for instance, can serve as shared spaces where information is efficiently released and disseminated to various stakeholders (Panori et al., 2021). Challenges in retrieving information from dispersed data sources, concerns over information security, and the presence of outdated or otherwise low-quality data hinder the sharing and utilization of crucial information. Even informal information can provide deeper insights. An additional obstacle is the lack of consistent metrics and standards to measure and guide practices across different sectors. In the context of sustainable finance, this issue is evident in the absence of universally accepted terms and metrics for assessing the environmental, social, and governance (ESG) factors, which complicates the evaluation of corporate sustainability and the reliability of sustainable investment products.

Data sharing challenges

Informational infrastructures provide critical support for the digital exchange of information and facilitate learning across European or national communities involved in EU missions (Polt, Linshalm & Ploder, 2024). These infrastructures are instrumental in advancing innovation projects, such as those involving health or diagnostic data critical for cancer research or initiatives aimed at climate and weather resilience. However, the open exchange of technical and R&D-relevant data introduces substantial challenges. The sharing of such sensitive and proprietary data can lead to issues regarding intellectual property rights, data security, and privacy concerns. Effective management of these risks is essential to maintain the integrity and utility of these informational exchanges, requiring robust data governance frameworks that ensure both accessibility and protection of data assets.

Decision-making challenges

The effectiveness of decisions in consumer, business, and policy-making domains heavily depends on the availability of consistent, high-quality, and accessible data. However, gaps in data can lead to non-informed or poorly informed decisions that adversely affect the outcomes of various initiatives. The absence of comprehensive data sets can result in missed opportunities for optimization and innovation, leading to suboptimal policy and business responses. Improving data collection methods, enhancing data integration technologies, and fostering open data cultures are critical steps toward overcoming these limitations. These improvements would enable stakeholders at all levels to make more informed decisions, thereby increasing the efficiency and impact of their actions.

Regulatory environment challenges

Many of the areas of focus of missions are challenged by a complex regulatory environment. For example, sustainable finance, health data management, and circular economy practices are often complicated by regulatory complexity, which can be both overly stringent and insufficiently comprehensive, creating a regulatory paradox. In sustainable finance, for instance, varying legal standards may simultaneously over-regulate and under-deliver (not impacting in the intended ways), leading to inefficiencies and enforcement gaps. Similarly, in the domain of health data, stringent data protection laws like the GDPR (General Data Protection Regulation) are intended to safeguard privacy but can inadvertently stifle research and innovation by imposing restrictive conditions on data usage. Informational infrastructures are therefore needed to decrease the costs and risk of regulatory compliance by providing access to informational resources such as curated data, standardized metrics, templates, and software tools.

Policy recommendations for informational infrastructures

We next outline our policy recommendations regarding design and governance principles for promoting the development of well-functioning informational infrastructure. One of the basic principles for well-operating informational infrastructures is open data principles and standard interfaces in APIs. Another key element is the government's role in actively encouraging the collection and making of information accessible through open data interfaces. The main target here should be to transform data collections into resources that are more market-friendly and accessible. Further, the goal should be to foster interoperable systems based on shared principles, moving away from centralized data stores.

Provide directionality through adaptive data principles

The creation of directionality (mission goals) through data principles for projects is needed. Policymakers need to agree on processes and representative principles for setting up such directionality and data principles. However, it is also essential to consider the unplanned or emergent aspects of informational infrastructures. There should thus be flexibility to embrace unexpected opportunities for innovation and to support both spontaneous and structured innovation processes. In fact, we expect informational infrastructures to create more possibilities to create such opportunities.

This is why policymakers should encourage the development of dynamic informational infrastructure ecosystems that support continuous learning and adaptation in the design and implementation of missions. This involves creating flexible platforms that can quickly adapt to new insights and changing conditions, supporting iterative testing and scaling of innovative approaches. Encouragement is needed for the adoption of smart development practices that prioritize modularity and scalability in informational infrastructures, enabling them to evolve in response to emerging needs and challenges.

Provide equal access and affordance

Providing equal access and appropriate tools and resources (affordances) through informational infrastructures to various groups and stakeholders involved in missions is crucial. The challenge, however, lies in the differing goals and interests of these groups. For instance, companies often use these infrastructures to discover and capitalize on business opportunities, while non-profit organizations or civil society groups might utilize them to promote societal and environmental benefits. Recognizing and understanding these varied motivations is essential for designing infrastructures that can serve a broad spectrum of needs effectively.

Clarify and harmonize data sharing rules

There is a need to develop clear, consistent, and harmonized regulations for data sharing and collaboration across sectors and borders to facilitate efficient and secure data exchange. This includes reforming restrictive laws and harmonizing terminology to prevent misinterpretations and conflicts.

Standardize informational infrastructures

Policymakers and initiated projects and programs should set up informational infrastructures that promote the establishment of EU-wide standards, rules, and tools for data management, particularly for ESG data in sustainable finance, reporting and monitoring. The aim should be to form informational infrastructures that can be reliably used across all member states to drive coherent pooling of data and compatibility in data handling.

Improve data management practices

The management of data should be enhanced through informational infrastructure innovations to boost efficiency in sectors such as the circular economy, including better sorting, storage, and processing methods that facilitate recycling and reuse. While this concerns all types of projects and programs, such developments are needed as well in policy work. Integrated information infrastructure is needed to enable seamless management and sharing of missions-related data across ministries and agencies. Such infrastructures should leverage advanced data technologies to ensure efficient data processing, storage, and analysis, facilitating quick access to mission-critical information and enhancing decision-making processes.

Encourage innovation-friendly legal interpretations

Policy makers should aim at advancing EU legal frameworks that favour innovation-friendly interpretations, for example, supporting health data hosting within the EU and facilitating the use of health data for innovative applications, such as in health research or equal measures for circular economy applications.

Explore business models for informational infrastructures

There is a pressing need to examine and establish business models for informational infrastructures, particularly concerning their financing and operational frameworks. To effectively balance public good with economic viability, it is crucial to develop robust public-private partnership models and innovative licensing strategies. These models should leverage the strengths of both public funding and private sector dynamism to avoid placing undue financial burdens on public funding while still capitalizing on market efficiencies. This recommendation advocates for the conceptualization, piloting, and scaling of diverse business and partnership arrangements for informational infrastructures. Additionally, smart public procurement strategies should be designed to set up platform resources, which not only provide marketplaces for data, applications, and services but also enhance the scalability and effectiveness of private sector involvement in informational infrastructures. This approach will ensure that informational infrastructure are both economically sustainable and aligned with the public interest.

Make the value and design of informational infrastructures tangible

While there is value in advancing mission-oriented activities through informational infrastructures, the concept remains novel and somewhat abstract. There is a need to make the ideas behind informational infrastructures more accessible and understandable. A practical approach to achieve this is by illustrating the concept with real-world examples. For instance, in Finland, platforms and data intermediaries like DigiOne, Kanta, and Finntrafic are exemplary cases of successful informational infrastructure applications. Similarly, at the European level, initiatives such as Gaia-X and the European data spaces demonstrate how informational infrastructures can be widely implemented. These examples showcase the potential impact and practical utility of well-designed informational infrastructure.

Examples of informational infrastructures

DigiOne A project launched by the City of Vantaa and involving the cities of Espoo, Jyväskylä, Lahti, Oulu, Tampere, Turku and Vantaa, as well as *Tiera*, an in-house company and social enterprise offering digital and ICT solutions and owned by 400 municipal organisations and wellbeing services counties. The aim of the project is to create a national digital service platform that brings together learning and education systems and enables the efficient production of high-quality education services. The digital service platform gathers all the information, systems and services used by teachers, learners, principals, guardians and administration. The goal and mission of DigiOne is to support an ecosystem, which allows for smooth and well-functioning digital services for schools, students, parents and stakeholders.

digione.fi

Gaia-X (European Association for Data and Cloud AISBL) Gaia-X is a European initiative established in 2019, aimed at enhancing the continent's digital infrastructure, accessibility, and applications, whose purpose and mission is to develop a federated secure data infrastructure for Europe. This infrastructure enables data sharing while ensuring that users retain control over their data access and usage, also contributing to European digital sovereignty. The initiative aims to establish digital governance based on European values such as transparency, openness, data protection, and security. These principles can be applied to cloud technologies, promoting transparency and controllability across data and services.

gaia-x.eu

The Upright Project This company is dedicated to quantifying the net impact of other companies. Upright aims to facilitate smarter decision-making for investors, companies, and governments by providing a comprehensive assessment of the overall impact of businesses. The company uses a unique model to quantify net impacts, drawing on scientific publications for data. Upright has developed an Open-Access Impact Database that features over 10,000 company profiles. This database includes various metrics, such as alignment with the EU taxonomy and the SDGs, along with Upright's proprietary net impact data. This information helps investors align their profits with their impact targets, while companies can use it to enhance and communicate their net impact, meeting the increasing expectations from clients, investors, employees, and regulators. Upright's mission is to clarify the complexities of company impacts through rigorous scientific analysis and insights, driving positive change.

uprightproject.com

These concrete examples make visible the various actors in the ecosystems that are being served by informational infrastructures, as they facilitate knowledge search, business development, and distributed data use. As the infrastructures, as distributed assets, can serve many purposes, there is a need to optimise their emergence and development. These cases serve as valuable benchmarks, especially when the state of informational infrastructure is still evolving, helping to recognize the diverse capabilities and stages of maturity of them across different settings.

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More information

More information on the IN2MISSION project can be found on the project website.
The project's other policy briefs are:

Accelerating circular economy through informational infrastructures

Artificial intelligence solutions to accelerate impactful data-driven cancer innovation
and research: a deep dive into data challenges

Catalysing transformation: The imperative of informational infrastructures in mission-
driven innovation policies

Fostering sustainable finance and corporate sustainability by means of well operating
informational infrastructures

Mission-driven innovation policy

IN2MISSION website: aalto.fi/en/IN2MISSION

Aalto University Policy Briefs: ourblogs.aalto.fi/politiikkasuosituksia-policy-briefs

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