# Coordinating digital transformation in healthcare

## Governance, platforms, and generative interdependencies
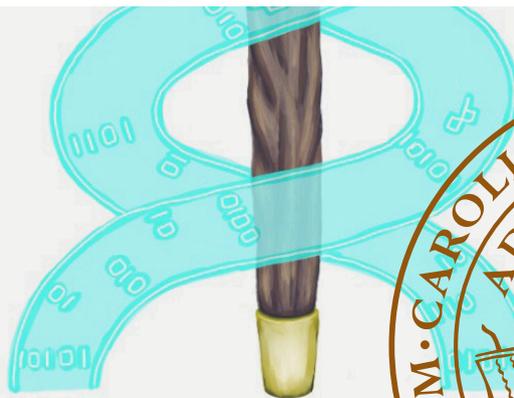
Saenyi, Betty Nekesa

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**Abstract:**

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The thesis addresses three research questions: how collective action is coordinated and sustained (1) through governance arrangements in decentralised healthcare ecosystems, (2) through digital platforms in time-critical settings, and (3) how recurring challenges identified across these settings can be explained. The dissertation is presented as a compilation thesis comprising four interrelated papers: an empirical study of governance arrangements in Sweden, an in-depth study of a health emergency response platform, and two systematic literature reviews that theorise coordination and standardisation work in digital health ecosystems.

Across the papers, the findings show that coordination failures persist not primarily because actors lack shared goals, but because digital initiatives continuously generate interdependencies that outpace the ecosystem's capacity to align governance, standards, and everyday practice. At the governance level, coordination is weakened by opaque governance, limited feedback mechanisms, and an over-reliance on regulation as a stabilising response to emerging cross-boundary dependencies. At the practice level, digital platforms coordinate emergency response through soft algorithmic coordination, while also shifting substantial responsibility for preparedness and continuity onto volunteers, with implications for accountability and support.

Synthesising these findings, the thesis explains recurring coordination challenges as outcomes of generative interdependencies in digital health transformation and outlines implications for building adaptive governance capacity as interdependencies evolve.

**Key words:** Digital health transformation, Digital transformation, Coordination, Generative interdependencies, Collective action, Digital platforms, Polycentric governance

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*To Mum, Austin, Winnie, Dan and Mercy*

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*/Betty*

*Lund, February 2026.*

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# Abstract

Digital transformation of healthcare has largely been conceptualised through adoption-centric lenses, relying on "barriers and facilitators" frameworks that focus primarily on individual technology adoption or organisational factors. Yet transformation in practice depends on sustained coordination among multiple autonomous actors who must align their actions across organisational, professional, and technological boundaries. This thesis examines healthcare's digital transformation through a coordination lens, conceptualising it as a multistakeholder collective action grounded in voluntary contributions and ongoing cross-boundary work.

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Synthesising these findings, the thesis explains recurring coordination challenges as outcomes of generative interdependencies in digital health transformation and outlines implications for building adaptive governance capacity as interdependencies evolve.

# Preface

My interest in coordination was sparked by a disconnect between digital promise and reality. In 2021, Sweden began rolling out the Millennium health information system in Västra Götaland and Skåne. On paper, the vision was flawless: a unified electronic record spanning hospitals, primary care, and municipal services. However, the implementation told a different story. Routine tasks became impossible, information flows broke down, and clinicians eventually issued public warnings regarding patient safety. This was not a localised failure; a similar pattern was unfolding in Norway with the Helseplattformen (Riksrevisjonen, 2024). I found myself asking: Why, despite aligned objectives and massive investment, did these actors fail to collaborate?

Initially, my curiosity focused on interoperability, the technical ability of systems to exchange data. I shared the common assumption that fragmentation could be solved through better engineering. However, as I watched the Millennium implementation unravel, I realised that "the system" was not just software. It was a contested terrain of governance, professional autonomy, and misaligned expectations.

My initial request for research access was first granted and then abruptly withdrawn, perhaps a small but telling episode that illuminated the political and organisational sensitivities surrounding these systems. It became clear that the real challenge wasn't the data flow itself, but the coordination work required to sustain it.

While these initiatives sparked my inquiry, this thesis examines coordination through other cases, tracing the ongoing labour of aligning actors, interests, and infrastructures in fragmented healthcare systems.

# 1 Introduction

## 1.1 Background: The digital transformation of healthcare

Across the globe, digital transformation has become a defining feature of contemporary healthcare systems (Kraus et al., 2021; Ayabakan et al., 2024). From telehealth and mobile apps (Ayabakan et al., 2024) to national electronic health records (Paparova et al., 2023) and AI diagnostics (Abdel-Karim et al., 2023), technological innovations are reshaping how healthcare is delivered, accessed, and managed. This ongoing shift reflects not only technological advancement but also healthcare systems' attempts to respond to mounting structural pressures, including demographic changes, economic constraints, and evolving patient expectations.

Among these pressures, demographic change presents perhaps the most fundamental challenge. A rising global life expectancy (WHO, 2020) has significantly increased demand for healthcare services, particularly among older adults with complex and chronic care needs. In Sweden, adults aged 65 and older constitute only 20% of the population, yet account for more than half of hospital services, with over 80% living with at least one chronic condition (Socialstyrelsen, 2022). Similar patterns are emerging across other high-income countries (European Commission, 2023; WHO, 2020).

While increasing life expectancy is a positive indicator of societal progress, it has also highlighted the limits of existing healthcare systems. Systems designed initially to handle episodic and acute care now struggle to sustain routine service provision alongside the growing needs of an ageing population with long-term, complex needs (Raine & Fitzpatrick, 2016; Oderanti et al., 2021; Appleman et al., 2022). In response, healthcare organisations have increasingly turned to digital technologies to enhance efficiency, manage resource constraints, and support new forms of care delivery. Examples include the provision of primary care via digital platforms (Frishammar et al.,

2022), remote monitoring of chronic conditions (Ayabakan et al., 2024), and the development of welfare technology (Socialstyrelsen, 2022).

At the same time, patient expectations are evolving. The increasing pervasiveness of digital technologies has normalised the idea of healthcare that is accessible on demand, regardless of time or location. This shift is particularly evident among younger generations (Frishammar et al., 2022; Low & Manias, 2019), but patients in general are seeking more immediate care solutions to avoid the long waiting lists often associated with public health systems. Additionally, both patients and healthcare providers have access to a plethora of mobile applications designed to track, diagnose, and manage various physiological processes. This convergence of trends fosters a demand for convenient access to healthcare, with many patients even willing to pay extra for such services (Constantinides, 2023).

The growing momentum towards personalised care and precision medicine represents another important driver of digital transformation in healthcare (Constantinides, 2023). This approach moves beyond the traditional "one-size-fits-all" model, emphasising treatments tailored to each patient's unique characteristics. Personalised medicine relies on aggregating diverse patient data, including medical history, lifestyle factors from wearable devices, and various physiological measurements. Constantinides (2023) argues that by harnessing this comprehensive data pool, healthcare professionals can develop more targeted and effective treatment plans. Technological advancements have also supported this shift; for instance, the use of AI in breast cancer imaging has been shown to enhance diagnostic accuracy and enable more individualised care strategies (Dembrower et al., 2023; Högberg et al., 2023).

Economic dynamics have further accelerated this transformation. Major technology companies, including Apple, Microsoft, Amazon, Alphabet, and Meta, have expanded into the digital health sector. At the same time, venture capital investment reached $21.6 billion in 2020 alone, signalling the sector's strategic importance and growth potential (Dorsey, 2021). Startups and private companies are similarly innovating to capture emerging opportunities in this evolving market (Neumann et al., 2020; Frost & Sullivan, 2020). Today, the sector spans consumer-oriented services offered by global technology giants, integrated care networks and specialised platforms. The financial stakes continue to rise, with global healthcare spending projected to reach $18.28 trillion by the year 2040 (Chong et al., 2022).

As these forces converge, healthcare systems are recognising that isolated digital projects cannot address the complexities of modern care delivery, nor

can any single provider meet all patient needs (Constantinides, 2023). This has led to increasing calls for multi-stakeholder approaches, bringing together healthcare providers, government agencies, and technology vendors to ensure data interoperability and care continuity (Mckinsey, 2020; Deloitte, 2020; Bardhan et al., 2020; Constantinides, 2023).

## 1.2 Challenges with the digital transformation of healthcare

Yet despite significant investment and the widespread proliferation of digital tools, many healthcare systems are struggling to achieve integrated, responsive, and sustainable digital transformation (Saenyi et al., 2025; Van Velthoven & Cordon, 2019). This is evident in digital infrastructures that remain fragmented, with patient data siloed across disparate systems (Li et al., 2024; Muñoz Monjas et al., 2025). Furthermore, adoption remains uneven, particularly within large, complex health systems (Marwaha et al., 2022; Van Velthoven & Cordon, 2019). For patients, this often translates to safety risks, fragmented care transitions, and increased care disparities (Li et al., 2022; Yao et al., 2022). Healthcare professionals, meanwhile, face exacerbated "digital workload" navigating multiple disconnected systems (Chen et al., 2024).

In some cases, these challenges have escalated beyond operational difficulties into costly and highly visible failures that burden healthcare systems and undermine confidence in digital transformation efforts. Large-scale initiatives such as Norway's Helseplattformen project, which exceeded its budget by 63%, and Sweden's Millennium system, which was suspended shortly after deployment, have consumed billions in public investment while struggling to deliver on their intended objectives (Riksrevisjonen, 2024; Sand et al., 2025; Läkartidningen, 2024). While the immediate causes of these failures differed, both cases point to a common underlying issue: a breakdown in coordination across stakeholders, infrastructures, and workflows.

These coordination challenges are particularly pronounced in decentralised healthcare systems, where authority and decision-making are distributed across regional and local entities (Sreeramareddy & Sathyanarayana, 2019). Even when national strategies emphasise integration, their implementation often varies across local contexts (Reidy et al., 2023). In Sweden, for example, although all regional healthcare providers participate in the National Patient Overview (NPO), a system designed to share data between healthcare

providers, only 15% of municipal providers contribute information, limiting its effectiveness as a shared information infrastructure (eHälsa2025, 2023).

These dynamics give rise to digital health ecosystems characterised by recurring patterns of drift, fragmentation, and friction, systems that scale more rapidly than the capacity to align actors, governance arrangements, and technologies (Constantinides & Barrett, 2015; Hermes et al., 2020). Rather than reflecting isolated implementation failures, this pattern points to persistent difficulties in aligning autonomous actors, governance arrangements, and technologies across complex digital health ecosystems.

## 1.3   Research problem and aim

Research on the digital transformation of healthcare has largely conceptualised transformation through adoption-centric lenses, relying on "barriers and facilitators" frameworks that focus primarily on individual technology adoption or organisational factors (Greenhalgh et al., 2017a; van Tilburg et al., 2024; Berardi et al., 2024; Iyanna et al., 2022). Within these frameworks, digital transformation is commonly framed as a process of overcoming discrete obstacles, such as user resistance, limited resources, or insufficient leadership, to achieve successful implementation. While such approaches provide valuable insights into immediate implementation challenges, they tend to treat digital transformation as a sequence of bounded adoption events and offer limited explanatory power for understanding transformation as an ongoing, system-wide process (Greenhalgh et al., 2017b; Greenhalgh et al., 2018; Charalambous, 2024).

This framing becomes particularly limiting in healthcare, where digital transformation typically involves multiple autonomous actors with divergent priorities, incentives, and timelines (Burton-Jones et al., 2020; Millar et al., 2023; Constantinides, 2023; Cresswell et al., 2024). In such settings, transformation depends not only on whether digital technologies are adopted, but on how interdependent actors align their actions, responsibilities, and resources over time (Constantinides, 2023; Millar et al., 2023; Cresswell et al., 2024). Digital health initiatives routinely require coordination across organisational, institutional, and technological boundaries, yet adoption-focused frameworks provide limited insight into how such alignment is practically achieved or sustained. Moreover, research on inter-organisational relationships has long shown that even ostensibly well-aligned partners

struggle with the practical challenges of coordinating interdependent efforts, particularly in determining "who does what, when, and how" (Gulati et al., 2012, p.537).

However, resolving these coordination challenges rarely follows a predetermined path. Coordination cannot be fully designed in advance, but must be continuously enacted through ongoing negotiation, adjustment, and mutual understanding (Bechky, 2006; Okhuysen & Bechky, 2009; Gkeredakis, 2014). Advances in digital technologies further complicate coordination by creating new and evolving interdependencies that connect previously separate actors through shared platforms, data standards, and interfaces (Yoo et al., 2010; Gkeredakis & Constantinides, 2019). These interdependencies increase coordination demands while simultaneously undermining assumptions of stable organisational boundaries and clear authority, thereby intensifying the challenges of collective action across fragmented healthcare systems.

Yet, prevailing digital-transformation research continues to frame transformation as an organisational change process unfolding primarily within individual firms or organisations (Wessel et al., 2021; Kaganer et al., 2023; Piccoli et al., 2024). In the digital transformation of healthcare, this firm-centric lens fails in two critical respects. First, it overlooks the sustained collective work required to build and govern shared digital infrastructures (platforms, data standards, interfaces) through which interdependent, autonomous actors coordinate care (Aanestad et al., 2017; Klecun et al., 2025). Second, it entrenches adoption-centric, descriptive frameworks that fail to capture the dynamic, socio-technical work shaping the digital transformation of healthcare (Greenhalgh et al., 2017b; Kyratsis et al., 2022). By failing to account for this cross-boundary organising, the current accounts offer limited explanatory power regarding the mechanisms that enable or constrain ecosystem-level change (Faik et al., 2020; Braa et al., 2023).

This thesis addresses this gap by examining healthcare's digital transformation through a coordination lens, conceptualising it as a form of multistakeholder collective action. Here, collective action is used descriptively to denote processes of transformation that depend on the voluntary contributions of multiple autonomous actors. The thesis focuses on how interdependent actors align decisions, responsibilities, and practices as digital infrastructures are developed, governed, and used across organisational and institutional boundaries. Specifically, it addresses the following research questions:

i. *How is collective action coordinated and sustained through governance arrangements, particularly in decentralised healthcare ecosystems?*

ii. *How is collective action coordinated and sustained in practice through digital platforms in time-critical settings?*

However, what remains underexplained is why coordination challenges recur over time, not only how they are managed in specific settings. Taken together, RQ1 and RQ2 therefore call for an integrative explanatory account of why coordination challenges re-emerge as digital transformation unfolds over time. To address this, the thesis asks:

iii. *How can the recurring coordination challenges identified in RQ1 and RQ2 be explained?*

The aim of the thesis is to advance understanding of how collective action is coordinated in the digital transformation of healthcare, particularly in decentralised ecosystems. Drawing on empirical studies of decentralised governance arrangements and an emergency response platform, the thesis examines coordination as a cross-boundary process unfolding across organisational, institutional, and technological settings. Building on these empirical insights, it develops a framework to explain why coordination challenges emerge during the digital transformation of healthcare. It conceptualises digital transformation as a process that generates new and evolving interdependencies, rendering coordination a necessary but ongoing response.

In doing so, it contributes a coordination-based perspective on digital transformation of healthcare that moves beyond adoption-centric and organisation-bound accounts.

# 1.4 Research approach and paper overview

This dissertation is presented as a compilation thesis, comprising this cover chapter and four appended, interrelated research papers (Papers I–IV). The cover chapter synthesises these individual contributions into a coherent whole by providing the dissertation's theoretical foundation, methodological approach, and an integrated discussion of findings. The papers include three conference papers and one journal manuscript. Importantly, the papers are not

presented chronologically; instead, they are numbered and ordered to best advance the dissertation's conceptual argument:

1) **Paper I:** Saenyi B., Mansour O., & Keller C. (2025). Navigating Governance Challenges in a Decentralised Healthcare Ecosystem. *Proceedings of the 58th Hawaii International Conference on System Sciences*. *https://doi.org/10.24251/HICSS.2025.421*

2) **Paper II:** Saenyi B., & Ademaj G. (2022). Systematic Literature Review: Data standardization in health information systems. *ECIS 2022 Research Papers*. 138 *https://aisel.aisnet.org/ecis2022_rp/138*

3) **Paper III:** Saenyi B., Keller C., & Kajtazi M. (2025). Infrastructures of coordination: Conceptualising coordination in digital health ecosystems. *ICIS 2025 Proceedings. 17. https://aisel.aisnet.org/icis2025/is_health/ishealthcare/17*

4) **Paper IV:** Saenyi B., Chowdhury A., & Keller C (2026). When every second counts: Coordinating health emergency response via digital platforms *(Manuscript to be submitted to an international journal)*

These four papers provide complementary empirical and conceptual perspectives on how collective action is coordinated across governance arrangements and everyday practices in the digital transformation of healthcare.

## 1.5  Definitions of key concepts

To ensure conceptual clarity, this section briefly defines the key concepts used in this thesis. The definitions are intended to clarify scope and usage rather than to provide exhaustive theoretical accounts. Concepts that form the core theoretical focus of the thesis are not defined here, as they are introduced and discussed in detail in subsequent chapters.

1) ***Collective action:*** To frame the coordination challenges in digital healthcare transformation, I use the concept of collective action, originating in political science and economics, which has been used to examine how groups work toward shared goals (Olson, 1965; Ostrom, 1990). Although Olson's work was aimed at public goods, IS research has suggested shifting the focus to viewing digital goods as collective goods (Constantinides & Barrett, 2015; Braa et al., 2023).

As Constantinides and Barrett (2015, p.42) argue, "*the good is not the information system itself, but the functionalities that it affords, and the willingness (interests) and capabilities (resources) of the users to take advantage of those affordances*".

In this thesis, I define collective action as a process of digital transformation that depends on voluntary contributions from multiple autonomous actors, where no single entity can unilaterally compel participation or dictate outcomes. This concept is two-fold: It refers to the collective work required to govern and develop shared digital infrastructures, as well as the coordinated practices those infrastructures enable in daily use.

2) ***Digital health ecosystems:*** In this thesis, the digital transformation of healthcare is situated within the context of digital health ecosystems. Drawing on prior research, digital health ecosystems are understood as configurations of interdependent and autonomous actors who must coordinate their activities across organisational, technological, and institutional boundaries to realise collective benefits from digital infrastructures (Stephanie & Sharma, 2020; Hermes et al., 2020; Constantinides, 2023).

Digital health ecosystems comprise a heterogeneous set of actors, including healthcare providers (such as hospitals, clinics, and primary care organisations), patients and patient organisations, technology vendors, payers, regulators, policymakers, and research institutions (Iyawa et al., 2016; Hermes et al., 2020; Leone et al., 2021; Constantinides, 2023). These actors operate under distinct mandates, incentives, and forms of authority, yet remain mutually interdependent.

# 1.6  Structure of Dissertation

The remainder of this cover manuscript is structured as follows:

**Chapter 2** situates digital transformation of healthcare as a multi-stakeholder phenomenon and conceptualises it as collective action.

**Chapter 3** develops the coordination-theoretical foundations of the dissertation and introduces the notion of generative interdependencies as a sensitising concept for synthesis.

**Chapter 4** presents the research design and methodology, including data collection and analysis across the appended studies, as well as the kappa-level synthesis approach.

**Chapter 5** provides background on the Swedish digital health ecosystem and the coordination context within which the empirical papers are situated.

**Chapter 6** summarises Papers I–IV and clarifies how each contributes to the dissertation's research questions.

**Chapter 7** synthesises the papers' findings and addresses **RQ1** and **RQ2** by integrating findings on coordination through governance arrangements and digital platforms. Finally,

**Chapter 8** develops the dissertation's integrative discussion and framework contribution, addressing **RQ3** by explaining why coordination challenges recur as digital transformation generates new and evolving interdependencies across technological and structural boundaries.

# 2 Digital transformation of healthcare

*This chapter situates the thesis within Information Systems and digital health scholarship by conceptualising digital transformation of healthcare as a phenomenon that unfolds beyond organisational boundaries. It defines the object of transformation as the organisation of collective action among multiple autonomous actors and motivates coordination as a central analytical concern, preparing the ground for a review of the theory of coordination in the next chapter.*

## 2.1 The digital transformation of healthcare as a multi-stakeholder phenomenon

The dominant literature on digital transformation conceptualises it as a strategic process within organisations that leverages digital technologies to induce disruptive change (Vial, 2019; Baiyere et al., 2020; Verhoef et al., 2021; Wessel et al., 2021; Piccoli et al., 2024). In this view, the object of transformation is usually a single organisation whose structures, processes, or business models undergo change to gain efficiencies, drive innovation, or gain a competitive advantage. While this perspective is useful for understanding digital transformation as a corporate strategy, it offers a limited understanding of digital transformation in contexts such as healthcare, where change is multistakeholder in nature and spans organisational and institutional boundaries (Hermes et al., 2020; Braa et al., 2023; Konopik & Blunck, 2023).

Highlighting the ecosystem character of this transformation, Constantinides (2023) argues that no single organisation can achieve the required change alone. As pressures on healthcare systems and organisations to pursue digital transformation intensify, the complexity of needs and the diversity of resources required to address both patient- and system-level demands make collaboration

among stakeholders unavoidable. For example, a provider offering online primary care may lack the necessary remote monitoring tools or digital diagnostics in-house; consequently, working with complementary actors becomes essential (Mckinsey, 2021). More broadly, digital health transformation has been characterised as involving a reconfiguration of the healthcare system as a whole, such that effective digital transformation depends on the coordinated contributions of multiple actors rather than the actions of any single organisation (Armanet, foreword to Constantinides, 2023).

Moreover, viewing digital transformation through a multi-stakeholder lens aligns with how healthcare leaders and institutions perceive it, as a means to improve health system performance and societal health outcomes. The WHO (2021, p. 4) global strategy on digital health, for example, is explicitly aimed at leveraging digital tools to support "*equitable, affordable and universal access*" to quality care, implying changes in how care is coordinated and delivered across communities and regions rather than within individual organisations. The Healthcare Information and Management Systems Society (HIMSS), for instance, conceptualises digital health transformation as

*"The shift towards an ecosystem of tools like patient portals, telehealth, predictive analytics, and medical AI. Patients are at the centre, but the ripple effects make interacting with the care system better for everyone"* (HIMSS, 2024).

Notably, this emphasis on *"ripple effects"* reflects a broader shift from organisation-centric change to system-level transformation in contemporary healthcare digital transformation efforts.

## 2.2  Conceptualising digital transformation of healthcare as collective action

As observed by Markus and Rowe (2023), the term *digital transformation* has been used broadly to describe a wide range of phenomena, spanning technological change, organisational restructuring, and broader societal shifts. In healthcare, the concept has expanded from early digitisation efforts focused on electronic health records (Agarwal et al., 2010) to encompass artificial intelligence (Leone et al., 2021), platform-based care delivery, and new forms of patient engagement (Hermes et al., 2020; Constantinides, 2023). This

expanding scope has contributed to persistent ambiguity regarding what, precisely, is being transformed, and how transformation should be understood in practice. As Charalambous (2024) notes, digital transformation has become a *"contractionary concept"*, used to denote a wide range of changes without consensus on how transformation unfolds.

Moreover, as noted earlier, digital transformation has been predominantly conceptualised at the organisational level (Vial, 2021; Wessel et al., 2021). In contrast, healthcare scholarship has increasingly adopted perspectives that examine transformation beyond organisational boundaries, emphasising institutional change and the emergence of novel constellations of actors (Leone et al., 2021; Kuhn et al., 2020; Hermes et al., 2020). Building on Hinings et al. (2018, p.1), this body of work conceptualises transformation as arising from the combined effects of multiple digital innovations that introduce new actors, structures, practices, values, and beliefs, thereby altering or reconfiguring existing "*rules of the game*".

Returning to Markus and Rowe's (2023) call for greater clarity regarding what precisely is being transformed, I build on this perspective to conceptualise digital transformation in healthcare as *the process through which stakeholders reorganise their ways of working together as digital technologies are integrated into healthcare delivery*. This conceptualisation shifts analytical attention away from digital technologies as isolated artefacts and towards how joint work is organised across organisational and institutional boundaries. Digital transformation, in this view, is not reducible to the adoption or implementation of individual systems but concerns how digital technologies reshape ongoing patterns of collaboration, decision-making, and responsibility across healthcare settings.

From this perspective, the object of transformation is not individual organisations or technologies, but collective action. Digital transformation in healthcare unfolds through the interdependent efforts of multiple autonomous actors, including healthcare providers, public authorities, technology vendors, professionals, patients, and citizens, whose contributions must be aligned for transformation to occur. These actors operate under distinct mandates, incentives, and forms of authority, and participation in transformation initiatives is typically voluntary rather than hierarchically enforced. As a result, transformation hinges on how actors reorganise their joint activities over time, rather than on the decisions or capabilities of any single organisation.

This conceptualisation aligns with a growing body of Information Systems research that examines digital transformation beyond the organisational

boundary. This literature examines transformation processes that unfold across organisational and institutional domains, often extending into societal and system-wide arrangements that shape how work is coordinated, controlled, and value is created (Majchrzak et al., 2016; Faik et al., 2020; Tana et al., 2023; Braa et al., 2023). Within this stream, digital transformation is understood as a cross-boundary phenomenon in which the integration of digital technologies is associated with new forms of interdependence among heterogeneous actors.

Related research on digital ecosystems further contributes insights into digital transformation within distributed configurations of interdependent actors operating without hierarchical authority (Wang, 2021; Jacobides et al., 2024; Oberländer et al., 2025). While differing in theoretical orientation, this work similarly foregrounds the collective and relational dimensions of transformation. Taken together, these strands of IS research situate digital transformation as a process that reconfigures collective activity across boundaries, providing a foundation for examining how such transformation is organised in practice.

Moreover, this research highlights coordination as a recurring challenge in digital transformation beyond organisational settings. Studies of digital ecosystems show that increasing interdependencies among actors, combined with the absence of hierarchical control, can give rise to what Jacobides et al. (2024) describe as "*functional failures*", where otherwise valuable contributions fail to cohere at the ecosystem level. Related work on societal-level digital transformation similarly points to persistent difficulties in organising collective action across heterogeneous organisational and institutional settings, characterised by differing mandates, rules, and logics (Faik et al., 2020; Braa et al., 2023). As digital technologies become integrated across such settings, coordination moves to the foreground as a central issue for understanding how digital transformation unfolds in practice.

Importantly, as Braa et al. (2023) argue, shifting analyses of digital transformation beyond organisational boundaries entails more than expanding the empirical scope of inquiry. Such shifts bring increased complexity, arising from the coexistence of multiple rationalities, interests, and institutional arrangements, and therefore call for analytical perspectives capable of accounting for how collective activity is organised across heterogeneous settings (Majchrzak et al., 2016; Faik et al., 2020). This observation provides the point of departure for the thesis, which approaches coordination as a central analytical concern in examining how collective action is organised in the digital transformation of healthcare.

Before turning to coordination theory, the next section identifies key sites where coordination work becomes salient in the digital transformation of healthcare.

## 2.3 What is being coordinated in the digital transformation of healthcare?

I now turn to a more focused question: what, in practice, requires coordinated effort as digital technologies become integrated into healthcare delivery? In line with the conceptualisation above, coordination refers here not only to the effort involved in realising digital transformation, but also to the ways in which activities, responsibilities, and information flows are organised and reconfigured across heterogeneous settings.

The coordination challenges emerging in digital health are wide-ranging, spanning access to patient data, the allocation of responsibilities, the timing of clinical actions, and the mobilisation of citizen participation. However, it is neither feasible nor desirable to address all of these simultaneously. Instead, I foreground below a small set of coordination sites that are both central to the empirical settings and widely recognised as consequential in digital health transformation: data standardisation and interoperability, innovation, and digitally mediated care coordination.

### 2.3.1.1    Data standardisation and Interoperability

A central ambition in digital health transformation is the ability to share and use information across organisational, regional, and technological boundaries. However, achieving this is the quintessential collective action challenge in the digital transformation of healthcare. Once viewed as a purely technical challenge, it is now understood as a sociotechnical challenge that depends on sustained collaboration among autonomous actors across organisational boundaries (newEIF, 2017; HIMSS, 2020; Saenyi, 2021).

Central to this challenge are two interdependent forms of collective effort: Data standardisation and interoperability. While often used interchangeably in policy rhetoric, they represent distinct yet interdependent coordination sites within healthcare ecosystems. Data standardisation involves aligning data formats, terminologies, and classifications so that different actors and systems can understand and act upon information in a consistent manner (Timmermans & Berg, 1997). It establishes the foundational "language" for recording,

sharing, and interpreting health information. This involves defining common terminologies, metadata schemas, minimum datasets, and regulatory classifications that enable alignment across clinical, administrative, and policy domains (Ademaj & Saenyi, 2022; Richesson et al., 2019).

Despite decades of standardisation efforts, fragmentation and inconsistency remain persistent. Multiple, often incompatible, standards coexist, creating misalignments that complicate integration and undermine interoperability (Bhartiya & Mehrotra, 2014; Fossum et al., 2019; Tsafnat et al., 2024). As Priou et al. (2024) pointed out, these challenges reflect tensions that hinder harmonisation. Consequently, debates continue over whether universal standards promote integration or whether domain-specific flexibility better serves diverse use cases (Tsafnat et al., 2024). The unresolved nature of these tensions results in data silos, reduced data quality, and limits the transformative potential of digital health innovation (Bhartiya & Mehrotra, 2014; Priou et al., 2024).

While standardisation establishes the semantic basis for shared understanding, interoperability refers to the ability of systems and institutions to exchange and make meaningful use of that information. Individual organisations may invest in electronic health records or data-sharing platforms, but the transformative potential of such systems depends on broad, cross-actor coordination around shared infrastructures and practices (Reisman, 2017). For instance, in the United States, most hospitals report they can send, receive, and integrate information but do so only "sometimes" (Gabriel et al., 2024). In Sweden, only 15% of municipal providers contribute to the National Patient Overview despite the existence of a national platform (eHälsa2025, 2023).

These persistent gaps highlight that effective data sharing in digital transformation depends on the continuous alignment of technical systems, legal frameworks, organisational roles, and institutional responsibilities. Achieving interoperability, thus, requires aligned data-sharing agreements, consent and stewardship frameworks, funding models, and accountability structures, all of which transcend institutional boundaries and demand ongoing negotiation (Reisman, 2017; McCullough et al., 2014).

### 2.3.1.2 Innovation

Beyond interoperability, digital transformation also requires coordinating how new ways of working are imagined, tested, and adopted as digital technologies open fresh possibilities. As digital technologies introduce new capabilities, they invariably compel a reconfiguration of established practices. For example,

Electronic Health Records (EHRs) have evolved from static systems for documentation into dynamic platforms supporting complex decision-making and population health management (Parker et al., 2017; Mills, 2019; Kruse et al., 2018). Likewise, telemedicine has matured beyond basic video consultations to form ecosystems critical for the coordinated management of chronic conditions (Keesara et al., 2020; Frishammar et al., 2022). Making these possibilities a reality, however, demands alignment around encouraging exploration and adapting work as innovations emerge (Noesgaard et al., 2023).

In this sense, coordination entails creating shared experimentation spaces (pilots, sandboxes, joint testing), learning loops (feedback, updates, post-deployment evaluation), and capability building (training, new roles) so that novel ideas and tools can be responsibly tried, assessed, and scaled across organisations (Leckenby et al., 2021; Cresswell et al., 2021). Because innovation work is ongoing, actors must negotiate emerging roles, risks, and value as apps, wearables, or AI are repurposed and integrated into care (Bossen et al., 2019; Bailey et al., 2020; Anderson & Sutherland, 2024; Warraich et al., 2025). In short, coordinating innovation means enabling new practices to emerge and adapting structures and responsibilities as those possibilities crystallise into everyday care.

### 2.3.1.3   Care coordination through digital platforms

Finally, digital transformation in healthcare is reshaping care pathways by integrating digital platforms, thereby enhancing patient outcomes, streamlining operations, and fostering new models of care delivery (Ologeanu-Taddei et al., 2023; Hermes et al., 2020). As Ologeanu-Taddei et al. (2023) point out, the shift towards digital platforms not only improves the quality and accessibility of healthcare but also empowers patients to actively manage their health. Furthermore, digital platforms have enabled a shift from reactive to proactive care models, focusing on patient needs and improving the overall care experience (Shapiro et al., 2023).

Digital platforms create value by orchestrating a wide array of partners and actors, transforming traditional healthcare roles and enhancing patient engagement (Hermes et al., 2020). However, as Horgan et al. (2019) note, this transformation also presents challenges, as it generates novel care pathways and services that struggle to integrate or are incompatible with the existing organisational structures, established clinical processes, or current models of healthcare delivery. It requires coordinating workflows and responsibilities to ensure that care remains continuous as patients and activities traverse organisational and professional boundaries (Chen et al., 2024; Rudin & Bates,

2014). This involves clarifying roles and dependencies within and between organisations, aligning professional practices with new digital processes, and ensuring that accountability mechanisms align with the distributed nature of care delivery enabled by digital technologies (Husain et al., 2021; Linden et al., 2022).

Ultimately, the purpose is to create a coherent patient experience across the complex landscape of modern healthcare. Digital transformation should enable care that follows the patient, rather than the organisation, linking institutions, professionals, and data around the patient's trajectory. In this sense, what is being coordinated, therefore, are the relationships, information flows, and institutional arrangements that allow healthcare to function as a coherent, digitally mediated ecosystem.

In this thesis, I understand coordination as the continuous process through which these interdependencies are aligned and sustained across organisational, institutional, and technological boundaries. Next, I therefore turn to coordination theory as an analytical lens for the thesis.

# 3 Coordination theory: Foundations and limitations

In common usage, the term "*coordination*" is readily understood as "*the process of organising people or groups so that they work together properly and well*" (Merriam-Webster, 2025). Despite this intuitive familiarity, coordination has proven difficult to specify rigorously as an academic concept. As Alexander (2014, p.3) observes, the difficulty does not stem from a lack of definitions, but rather from the opposite problem: there are "*too many different definitions, and too little agreement*", with some definitions becoming so inclusive that they risk losing analytical clarity. Coordination, in this sense, is a concept that is widely recognised but inconsistently specified across scholarly traditions.

Across organisational and information systems research, coordination has been approached from multiple analytical standpoints. Some strands of literature emphasise the role of coordination in aligning actors' efforts toward shared or mutually recognised goals (e.g. March & Simon, 1958; Gulati et al., 2012; Adner, 2017). Others focus on the mechanisms through which such alignment is achieved, highlighting structures, routines, and processes such as mutual adjustment, supervision, and standardisation (Mintzberg, 1979; Van de Ven et al., 1976). A further body of work foregrounds the task and resource-based relationships that give rise to coordination demands, framing coordination as the management of interdependencies among activities (Thompson, 1967; Malone & Crowston, 1994).

One reason for this conceptual diversity lies in the nature of coordination problems themselves. As Alexander (2014) argues, demand for coordination arises when multiple actors must act together in the absence of a single authority. Under such conditions, coordination is inherently context-dependent and negotiated, shaped by the relationships among participating actors rather than by predefined structures alone. Across the perspectives outlined above, coordination theory is therefore united less by a shared definition than by a

common concern with how interdependent actors and activities attempt to align their actions.

Rather than seeking to reconcile these perspectives into a single definition, this chapter treats their diversity as analytically productive. It traces the historical development of coordination theory across organisational theory, management studies, and information systems research, examining how coordination has been conceptualised over time and highlighting key shifts in emphasis and underlying assumptions that continue to shape contemporary understandings of coordination as an analytical lens. It closes by introducing "*generative interdependencies*" as a sensitising concept for examining coordination in digital transformation.

## 3.1  Early perspectives on coordination

The concept of coordination has long been a central concern in organisational theory, emerging alongside the rise of large-scale industrial production. As Jacoby (2004) notes, early studies of coordination developed in response to the inefficiencies of traditional management practices as organisations grew in size and complexity. Scientific management approaches sought to address these challenges by decomposing work into discrete tasks, enabling specialisation and efficiency through standardisation (Taylor, 1915). By rationally organising work processes and standardising inputs and outputs, early management efforts aimed to reduce waste and improve productivity. At the same time, increasing task specialisation created new demands for integrating interdependent activities (Scott & Davis, 2015).

Subsequent scholarship shifted attention from task optimisation at the shop-floor level to the deliberate design of organisational structures capable of coordinating increasingly differentiated organisational units. Classical management theory framed coordination as a function of formal authority, hierarchy, and rules (Fayol, 1949), while organisational design research treated coordination as a structural outcome of aligning formal arrangements with environmental contingencies (Lawrence & Lorsch, 1967; Thompson, 1967). In this view, coordination could be achieved by selecting appropriate structural mechanisms to match the nature of organisational tasks and interdependencies.

Notably, Thompson's (1967) typology of pooled, sequential, and reciprocal interdependence was particularly influential in positioning coordination as a response to task interdependencies, with different mechanisms, such as

standardisation, planning, and mutual adjustment, corresponding to each type. Lawrence and Lorsch (1967) further emphasised that differentiation and integration are inherently linked: as organisations specialised into distinct sub-units, they faced heightened needs for integrative mechanisms to avoid fragmentation. Galbraith (1977) extended this structural perspective by conceptualising organisations as information-processing systems, arguing that coordination capacity depended on aligning information-processing requirements with organisational design choices, including rules, plans, and lateral relations.

These foundational studies established coordination as essential for accomplishing interdependent work across multiple actors and identified a repertoire of mechanisms through which coordination could be achieved. These included formal structures and rules that allocate authority (Fayol, 1949), standards, plans, and schedules designed to structure interdependent tasks (Thompson, 1967; Galbraith, 1977), communication channels and lateral relations that enable adjustment across organisational units (Galbraith, 1977). This understanding was later crystallised in Malone and Crowston's (1990, p. 361) influential definition of coordination as "*the act of managing interdependencies between activities to achieve a goal*".

While foundational, these approaches were shaped by the industrial contexts in which they emerged. As Okhuysen and Bechky (2009) observe, early coordination theories were developed during an era dominated by the production of physical goods, leading scholars to conceptualise coordination mechanisms as relatively stable and reified entities. This industrial orientation contributed to mechanistic and hierarchical models of coordination, which may be less suited to capturing the fluid and emergent dynamics of contemporary organisational forms, particularly in digital and networked environments (Jarzabkowski et al., 2012; Gkeredakis, 2014; Okhuysen & Bechky, 2009; Gkeredakis & Constantinides, 2019).


## 3.2  Coordination as an emergent practice

While early coordination theories provided powerful tools for managing interdependent work in stable organisational settings, their emphasis on formal structures, rules, and predefined mechanisms proved insufficient for understanding coordination in contexts characterised by uncertainty, time pressure, and knowledge-intensive work (Okhuysen & Bechky, 2009;

Jarzabkowski et al., 2012). As organisational activity shifted toward service provision and real-time decision-making, it became clear that coordination could not always be fully designed in advance through hierarchical authority or standardised procedures (Gkeredakis, 2014). Instead, actors frequently adjust their actions in situ, responding to emerging contingencies and unanticipated interdependencies as they arise (Jarzabkowski et al., 2012). This shift prompted a body of research that redirected attention away from structural design and toward examining "*what people actually do to coordinate*" (Gkeredakis, 2014, p.1474).

A wave of empirical research has elaborated on this view by foregrounding informal and situated coordination work, in which actors rely on interaction, negotiation, and mutual adjustment rather than on formalised rules or hierarchical authority (Bechky, 2006; Faraj & Xiao, 2006; Kellogg et al., 2006; Jarzabkowski et al., 2012). For example, research on medical and emergency work illustrates how integrative conditions are sustained not only through formal protocols but also through real-time interaction and collective sensemaking as professionals respond to evolving conditions (Faraj & Xiao, 2006). Similarly, studies of project-based and distributed work showed how actors improvise coordination practices to manage interdependencies that cannot be fully anticipated, relying on informal communication, boundary-spanning roles, and iterative adjustment (Bechky, 2003; Kellogg et al., 2006), 2003; Kellogg et al., 2006). Viewed through this lens, coordination is constantly reshaped by local contingencies and the unpredictable flow of work.

Providing a conceptual synthesis of these emergent dynamics, Okhuysen and Bechky's (2009) seminal review conceptualises coordination as the ongoing production of three integrative conditions: *accountability, predictability, and common understanding*. Rather than being fully determined by formal mechanisms, these conditions are continuously enacted through interaction as actors make sense of their roles, anticipate one another's actions, and negotiate responsibility. This framing foregrounds coordination as a situated and temporal process, highlighting how alignment is achieved through communication, adjustment, and sensemaking in the flow of work, rather than through prior specifications.

Despite this reconceptualisation, practice-based approaches to coordination have largely been developed within organisational or team-based settings. Even when coordination is understood as emergent and negotiated, shared organisational membership, professional norms, or established authority relations often continue to provide a common frame of reference for coordinating action (Okhuysen & Bechky, 2009; Gkeredakis, 2014). As a

result, while practice-oriented coordination theory addresses important limitations of structural models, it remains less equipped to account for coordination challenges that arise across organisational, institutional, and technological boundaries, where no shared authority or stable context can be assumed.

This limitation becomes particularly salient in contexts of digital transformation, where coordination increasingly involves heterogeneous actors interacting through evolving technological infrastructures. The following section, therefore, extends the discussion by examining how coordination has been theorised in digital contexts and how these settings further challenge established assumptions within coordination theory.

## 3.3  Coordination in the digital era

The turn toward practice-based perspectives successfully highlighted the dynamic, contextual nature of coordinating within bounded organisations. However, as digital transformation decentralises work and dissolves traditional firm boundaries, actors must increasingly coordinate across organisational, institutional, and technological boundaries. The theoretical implications of this shift have been most extensively examined in the literature on digital platforms and ecosystems. It is within this body of work that the problem of large-scale, extra-organisational alignment has been explicitly addressed. Here, platforms are conceptualised as meta-organisations that orchestrate coordination among heterogeneous, largely autonomous actors without relying on hierarchical authority or formal employment relations (Ens et al., 2023; Kretschmer et al., 2022; Möhlmann et al., 2021).

In these settings, practice-based coordination mechanisms are complemented, or even replaced, by architectural and algorithmic mechanisms. Platforms employ mechanisms such as algorithmic management to direct and coordinate user activities at scale (Kellogg et al., 2020; Möhlmann et al., 2021). This is reinforced by platform architectures that leverage modular designs and boundary resources, such as APIs, to partition tasks and standardise interactions while allowing self-organisation (Ghazawneh & Henfridsson, 2013; Engert et al., 2024). While this scholarship has advanced our understanding of coordinating in digital contexts, it has not extended to interrogating the assumptions underpinning the theory of coordination. To

clarify, it is helpful at this point to step back and briefly revisit the historical trajectory of how coordination research has conceptualised interdependence.

Early research focused on the interdependencies between physical tasks and material resources in manufacturing environments, where the challenge was to ensure predictable sequences through standardisation and supervisory control (Taylor, 1915; Fayol, 1949). As organisations grew more complex, the focus shifted to the structural interdependencies between differentiated units, framing coordination as the reintegration of work decomposed through organisational design (Fayol, 1949; Lawrence & Lorsch, 1967; Thompson, 1967).

**Table 1. Summary of the theoretical evolution of the coordination theory**

| Period | Authors | Settings | Interdependence focus | Coordination mechanisms |
|---|---|---|---|---|
| **Designing work** | (Taylor, 1915; Fayol, 1949) | Manufacturing and industry | Sequential | Standardisation; supervisory control |
| **Designing organisations** | (Fayol, 1949; Lawrence & Lorsch, 1967; Thompson, 1967; Van de Ven et al., 1976; Mintzberg, 1979) | Differentiated organisational units and workflows | Pooled; sequential; reciprocal | Formal governance structures and rules; information-processing systems; plans/procedures; mutual adjustment |
| **Emergent practice** | (Bechky, 2003; Bechky, 2006; Faraj & Xiao, 2006; Kellogg et al., 2006; Jarzabkowski et al., 2012; Okhuysen & Bechky, 2009) | Teams, projects and knowledge-intensive work | Situated, shifting interdependencies in real-time work | Mutual adjustment and sensemaking; producing integrative conditions (accountability, predictability, common understanding) |
| **Digital ecosystems** | (Ghazawneh & Henfridsson, 2013; Möhlmann et al., 2021; Leong et al., 2024) | Platforms and ecosystems | Emergent, network interdependencies | Platform architecture and boundary resources, algorithmic management |

Later, practice-based approaches reoriented attention towards informal interactions among actors. Rather than focusing on predetermined structural relationships, they emphasised the importance of coordinating the conditions for managing distributed expertise and capabilities in real time (Faraj & Xiao, 2006; Okhuysen & Bechky, 2009). Contemporary ecosystem literature has further extended this by examining network interdependencies mediated through platform architectures, boundary resources, and algorithms (Ghazawneh & Henfridsson, 2013; Möhlmann et al., 2021; Leong et al., 2024). Table 1 summarises this theoretical arc.

This trajectory reveals an important theoretical lacuna. While traditional coordination theory has focused on task-based interdependencies that assume division of labour and reintegration, the ecosystem literature demonstrates coordination mechanisms that operate through different logics. Digital platforms, in particular, coordinate interdependencies among autonomous actors who constitute independent participants rather than components of predetermined task structures. Yet despite this departure from task-based coordination models, the ecosystem literature has not systematically interrogated how these practices challenge foundational assumptions within coordination theory.

Gkeredakis and Constantinides (2019) describe this as the "*flipside metaphor*", the assumption that coordination problems arise from dividing overarching tasks into subtasks that subsequently require reintegration. This metaphor spans both structural accounts emphasising formalised coordination (Thompson, 1967; Malone & Crowston, 1994) and practice-based accounts foregrounding informal, interactional alignment under uncertainty (Faraj & Xiao, 2006; Bechky, 2006). Digital transformation, however, challenges this logic. Coordination increasingly involves autonomous actors (Kretschmer et al., 2022), interdependencies that emerge through technological mediation rather than predefined task design (Yoo et al., 2010; Bailey et al., 2010), and alignment processes that unfold across evolving infrastructures rather than within stable organisational structures (Tilson et al., 2010; Kallinikos et al., 2013).

Taken together, these dynamics call for renewed conceptual attention to the nature of interdependencies in the context of digital transformation. The following section builds on this insight by introducing the notion of generative interdependencies (Gkeredakis & Constantinides, 2019) as a sensitising concept for articulating how interdependence emerges and evolves as digital transformation unfolds.

## 3.4 Generative interdependencies in digital transformation

The challenge, then, is not only how coordination is achieved, but how interdependencies arise and evolve over time. To articulate this shift, Gkeredakis and Constantinides (2019) introduce what they term "*generative interdependencies*", dependencies that are not specified a priori through task design or organisational structure, but instead emerge and evolve through ongoing interaction with digital technologies. This concept builds on a substantial body of research that emphasises the generative properties of digital technologies (Zittrain, 2006; Tilson et al., 2010; Yoo et al., 2010; Henfridsson & Bygstad, 2013; Kallinikos et al., 2013).

Gkeredakis and Constantinides (2019) highlight three characteristics of digital technologies that explain why such interdependencies become generative. First, digital technologies are *"intentionally incomplete and perpetually in the making"* (Gkeredakis & Constantinides, 2019, p.8), meaning they evolve continuously through use (Garud et al., 2008). Second, this incompleteness also means that digital architectures no longer mirror organisational structures (Colfer & Baldwin, 2016; Gkeredakis & Constantinides, 2019), thereby "*inverting*" the locus of coordination from internal task alignment to external ecosystem interactions. Third, digital technologies are product agnostic and generative, allowing actors to repurpose and recombine technological building blocks for uses never originally envisioned (Yoo et al., 2010; Henfridsson et al., 2018).

As a result, the generative interdependencies created by digital technologies call for explanatory frameworks for coordination that do not presume stable, predefined relations among tasks, roles, and organisations (Gkeredakis & Constantinides, 2019). The incompleteness implies ongoing collaboration as actors collectively develop and adapt capabilities over time, while non-mirroring requires autonomous actors to align their activities without predetermined authority relationships. Moreover, the agnostic and generative nature of digital technologies amplifies these dynamics by enabling emergent forms of coordination and creating network effects whereby the value of participation increases as more actors join the ecosystem, generating interdependencies that cannot be predetermined (Henfridsson et al., 2018). Table 2 summarises these digital characteristics and the corresponding forms of generative interdependence they give rise to.

**Table 2. Generative interdependencies from digital technologies**

|   | Digital characteristic | Generative interdependence |
|---|---|---|
| 1 | Incompleteness | Ongoing collaboration between actors to collectively develop and adapt capabilities over time |
| 2 | Non-Mirroring | Autonomous actors align their activities beyond their established organisational structures. |
| 3 | Product agnostic and Generativity | Actors repurpose and recombine technological building blocks in unexpected ways, creating network effects that generate new interdependencies. |

Generative interdependencies, therefore, provide an analytical lens for examining how coordination challenges arise, persist, and transform as digital transformation unfolds across decentralised settings and continually reconfigures relations among actors (Gkeredakis & Constantinides, 2019). By foregrounding the emergent nature of these relations, the concept helps to explain why coordination may remain provisional, contested, and subject to continual reworked. In this thesis, I therefore define coordination as:

*The management of generative interdependencies emerging from the digital transformation of healthcare*

Building on this definition, I use generative interdependencies as a sensitising concept to guide empirical analysis toward identifying how healthcare's digital transformation both responds to and produces interdependencies as digital infrastructures are developed, governed, and used. Used as a sensitising concept, it does not offer a predictive framework but orients the analysis to how interdependencies take shape and are stabilised (Blumer, 1954; Bowen, 2006). In this way, the concept provides a bridge between the coordination theories reviewed in this chapter and the empirical chapters that follow (RQ3), which examine how collective action is coordinated and sustained through governance arrangements (RQ1) and in practice through digital platforms in time-critical settings (RQ2).

## 3.5 Connecting the dots: Synthesising theoretical approaches from individual papers

This thesis is structured around a set of papers that gradually expanded the analytical focus—from ecosystem-level governance to the socio-technical work of standardisation and infrastructuring, and finally to practice-level coordination in time-critical settings. Developed at different stages of the research, the papers address coordination-related challenges from distinct vantage points. To integrate these findings, I distinguish between two levels of analysis, governance and practice. At the governance level (RQ1), coordination concerns the macro-level institutional arrangements that enable, constrain, and sustain collective action among autonomous actors in ecosystem-wide digital transformation. At the practice level (RQ2), coordination concerns the situated enactment of collective action through digital technologies.

Paper I anchors the governance level by examining how collective action is coordinated and sustained through governance arrangements in a decentralised healthcare ecosystem (RQ1). Paper IV anchors the practice level by examining how collective action is coordinated and sustained in a time-critical platform setting (RQ2). Paper II and Paper III strengthen the analytical foundation across both levels by clarifying forms of coordination work that build and maintain coordination capacity over time, through ongoing infrastructural alignment work (Paper II) and standardisation processes (Paper III).

Across the thesis, the notion of generative interdependencies is introduced as a sensitising concept that orients synthesis to how interdependencies emerge and shift as digital technologies evolve, practices adapt, and institutional arrangements are renegotiated (RQ3). In the individual papers, complementary theoretical lenses are used to analyse coordination from different vantage points; their detailed use and methodological implications are presented within each paper. Here, I focus on how these lenses relate across the thesis and how they support a synthesised understanding of coordination as the phenomenon of interest.

At the **governance level** (RQ1), Paper I uses the polycentric governance and the COOF frameworks (Ostrom, 1990; Baldwin et al., 2023) to support the analysis of how coordination is shaped by multiple autonomous decision centres and by the institutional arrangements through which they interact, make decisions, and adapt over time. At the **practice level** (RQ2), Paper IV utilises the assemblage theory (Deleuze & Guattari, 1987; DeLanda, 2006) to

support the analysis of coordination as a provisional accomplishment in platform-based, time-critical settings, where action depends on fragile alignments among heterogeneous actors and sociotechnical arrangements rather than on hierarchical control.

Two further perspectives strengthen the analytical foundation by clarifying how coordination capacity is built and sustained. The multi-thread social activity model (Fomin et al., 2003) in Paper III makes visible the socio-technical work involved in standardisation—showing how coordination depends on intertwined processes of design, sensemaking, and negotiation among actors with partially aligned incentives. An infrastructuring lens theory (Star & Ruhleder, 1996; Pipek & Wulf, 2009) in Paper II conceptualises coordination as ongoing work across infrastructural layers. Figure 1 positions the papers across these two levels of analysis
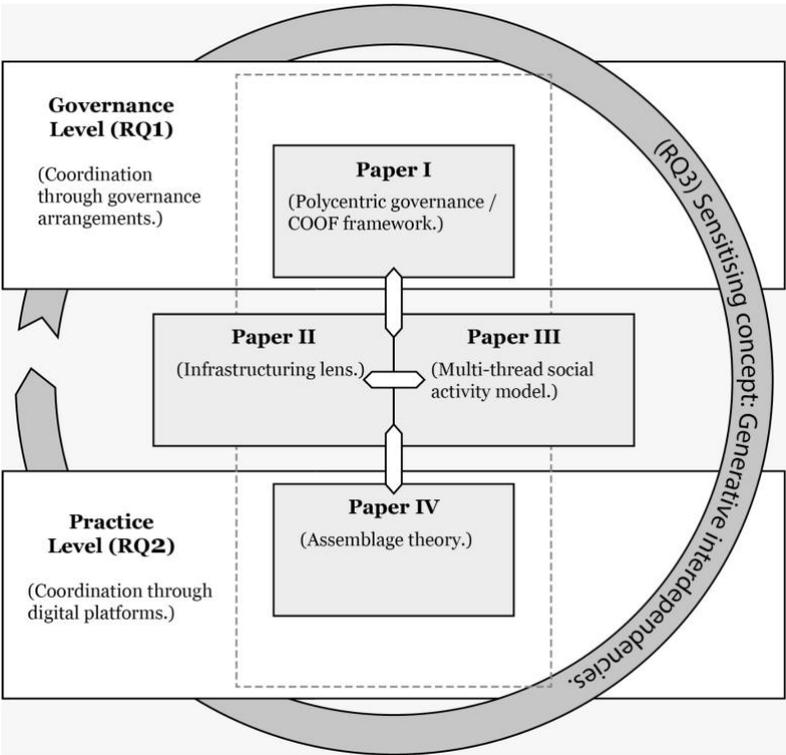


**Figure 3 The different levels of analysis**

# 4 Research design and methodology

This chapter outlines the methodological framework of the thesis. The design evolved in tandem with the phenomenon it sought to understand; early explorations into interoperability and digital platforms revealed that technical integration was inseparable from institutional negotiation. As detailed in the preface, these empirical encounters gradually shifted the inquiry from interoperability as a technical challenge to the organisational and institutional work through which multiple actors make joint action possible, bringing coordination into view as the thesis's central analytical lens.

The remainder of this chapter outlines how this orientation translated into a concrete research design. It first clarifies the interpretive stance that guided the approach to coordination, then describes the pragmatic logic that guided the development of the inquiry. The chapter then turns to the empirical contexts and the qualitative methods for data collection and analysis that underpinned the four constituent papers, before concluding with the meta-synthesis that bridges them.

## 4.1 An interpretive understanding of coordination

Observing the breakdowns in the regional projects, for instance, when clinicians raised concerns of being sidelined and patient safety warnings appeared (Svt Nyheter, 2022b; 2022a), it became clear that "the information system" was not a neutral tool but a contested terrain in which autonomous actors negotiated meanings and expectations. Understanding these frictions as coordination challenges, therefore, required an approach attuned to the experiences, meanings, and situated actions through which digital transformation unfolds. Accordingly, I adopted a qualitative research design grounded in an interpretive epistemology. Interpretivism rests on the assumption that reality is socially constructed and that understanding arises

through engagement with participants' lived worlds (Orlikowski & Baroudi, 1991; Klein & Myers, 1999; Walsham, 2006).

This is particularly relevant in healthcare digital transformation, where multiple autonomous actors, evolving technologies, and institutional arrangements must be aligned. An interpretive approach enables examination of how these elements interact and shape one another in practice (Myers, 2019). Additionally, research on coordination emphasises understanding from the perspectives of those who enact it through situated practices, negotiations, and sense-making activities (Okhuysen & Bechky, 2009; Jarzabkowski et al., 2012).

Building on this view, I analyse coordination by tracing what people do to achieve collective action in healthcare's digital transformation: how they make sense of situations, negotiate responsibilities, and adjust actions across organisational boundaries. I examine how these actions are shaped and sometimes constrained by technologies (e.g., data standards, platforms) and by institutional arrangements (e.g., governance structures). An interpretive design, therefore, traces these dynamics, capturing the formal structures and informal practices shaping collective action, as well as how diverse actors negotiate toward shared understanding and coordinated action (Orlikowski & Baroudi, 1991; Langley, 1999; Constantinides & Barrett, 2012).

## 4.2 The logic of inquiry: A pragmatic orientation

While the thesis is grounded in an interpretive understanding of meaning and practice, the research design evolved in a way that aligns with what Dewey (1938) describes as a pragmatic logic of inquiry. What began as an inquiry into interoperability and digital platforms gradually shifted toward investigating how collective action is coordinated within the broader landscape of digital transformation. In pragmatic terms, the research progressed by working through problematic situations and iteratively refining what needed to be explained (Levi & Levi, 2012). As Dewey puts it:

*"All logical forms (with their characteristic properties) arise within the operation of inquiry and are concerned with control of inquiry so that it may yield warranted assertions."* (Dewey, 1938, p.104).

For Dewey, inquiry is not the application of a priori universal truths, but rather the forms of reasoning and the distinctions that matter emerge through the

work of inquiry itself, shaped by context, experience and response (Ormerod, 2006; Metcalfe, 2008). This perspective resonates with the mode of reasoning that came to define this thesis, which developed through recursive movement between empirical encounters, emerging puzzles, and conceptual reframing. Dewey's pragmatist account, in this sense, is not used here as a prescriptive methodological framework; rather, it provides a conceptual grounding for articulating the inquiry I found myself conducting and its orientation towards practice-relevant insights (Goldkuhl, 2008; 2012).

In practice, this meant letting the inquiry guide the design. As different coordination challenges emerged over the course of the research, I assembled complementary studies, selecting approaches suited to capturing their richness and diversity (Martela, 2015; Mendling et al., 2021). Accordingly, the thesis assembles four interrelated studies using complementary qualitative approaches, including empirical investigations, systematic literature reviews, and theory-informed analyses. The empirical studies trace coordination as it is enacted in practice, while the literature-based analyses synthesise and extend existing knowledge to identify conceptual tensions and theoretical opportunities (Webster & Watson, 2002; Vom Brocke et al., 2015; Myers, 2019). Taken together, these approaches constitute a coherent design guided by an iterative, responsive pragmatic logic of inquiry.

Although the papers are presented in an order that supports the thesis' conceptual argument, they were developed iteratively as the inquiry progressed. Early work on data standardisation (Paper III) reframed interoperability as sociotechnical and institutional work rather than technical integration alone. Analysis of polycentric governance (Paper I), prompted by scrutiny of regional platform rollouts, brought jurisdictional and accountability questions into focus and sharpened the coordination problem. This, in turn, motivated closer examination of coordination in practice through the Sms-livräddare setting (Paper IV), before Paper II synthesised existing digital health research to conceptualise coordination as an ongoing infrastructuring challenge spanning institutional, informational, and technological layers. Two additional studies (Saenyi, 2021; Saenyi, 2023) explored related questions but fall outside the scope of this compilation. Table 3 summarises the papers and their methods.

**Table 3. Summary of included papers and their approaches.**

| Paper No. | Reseseach approach | Research Question | Theoretical Concepts | Phenomenon under study |
|---|---|---|---|---|
| I | Qualitative empirical study (interpretive), ecosystem-level analysis | Why do problems persist in achieving collective digital health goals in decentralised healthcare systems? | Polycentric governance; COOF framework (Context–Operations–Outcomes–Feedback); collective action | Macro-level coordination through governance arrangements in Sweden's decentralised digital health ecosystem (interoperability, scaling of innovations, cross-regional collaboration) |
| II | Systematic Literature Review (SLR) with theory-informed analysis | How is coordination infrastructured in digital health ecosystems? | Infrastructuring theory; coordination theory (coordination as ongoing alignment) | Coordination as an infrastructural process across technological, informational, and institutional layers in digital health ecosystems |
| III | Systematic Literature Review (SLR) with inductive qualitative synthesis | What practices are vital for effective data standardization processes in healthcare information systems? | Data standardisation as coordination work; multi-thread social activity model (design–sensemaking–negotiation) | Data standardisation practices that enable/shape interoperability and coordination across heterogeneous health IS |
| IV | Qualitative empirical study (interpretive), practice-level coordination in an emergecny setting | How do non-interventionist Social Mission platforms (SMPs) coordinate volunteer actions in emergency responses? | Assemblage Theory, Platform Coordination, process-oriented view of emergent coordination | Platform-mediated coordination in Sms-Livräddare during OHCA response (before/during/after alarm) |

Having explained how the inquiry developed across the studies, I now introduce the empirical settings that ground the empirical papers and shaped data generation.

## 4.3 Empirical contexts

Shared digital infrastructures in healthcare create interdependencies when data, services, and workflows are meant to connect across organisations; collective action depends on aligning actors who hold different mandates, incentives, and information systems (Fürstenau et al., 2019; Constantinides & Barrett, 2015). The empirical settings introduced below show how collective action is pursued under different institutional and infrastructural conditions through governance arrangements in the wider ecosystem and through a platform in time-critical practice. A fuller account of the Swedish digital health ecosystem, its actors, governance arrangements, and shared digital infrastructures is provided in Chapter 5.

### 4.3.1 Sweden's digital health transformation as a governance setting (Paper I)

Swedish healthcare is characterised by decentralised responsibility, with regions and municipalities holding substantial authority over care provision and, by extension, key decisions in digitalisation. This structure is a form of polycentric governance, where multiple autonomous decision-making centres must coordinate without a single hierarchical command. While this allows for local experimentation, it creates a "patchwork" of technologies and priorities that makes national digital goals a recurring challenge. In this setting, digital transformation is pursued through a mix of regionally driven initiatives and shared national infrastructure, including interoperability platforms and other services deemed of national interest (e.g., initiatives related to data reuse and AI adoption).

In this ecosystem, collective action is often centred around two practical problems: interoperability and innovation. Interoperability depends on agreements about standards, interfaces, access rules, and responsibilities so that data and services can move across organisational boundaries. Innovation depends on creating workable conditions for developing, onboarding, and scaling new digital services, often through the same shared infrastructures. Consequently, the actors who govern them shape who can participate, on what terms, and how quickly new initiatives diffuse through the ecosystem.

Paper I follows these collective action challenges across a heterogeneous set of actors, including public bodies, private providers, intermediaries, and innovators. The Swedish context is thus not treated as background but as part

of the phenomenon: distributed authority shapes what forms of collective action are possible, and what work is required to sustain it. This context informed the empirical focus of Paper I by directing attention to how collective action is organised through institutional arrangements.

### 4.3.2 Platform-mediated emergency response through Sms-livräddare (Paper IV)

The second empirical setting is Sms-livräddare, a digital platform that supports volunteer mobilisation in time-critical emergency response. This case was selected as a strategic counterpoint to the institutional friction observed in regional digital health initiatives. Whereas Paper I foregrounds the slow, often stalled work of bureaucratic alignment, Sms-livräddare provides a site where coordination becomes visible in action, under conditions of urgency, partial information, and distributed participation among actors not connected by a formal organisational hierarchy. At the same time, the platform is not external to healthcare as it is embedded within formal emergency response arrangements and relies on existing infrastructures, protocols, and recognised roles to function as intended.

Paper IV examines coordination in this setting as it is enacted through platform-mediated action across organisational boundaries. The focus is on how collective action is mobilised and sustained in practice. This includes how actors make sense of unfolding situations, negotiate responsibilities, and adapt their actions as conditions change, and how these dynamics are shaped by both the platform's functionalities and the broader institutional arrangements surrounding emergency response.

Studying Sms-livräddare therefore, complements the governance setting examined in Paper I. Collectively, these two contexts illustrate contrasting coordination patterns within Sweden's fragmented digital health ecosystems. While Paper I emphasises how collective action is organised via governance structures, shared infrastructure, and cross-regional dependencies, Paper IV highlights how it is enacted in real time through platform-mediated mobilisation. This approach enables the thesis to explore coordination needs across both institutional frameworks and situated practice.

## 4.4 Data Collection and Analysis

### 4.4.1 Paper I: Coordination in Sweden's decentralised digital health ecosystem

Paper I focuses on understanding the challenges and strategies involved in coordinating collective action in the digital transformation of the Swedish healthcare system. The study draws on a combination of interviews and documentary material. In total, 12 semi-structured interviews were conducted between March and October 2023 (10 individual interviews and two group interviews; 45–80 minutes). Participants were selected purposively to capture perspectives from key positions across the ecosystem, including national agencies, regional organisations, digital infrastructure actors, innovation intermediaries, and consultants involved in digital health initiatives.

Interview questions were open-ended and aimed to elicit stakeholders' experiences, including perceived challenges, strategies, and obstacles encountered in the digital transformation of Swedish healthcare. The interviews were guided by a semi-structured protocol that was adapted to each informant's role, background, and position, and iteratively refined as our understanding of the case developed over time. In one interview, the participant withdrew consent to be recorded; the recording was stopped, and the interview was excluded from the analysed dataset.

Interview material was complemented by a corpus of secondary sources, including organisational documents (e.g., policy and strategy documents, annual reports, and evaluation/oversight reports) and publicly available audiovisual material such as recorded webinars and panel discussions published by key ecosystem organisations (e.g., Inera). These sources were used to triangulate and contextualise interview accounts, and to trace how coordination problems and governance ambitions were articulated. Table 4 summarises the data sources.

Throughout, data collection and analysis informed one another, with early coding guiding subsequent interviews and refining the analytical focus. Interviews and documents were first coded inductively to map recurring coordination challenges and governance dynamics. As patterns stabilised, the COOF framework (Baldwin et al., 2023) was used as an organising device for directed coding to examine relationships between context, operations, outcomes, and feedback (Hsieh & Shannon, 2005). This provided a structured way to relate empirically identified challenges to patterns of governance.

**Table 4. Summary of data sources for paper I**

| Empirical sources | Category | Sources | Description |
|---|---|---|---|
| Interviews | National digital health infrastructure | 6 (Including 1 group interview) | **(R1–R2: ~80; R7: 60; R8: 75; R9: 60; R10: 60; R11: ~75).** Representatives involved in national digital health infrastructure and implementation, including a project manager/medical editor, information architect, solutions architect, and external digital health/solution consultants |
| | Regional Innovation intermediary | 1 | **(R3: 75)** Digital health innovation manager |
| | Digital health Innovation company | 2 (Including 1 group interview) | **(R4–R5~70; R6~45)** Representatives of digital innovation companies, CEO, project manager and customer manager |
| | Regional | 1 | **(R12: 55)** eHealth strategist |
| | eHealth Agency | 1 | **(R13: 65)** Senior advisor and coordinator |
| | Innovation Incubator | 1 | **(R14: 50)** Programme manager |
| Documents | | 35 | Strategy and roadmap documents (Vision eHealth 2025; Inera; eHälsomyndigheten), service and functionality guides for shared platforms (1177, National Service Platform), architecture/interoperability documentation (reference/goal architectures, implementation guides), terms of use and data governance role documents, evaluations and oversight reports (including Vård- och omsorgsanalys), and annual reports from key ecosystem organisations |
| Public videos | | 11 | Recorded webinars, presentations, and informational videos (typically 30 mins each) published by key ecosystem organisations (e.g., Inera's official YouTube channel), used to trace public framings of coordination, governance roles, strategies and shared digital services and infrastructure. |

### 4.4.2   Paper II and Paper III: Literature reviews

Both Paper II and Paper III are systematic literature reviews (SLRs) that collectively enrich the empirical insights from Papers I and IV. An SLR is a structured and reproducible approach to reviewing prior research, in which relevant studies are identified, screened, and synthesised using predefined procedures to enhance transparency and minimise selection bias (Webster & Watson, 2002; Okoli, 2015). This enabled systematic mapping and analysis of scholarship addressing theoretical and empirical dimensions of coordinating digital transformation in healthcare. While sharing an overarching SLR approach, each review was tailored to its specific research question and scope. Full details of search strings, inclusion/exclusion criteria, and screening procedures are provided in Papers II and III.

*Paper II* develops a conceptual understanding of how coordination is infrastructured in digital health ecosystems. The review employed a broad systematic search in Scopus, covering leading Information Systems outlets and specialised health informatics journals (including those recommended by AIS SIGHealth) to reflect the interdisciplinary nature of the topic. The analysis followed a theory-informed thematic approach (Braun & Clarke, 2006), sensitised by concepts from infrastructuring theory and coordination literature (Star & Ruhleder, 1996; Okhuysen & Bechky, 2009). This enabled the development of a conceptual framework that synthesises the key processes and arrangements through which coordination is built, maintained, and adapted in complex digital health ecosystems.

*Paper III* focused on data standardisation practices in healthcare. The review employed a pragmatically tailored systematic search using Google Scholar to capture a broad, interdisciplinary body of research on this practice-oriented phenomenon. The identified literature was then analysed through an inductive qualitative synthesis (Hsieh & Shannon, 2005; Elo & Kyngäs, 2008), to identify recurring practices and emergent themes in data standardisation work. The resulting categories were then interpreted through the multi-thread social activity model to explain how design, negotiation, and sensemaking are interwoven in ongoing data standardisation efforts (Fomin et al., 2003).

### 4.4.3   Paper IV: Coordination through the Sms-Livräddare Platform

Paper IV examines how collective action in emergency response is coordinated through Sms-livräddare, a digital platform that mobilises citizen volunteers

alongside formal services in out-of-hospital cardiac arrest response. The platform provides a distinctive empirical setting for examining coordination across a hybrid public–private–civic arrangement in time-critical situations where action must be aligned in real time. The study draws on 17 semi-structured interviews conducted between July 2024 and March 2025 with stakeholders across the response assemblage, including CPR-trained volunteers, a regional coordinator, and a representative from the platform organisation. Interviews focused on participants' experiences of alarms and response, how the platform shapes action and judgment under time pressure, and how coordination unfolds across volunteers and formal emergency services.

To triangulate and contextualise interview accounts, the study also drew on supplementary material. This included a walkthrough analysis of the app interface and documentary sources such as policy reports and organisational communications. In addition, the study drew on publicly accessible user-generated content from social media and online forums (e.g., public Facebook posts and discussion threads) to capture post-event reflection and sensemaking in the aftermath of alarms. These materials were treated as complementary digital trace data (Pentland et al., 2020) to enrich the interpretation of how coordination, responsibility, and outcomes are discussed and evaluated after response episodes. Table 5 summarises the data sources.

**Table 5. Summary of data sources for paper IV**

| Empirical sources | Category | No. of sources | Description |
|---|---|---|---|
| Semi-structured interviews | Volunteers | 15 | **(R2–R16: ~60mins).** CPR-trained volunteers who had responded to at least one alarm |
| | Platform organisation | 1 | **(R1: 55mins)** Platform manager/representative |
| | Regional coordinator | 1 | **(R17: 60mins)** Regional coordinator involved in organising/overseeing the initiative regionally |
| Documents | Public documentary material | 11 | Publicly available documents downloaded from official organisational websites (e.g., prior research/white papers, implementation and communication materials, user guidance, and informational pages relevant to Sms-livräddare and associated response arrangements) |
| Digital trace data | Public online content | 5 forums | Public Facebook posts (no private groups) and discussion threads from relevant online forums |

Analysis followed a theory-sensitised thematic approach (Braun & Clarke, 2006), guided by interpretive principles in Information Systems research (Klein & Myers, 1999; Walsham, 2006) and sensitised by assemblage thinking (Deleuze & Guattari, 1987; DeLanda, 2006) to attend to heterogeneous elements, relationships, and dynamics over time. Coding focused on moments of mobilisation, decision-making, coordination breakdowns and repairs, and the interplay between platform features, organisational arrangements, and volunteer autonomy. A process orientation informed the analysis, enabling attention to temporality, iteration, and change across phases of response (Langley, 1999; Pentland, 1999).

### 4.4.4    Meta synthesis for the thesis cover chapter.

The aim of this cover chapter is to move beyond the individual findings of its constituent papers and synthesise them into a coherent overarching understanding that addresses the thesis's broader research questions. For me, this synthesis was the most critical methodological step in the thesis, as it required making explicit what can be learned from the papers collectively rather than treating them as standalone contributions. I draw on the typology proposed Sarker et al. (2025) as a descriptive lens for characterising the cover chapter's design. Following this typology, the thesis can be characterised as an *assembly of multimethod* studies, with *interlayered juxtaposition*, in which distinct studies retain methodological autonomy while jointly contributing to an integrated understanding of the phenomenon.

This typology is parallel and complementary. The methods are proximate in that they share an interpretive orientation and a processual interest in how sociotechnical arrangements shape coordination in practice (Orlikowski & Baroudi, 1991; Walsham, 2006; Langley, 1999). Within this design, the conceptual papers (Papers II and III) develop a conceptual understanding of coordination work in digital health, while the empirical papers (Papers I and IV) examine how coordination is organised and enacted in specific settings.

The synthesis followed a pattern-oriented approach to theorising, moving from empirical and conceptual findings toward more general explanatory patterns by identifying recurring relations and mechanisms across settings (Cornelissen, 2017). The purpose was not to collapse the papers into a single set of themes, but to examine how coordination problems and solutions connect across levels of analysis, including governance arrangements, infrastructures, and situated coordination in practice. This mirrors a process sensibility that emphasises unfolding dynamics, interdependencies, and

conditions that shape how coordination succeeds or breaks down over time(Langley, 1999; Langley & Tsoukas, 2016).

As a first step, I re-analysed each paper to distil its core contribution into a concise contribution statement. Each statement articulated the specific coordination problem addressed, the key actors and relations involved and the mechanisms through which coordination was enabled or constrained, as shown in Table 6 below. This step served as a disciplined reduction of each paper into comparable analytic units by preserving their methodological autonomy while making their contributions legible for a systematic cross-paper synthesis. Throughout, I iterated between the paper texts, analytic memos, and the thesis-level research questions, refining the distillations until they were both faithful to the papers and sufficiently precise to support synthesis, consistent with qualitative analysis strategies that combine categorising and memoing (Maxwell & Miller, 2008).

**Table 6. Distillation of papers**

| Paper | Coordination Problem addressed | Key actors and relations implicated | Core contribution statement. |
|---|---|---|---|
| Paper I | Why collective digital health goals (e.g., interoperability, integrated care) persistently fail to be achieved in a decentralised system with autonomous regions | Regional authorities; national e-health agencies; innovation intermediaries; digital health companies/vendors; consultants; relations across governance levels and between public actors and market actors | Shows how polycentric governance formally organises collective action for digital health, but coordination breaks down when governance cannot absorb ecosystem-wide interdependencies. |
| Paper II | How coordination is accomplished in digital health ecosystems beyond treating it as either a technical integration problem or an organisational alignment problem | Distributed ecosystem actors whose coordination depends on alignment across technological, informational, and institutional arrangements; relations at layer intersections where breakdowns occur | Shows coordination in digital health ecosystems is "infrastructured" across interdependent layers; alignment requires sustained work across technology, information, and institutions. |

| Paper | Coordination Problem addressed | Key actors and relations implicated | Core contribution statement. |
|---|---|---|---|
| Paper III | How data standardisation—central to interoperability—is practically accomplished in health information systems | Stakeholders engaged in ontological work, organisational change, and governance decisions; relations among actors negotiating standards across contexts and use cases | Reframes data standardisation as ongoing coordination work rather than a purely technical task, showing it unfolds through multiple practical activities. |
| Paper IV | How a non-interventionist social mission platform coordinates urgent collective action among distributed volunteers in time-critical emergency response | Citizen volunteers; platform provider; regional coordinator; formal emergency response actors; bystanders; relations mediated by the platform across phases of response | Shows how platforms can coordinate collective action without direct hierarchy through soft algorithmic cues and responsibilisation, but scaling generates new institutional demands. |

In the second step, I compared the contribution statements across papers to find patterns of convergence, complementarity, and tension. The analysis was guided by the concept of generative interdependencies, which served as a sensitising concept (Blumer, 1954; Bowen, 2006) to explore how digital initiatives create cascading coordination demands across actors, infrastructures, and governance arrangements. Analytically, the comparison emphasised relations rather than similarities: how one coordination problem generates another, how solutions introduce downstream dependencies, and why breakdowns continue when governance and practice are misaligned. In this sense, the synthesis attended to both "structures" that condition coordination, such as polycentric arrangements, shared infrastructures, and the situated work through which coordination is accomplished in practice (e.g., sensemaking and role negotiation).

As patterns across the papers became clearer, it became analytically useful to distinguish between two recurring forms of generative interdependence that structure the thesis's theoretical contribution in Chapter 8. *Generative technological interdependencies* refer to how digital capabilities and recombination create new couplings among actors, infrastructures, and practices. *Generative structural interdependencies* refer to how these emerging technological couplings trigger institutional realignments around

roles, accountability, financing, and regulation. This distinction emerged through iterative movement between the paper-level contributions and the developing thesis-level explanation, drawing on an abductive logic of theory development (Dubois & Gadde, 2002) alongside qualitative analysis strategies that build explanations by connecting analytic elements (Maxwell & Miller, 2008).

The identified patterns are synthesised in Chapter 7 to answer RQ1 and RQ2, while RQ3 is addressed through the theoretical account developed in Chapter 8.

## 4.5 Ethical considerations

Conducting qualitative research in a public-sector healthcare context required careful attention to participants' autonomy, confidentiality, and potential risks associated with discussing organisational arrangements and, in some cases, emergency response work. Accordingly, I integrated ethical considerations throughout the research process, guided by GDPR regulations, Lund University's data management principles, and established frameworks for informed consent and harm minimisation (Franzke et al., 2020; Hård af Segerstad, 2021).

Participation was entirely voluntary and based on informed consent. Since interviews were held remotely via Zoom, I provided information in advance and collected signed consent forms before each interview. At the outset, I reiterated the study's aims, how the material would be used, and participants' rights to decline questions, pause, stop, or withdraw at any point without consequence. Yet consent, for me, extended beyond that initial agreement. I treated it as an ongoing and situated process shaped by the dynamics of the conversation, following the principles of digital qualitative research (Ryen, 2016; Franzke et al., 2020). This became particularly evident when one participant asked to continue off the record shortly after beginning. Although this interview was excluded from analysis, the exchange deepened my understanding of the tensions surrounding collective action in the ecosystem.

Anonymity posed another layer of complexity. In a relatively networked ecosystem, removing a name is rarely enough to ensure confidentiality, as roles and specific organisational incidents can easily lead to "deductive disclosure" (Kaiser, 2009). To reduce the risk, I intentionally minimised identifying details in the transcripts and reporting and selected and presented quotes to preserve

analytic meaning while avoiding unnecessary contextual markers. This aligns with ethical recommendations for minimising harm in digital and organisational contexts where confidentiality risks are heightened (Tsai et al., 2016; Markham et al., 2018; Franzke et al., 2020).

This also extended to how I engaged with publicly accessible material, including policy documents, platform content, and online discussions. While these are open sources, their ethical use depends on contextual expectations, potential traceability, and the vulnerability of those represented (Markham et al., 2018; Franzke et al., 2020). In my analysis, particularly in Paper IV, I therefore used such materials sparingly, preferring aggregated descriptions and triangulation over verbatim or traceable excerpts.

Data management decisions also built on the principle of data minimisation. I retained only materials essential to the research questions and removed any personal or irrelevant information encountered (Hård af Segerstad, 2021; Markham et al., 2018). All materials, including recordings and transcripts, were securely stored with restricted access in accordance with Lund University's data protection guidelines.

Finally, interpretive research requires reflexive attention to how the researcher's positioning, framings, and analytic choices shape what becomes visible and what is foregrounded as the problem (Schultze, 2000; Markham et al., 2018). Throughout the analysis, I engaged in reflexive memoing to examine how my framings, particularly in interpreting governance breakdowns and platform coordination issues, influenced representation. This practice helped me maintain balance, ensuring that critical insights were presented fairly and proportionately.


## 4.6  Research Quality: Rigour and trustworthiness

In an interpretive study, quality is determined by the transparency of the research process, the plausibility of interpretations, and the ultimate utility of the findings (Klein & Myers, 1999; Walsham, 2006). Throughout this work, I have viewed rigour as an active responsibility to ensure that my claims are well-grounded, traceable, and capable of speaking to contexts beyond the specific Swedish cases I studied (Lincoln, 1985).

The credibility of my interpretations rests on the breadth and depth of the empirical material. Rather than relying on a few hero quotes, I intentionally

sought out a diversity of roles from national policy makers to grassroots volunteers to build explanations that cut across individual viewpoints (Klein & Myers, 1999). In Paper I, this meant comparing how governance challenges were described by actors at different levels of the ecosystem and checking these accounts against public documents. Similarly, in Paper IV, credibility relied on linking volunteer accounts directly to the platform's documentation, public posts and walkthrough analysis, allowing me to identify specific mechanisms, such as responsibilisation, rather than simply reporting attitudes. By maintaining a clear chain of evidence from raw transcripts to analytical claims, I ensured the work was confirmable (Lincoln, 1985).

Finally, to ensure the reliability of my findings, I maintained a rigorous, traceable analytical process. This involved iterative coding to document how my interpretations evolved as I moved deeper into the data. In Paper I, the COOF framework provided the structural discipline needed to consistently analyse operational arrangements and feedback loops. Similarly, in Paper IV, I mapped the coordination cycle phase by phase, ensuring that my claims about soft algorithmic cues or responsibilisation were directly anchored in the volunteers' lived routines. This iterative approach allowed me to account for my analytic decisions over time, creating a coherent audit trail that links empirical observations to my theoretical conclusions (Sandberg, 2005).

# 5 An overview of the digital health ecosystem in Sweden

*In this chapter, I map the structure of Sweden's digital health ecosystem by outlining the principal actors involved in developing, governing, and using digital health solutions, the shared digital infrastructures through which information and services are organised, and the governance arrangements that coordinate action across jurisdictions. It serves both as the empirical grounding for the thesis and as a conceptual illustration of digital health ecosystems as multi-actor, sociotechnical formations that require continuous coordination across organisational, technological, and institutional boundaries.*

## 5.1 Decentralised healthcare system

Sweden's healthcare system is highly decentralised, with authority and responsibility shared among the state, 21 regions, and 290 municipalities (Socialstyrelsen, 2024). The elected regional councils manage most healthcare provision, from hospitals to primary care, while municipalities handle community care services such as elderly care, support for the disabled, and home care programmes (Janlöv et al., 2023; Richardson & Andersson, 2023). This structure ensures that health care is democratically governed and locally managed, while the central government sets overarching policy principles and guidelines (Höglund & Falkenström, 2018). As a result, local authorities enjoy substantial autonomy in organising and prioritising health services for their populations.

This system is guided by a set of ethical principles established in the Government Bill 1996/97:60, which emphasises *human value*, *individual need*, and *cost-effectiveness* (Socialdepartementet, 1996). The human value principle affirms equal dignity and universal entitlement to care; the individual need principle requires that those with the greatest medical needs receive priority;

and the cost-effectiveness principle promotes responsible resource use while remaining subordinate to the first two. Collectively, these core principles provide a normative anchor for fairness, equity, and efficiency across the decentralised system, ensuring local funding and treatment decisions adhere to national values (Höglund & Falkenström, 2018; Ludvigsson et al., 2025).

This decentralised system is commonly described as polycentric governance, in which multiple decision-making centres hold authority across levels and must coordinate without a single hierarchical command (Saenyi et al., 2025). In Sweden, responsibility for healthcare delivery and associated digital investments is distributed across national, regional, and municipal actors, with substantial local autonomy. Such arrangements are often associated with local experimentation and adaptation, as regions and municipalities can pursue initiatives tailored to their contexts (Carlisle & Gruby, 2019; Baldwin et al., 2023). At the same time, when digital initiatives are expected to support national goals such as equitable access, information sharing, and continuity of care, progress depends on alignment across actors who can act independently.

Importantly, this governance arrangement shapes how digital transformation unfolds. It creates a digital health ecosystem characterised by the absence of a single hierarchical authority, where actors must voluntarily align their efforts to realise national goals for equitable and efficient care. The following section maps the ecosystem actors.

## 5.2  Key actors in the digital health ecosystem

The Swedish digital health landscape is shaped by a network of interdependent actors, including public agencies, private-sector providers, and civic stakeholders. These actors operate across different levels of governance and domains of practice, contributing to the development, implementation, and use of digital health solutions. Figure 2 provides a visual overview of this ecosystem.

*Public agencies*
At the national level, the state provides the legislative framework and overall strategic direction through the Parliament *(Riksdagen)* and the Ministry of Health and Social Affairs *(Socialdepartementet),* primarily steering through legislation and national strategies (Richardson & Andersson, 2023; Ludvigsson et al., 2025). It also provides supervision to the regional and

municipal levels through its various agencies (Richardson & Andersson, 2023). Key agencies include the National Board of Health and Welfare (*Socialstyrelsen*), which develops guidelines and standards to ensure quality and equity nationwide, and the Swedish eHealth Agency *(eHälsomyndigheten),* tasked specifically with advancing digitalisation and improving information exchange across healthcare systems (Socialstyrelsen, 2024; ehälsomyndigheten, 2025). The national government also allocates funding, including targeted grants for health IT projects and initiates joint programmes such as the *"Vision eHealth 2025"* to support shared digital priorities (eHälsa2025, 2016).

Within this national framework, regions and municipalities act as autonomous owners and implementers of digital systems. Regions make substantial investments in health information systems and have historically procured EHRs and related digital solutions independently, contributing to a heterogeneous installed base of vendors and platforms (eHälsa2025, 2023). Municipalities similarly adopt digital tools to support their service responsibilities, particularly in long-term and preventive care, and their systems must often interface with regional infrastructures during care transitions (Richardson & Andersson, 2023). These distributed decisions make coordination across organisational and technical boundaries a recurring challenge, including for cross-regional information sharing and continuity of care (Saenyi et al., 2025).

A central actor in bridging these boundaries is SALAR, the Swedish Association of Local Authorities and Regions (*in Swedish, Sveriges Kommuner och Regioner, SKR).* SALAR represents all 21 regions and 290 municipalities and facilitates collaboration across its members (SALAR, 2024). In digital health, SALAR has brokered agreements between the national government and regions, co-led strategic work (including Vision eHealth 2025, discussed below), and supported national coordination of shared priorities. SALAR's role is closely tied to the realities of implementation across autonomous regions and municipalities.

SALAR also owns Inera AB, a joint venture of regions and municipalities that provides shared digital infrastructure (Inera AB, 2022a; SALAR, 2024). Inera develops and manages national e-health services on behalf of its owners, including 1177.se (the national online health portal), and the National Service Platform *(Nationella tjänsteplattformen),* an interoperability hub enabling secure data exchange between healthcare providers and systems across Sweden (Inera AB, 2023).

*Private sector actors*

Private-sector actors shape the Swedish digital health ecosystem through the technologies and services they supply and the long-term interdependencies that follow from procurement and implementation. Suppliers of core information systems, particularly EHR vendors such as Cambio and Oracle Health (formerly Cerner), influence how health data is recorded, accessed, and integrated across regions and municipalities (eHälsa2025, 2020b).

Alongside these large vendors, Sweden has a broad health tech scene of start-ups and SMEs developing digital solutions for clinical work, patient-facing services, and administrative support. Private digital care providers such as Kry, Min Doktor, and Doktor.se have also expanded rapidly since around 2016, contributing to care-seeking and service patterns that often cut across regional boundaries (Kry, 2023; Doktor.Se, 2023).

These providers typically operate through regional contracting and reimbursement arrangements, meaning services are delivered by private organisations but governed through public funding rules, access conditions, and regional accountability structures. Private firms further engage with public actors through pilots and testbeds linked to regional innovation environments, creating additional pathways for experimentation and adoption (Jabin et al., 2022).

Another subset of private actors operates in close partnership with the public sector by linking into existing public infrastructures and protocols. A prominent example is Sms-livräddare, a volunteer responder initiative operated by Heartrunner Sweden AB that mobilises CPR-trained citizens to respond to suspected out-of-hospital cardiac arrests (SMS-Livräddare, 2024). Sweden's emergency response is coordinated through SOS Alarm, which serves as the primary dispatch hub for the country's 21 regional authorities. While SOS Alarm manages dispatching, healthcare services fall under regional jurisdiction, and regions contract SOS Alarm for emergency medical dispatch (SOS Alarm, 2025).

Sms-livräddare operates within this arrangement through collaboration with SOS Alarm and regional health authorities, and functions alongside professional dispatch by alerting nearby volunteers via mobile notification and often directing them to the nearest AED. In this way, the initiative illustrates how private digital initiatives can become embedded in public service delivery while also depending on established infrastructures and response protocols to function as intended. Sms-livräddare also serves as the empirical setting for Paper IV.

In summary, the Swedish digital health ecosystem brings together a diverse constellation of actors who develop, govern, and use digital technologies across healthcare. It includes governmental bodies setting visions and rules, regional and local authorities delivering services, vendors supplying technology, researchers providing knowledge, and citizens driving demand and even contributing directly. This constellation of actors, each with its own mandate and interests, must work in concert, a considerable coordination task that can undermine the ethical foundations of the healthcare system when uneven digital transformation efforts create disparities in access, quality, and care coordination. As Ludvigsson et al. (2025) noted, despite strong outcomes, the Swedish healthcare system struggles with care continuity and coordination, reflecting siloed digital infrastructures and heterogeneous governance.

## 5.3  Vision eHealth 2025: A Shared National Strategy

Recognising the need for greater alignment in a decentralised system, Sweden's national and regional leaders came together to formulate a unifying strategic roadmap for digital health. In 2016, the Ministry of Health and Social Affairs and SALAR jointly launched an ambitious "Vision eHealth 2025":

*"In 2025, Sweden will be best in the world at using the opportunities offered by [digitalisation] and eHealth to make it easier for people to achieve good and equal health and welfare,....."*

<div align="right">(eHälsa2025, 2016) p.1.</div>

The vision frames digitalisation as a means to support equitable and efficient services and emphasises improved access to timely information and the conditions for digital development through stakeholder collaboration (eHälsa2025, 2016).

Follow-up strategy work specifies priorities such as strengthening national information infrastructure, promoting technical standards, and clarifying governance roles (eHälsa2025, 2020a). The roadmap has informed national initiatives and shared platforms, and it is operationalised in part through Inera's shared services and strategic alignment, alongside targeted government funding intended to support regional digitalisation in line with national priorities (Inera AB, 2020; eHälsa2025, 2023; DigitalWell Arena, 2024).

Assessments nonetheless indicate mixed progress: while some national services have achieved wide uptake (like e-prescriptions and the 1177 portal), interoperability across regions and more even access to eHealth services remain uneven (eHälsa2025, 2023). In this sense, Vision ehealth 2025 has provided a strategic anchor in the ecosystem, helping align decentralised digital transformation within a broader governance framework.

## 5.4 Coordinating digital transformation in the ecosystem.

Many digital health initiatives originate in regions and municipalities, but ambitions for shared services and interoperability require coordination beyond any single organisation. As noted earlier, Inera AB, which is jointly owned by regions and municipalities, plays a key coordinating role for developing shared digital services and infrastructures. Inera's approach rests on the idea that digitalisation cannot be delivered through unilateral decisions but must be carried through commitment-building across multiple autonomous owners. As Inera's CEO has described it, succeeding with digitalisation requires recognising that one is "*part of a larger ecosystem*" (Inera AB, 2022b).

### 5.4.1   At the national level

As explained by a regional ehealth strategist, new shared digital solutions typically enter the agenda through a bottom-up pathway. Needs are identified within a region or municipality and then brought to Inera for consideration. Inera assesses the proposal's relevance and feasibility and consults programme committees with representatives from both regions and municipalities to gauge early interest and surface requirements. Where interest appears promising, the process becomes progressively more formal. Inera circulates a letter of intent to gather explicit expressions of support. If support reaches a threshold representing 60% of the population (through participating regions/municipalities), Inera proceeds with a more detailed cost–benefit analysis to assess viability and likely impact.

On this basis, Inera prepares a formal proposal describing the development plan and the financial implications for participating owners. A final go/no-go decision is then made by regions and municipalities. Development begins only if at least 60% of the population (regions) commit to funding the solution for

at least 4 years; if not, the initiative does not move forward. This stepwise process coordinates the development of shared digital services without a hierarchical mandate, while keeping participation voluntary.

## 5.4.2   At the local level

Alongside these national pathways, digital transformation also progresses through more localised innovation activity. Ideas may originate within regions, hospitals, municipalities, and frontline work practices, as well as from private providers and start-ups. The routes from idea to adoption vary across regions and commonly involve some combination of regionally organised innovation support (e.g., intermediaries or incubator programmes), pilot deployments in municipal or regional settings, and subsequent scaling through procurement and contracting processes. This local dynamism contributes to pluralism and experimentation, while also shaping the conditions under which national coordination efforts seek to extend, standardise, or integrate solutions across organisational boundaries. Figure 2 provides an overview of coordination at both the national and local levels.
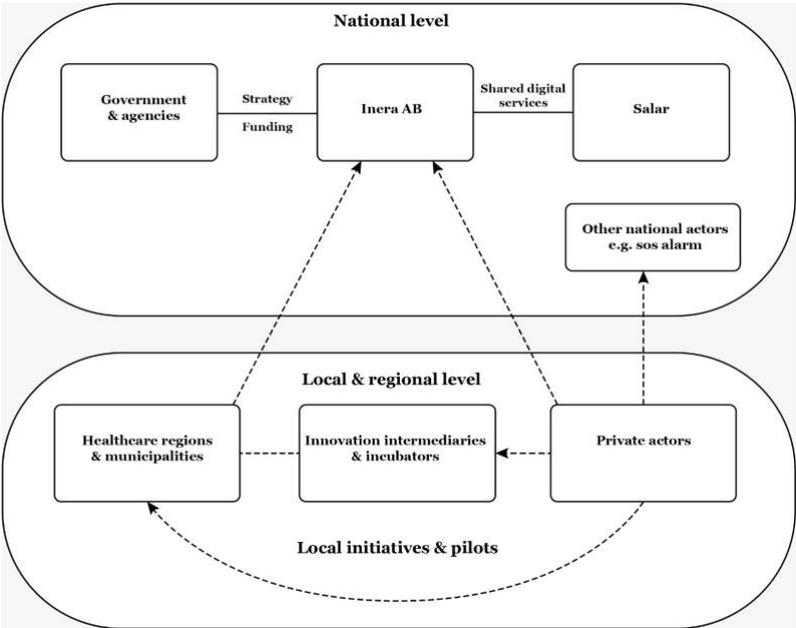


**Figure 2 Sweden's digital health ecosystem: hierarchical structure and key dependencies**

# 6 Paper Summaries

This chapter summarises the four papers that constitute this thesis, providing an overview of their empirical contexts, analytical approaches, theoretical frameworks, and key contributions to understanding coordination in digital health ecosystems. Table 7 summarises the material, theoretical approaches, and authorship details for each paper.

**Table 7. Summary of appended papers**

| Paper No. | Theoretical Concepts | Research Question | Outlet | Author(s) |
|---|---|---|---|---|
| I | Polycentric Governance, COOF Framework | Why do governance challenges persist in decentralized digital health ecosystems despite well-intentioned policies and institutional arrangements? | Hawaii International Conference on System Sciences (HICSS) | Saenyi, Betty; Mansour, Osama; and Keller, Christina |
| II | Infrastructuring Theory, Coordination | How is coordination infrastructured in digital health ecosystems? | International Conference on Information Systems (ICIS) | Saenyi, Betty; Keller, Christina; and Kajtazi, Miranda |
| III | Multi-thread Social Activity Model, Data Standardization | What practices are vital for effective data standardization processes in healthcare information systems? | European Conference on Information Systems (ECIS) | Ademaj, Gemza and Saenyi, Betty |
| IV | Assemblage Theory, Platform Coordination | How do sociotechnical arrangements mediate the coordination of volunteer actions in non-interventionist social media platforms? | Manuscript to be submitted to an international journal | Saenyi, Betty; Avijit chowdhury; and Keller, Christina; |

# 6.1  Paper I

Sweden's decentralised healthcare system faces persistent coordination challenges in digital health transformation despite substantial investment and well-intentioned policies. With 21 autonomous regional authorities, achieving national interoperability and integrated care requires coordination across organisational and political boundaries. In this paper, we investigate why these governance structures fail to achieve collective goals despite being theoretically well-suited for such contexts. The research question was: *Why do problems persist in achieving digital health goals in decentralised healthcare systems?*

To address this question, we employ polycentric governance theory (Ostrom, 1990; Carlisle & Gruby, 2019) and analyse it through the Context-Operations-Outcomes-Feedback (COOF) framework (Baldwin et al., 2023). The COOF framework examines how contextual factors, operational arrangements, outcomes, and feedback mechanisms interact to shape governance effectiveness in polycentric systems.

The analysis of the empirical material identified three governance dynamics that explain persistent failures in coordinating collective action in the ecosystem. First, coordination was repeatedly undermined by *governance opacity*. Although multiple governance bodies and formal structures were in place, decision authority and accountability remained difficult to locate across the multiple governance levels. As a result, collective action was slowed by continual questions of *who* had the right to decide, *when* decisions could be taken, and how disagreements could be resolved, creating an environment of ambiguous authority.

Second, the system exhibited *inadequate feedback mechanisms*. Operational outcomes—what worked, what failed, what produced unintended effects—did not reliably travel back into the sites where governance rules, priorities, or resource allocations were revised. Without systematic feedback channels, lessons remained local, episodic, or informal. This weakened adaptive learning and made it difficult to recalibrate policies in response to emerging dependencies, reinforcing path-dependent trajectories and allowing ineffective arrangements to persist even when their shortcomings were widely recognised.

Third, these conditions contributed to an over-reliance on regulation as a default response to newly emerging interdependencies. When coordination tensions intensified, often prompted by new infrastructures, data-sharing demands, or interoperability ambitions, stakeholders reached for regulatory instruments to stabilise expectations. Yet regulatory interventions move more slowly than technological change. Regulation, in this sense, becomes a substitute for adaptive governance, offering clarity and control but often at the cost of responsiveness to ongoing transformation.

**Contribution:** The paper contributes to digital health governance by showing that polycentric governance is not self-enabling in the context of digital transformation. Even where the overall arrangement appears to "fit" in theory—distributing authority across multiple centres to support local responsiveness—governance can still fail as a coordination mechanism when decision-making authority is opaque and when feedback from operational outcomes does not travel back into the sites where rules, priorities, and responsibilities are revised. In such settings, coordination of collective action depends on whether governance structures render authority legible and enable learning.

Conceptually, the paper surfaces a deeper mismatch between governance designs and the dynamics of digital transformation. Polycentric arrangements are often premised on interdependencies that are assumed to be relatively stable and knowable, allowing responsibilities to be allocated, compliance to be monitored, and performance to be evaluated against agreed objectives. Digital transformation, however, continually reworks the relations among actors, technologies, and data, generating expansive, evolving interdependencies. The implication is that governance oriented toward static rule-setting and episodic adjustment will repeatedly fall behind.

**Contribution to the overall thesis:** This paper anchors **RQ1** by showing why coordination through governance arrangements fails in Sweden's decentralised digital health ecosystem. It reframes persistent fragmentation as an outcome of systemic governance dynamics that becomes especially consequential as digital initiatives continuously generate new cross-boundary interdependencies. In doing so, the paper establishes the thesis's broader argument that coordination cannot be predetermined by structural designs but must remain adaptable to evolving interdependencies.

At the same time, the paper provides a governance-level point of departure for the synthesis that follows. By tracing how authority becomes opaque, feedback fails to travel, and regulation becomes a default response, it makes visible the

limits of coordinating by structural designs. This opens the analytical space for the subsequent papers to show how coordination is accomplished in practice through ongoing work across technological, informational, and institutional layers, and how such practical accomplishments can, in turn, generate fresh governance demands.

## 6.2  Paper II

**Saenyi B., Keller C., & Kajtazi M. (2025). Infrastructures of coordination: Conceptualising coordination in digital health ecosystems** *ICIS 2025 Proceedings.*

Digital health transformation increasingly unfolds through ecosystems that cut across organisational, professional, and technological boundaries. What is often presented as a problem of "interoperability" or "stakeholder alignment" is, in practice, the continuous sociotechnical work of making technologies, information, and institutional arrangements hang together. Yet while coordination is widely recognised as essential to realising ecosystem-level aims, it remains conceptually fragmented and rarely examined as a phenomenon of interest. In this paper, we reconceptualise coordination as an infrastructural process, continuously enacted and sustained across the ecosystem. The research question asks: *How is coordination infrastructured in digital health ecosystems?*

Through a systematic literature review, we identified three nested infrastructural layers that both enable and constrain collective action: a technological layer (e.g., platforms, APIs, EHRs), an informational layer (e.g., standards and terminologies), and an institutional layer (e.g., governance, regulation, and professional roles). Importantly, coordination breakdowns frequently arise at the intersections of these layers, for example, when technical integration outpaces semantic standardisation, when shared terminologies collide with institutional ambiguity, or when governance arrangements cannot adapt to emerging technological capabilities.

We further identified four recurring infrastructuring processes through which collective action is enacted: *building collective capacity, standardising information, aligning work practices and roles*, and *boundary-spanning.* These processes are mutually shaping and iterative: capacity-building exposes informational limitations, standardisation reshapes work organisation, alignment difficulties prompt boundary-spanning, and boundary-spanning

loops back into capacity-building. Critically, we show that these processes unfold through persistent tensions that must be continually navigated, highlighting coordination as ongoing infrastructuring work..

**Contribution:** The paper contributes to digital health transformation literature by reconceptualising the coordination of collective action as ongoing infrastructuring across technological, informational, and institutional layers. It shows how new types of collective action are continually generated as technologies, standards, work practices, and governance arrangements are brought into relation. In doing so, it provides a shared vocabulary that integrates fragmented literatures and makes visible the cross-layer work through which collective action is sustained in the digital transformation of healthcare.

Second, the paper offers diagnostic utility by identifying where collective action commonly falters and why. It shows that breakdowns often surface at layer intersections, for example, when institutional arrangements lag behind evolving infrastructures. By specifying recurring infrastructuring processes and the persistent tensions they generate, the paper shifts attention toward understanding how collective action in digital health ecosystems is sustained over time through continuous negotiation and adjustment.

**Contribution to the overall thesis:** Paper II provides the conceptual backbone for the kappa's synthesis by providing a cross-paper language for analysing how collective action is coordinated through tension-filled infrastructuring processes. This reframes the governance problem identified in Paper I by showing what it takes to sustain collective action in digital health transformation. It highlights how governance arrangements operate most effectively when they support ongoing infrastructuring work across technological, informational, and institutional layers. In this view, governance contributes by rendering authority legible, enabling learning through feedback, and legitimising cross-boundary collaboration as infrastructures evolve

Additionally, it connects the thesis's two research questions by showing how governance-level coordination **(RQ1)** and platform-mediated coordination in practice **(RQ2)** are enacted through the same infrastructuring dynamics, even as they take different forms across settings. By foregrounding standardising information as a central infrastructuring process, Paper II lays the groundwork for Paper III's closer examination of standardisation practices.

## 6.3 Paper III

**Ademaj, G., & Saenyi, B. (2022). Systematic Literature Review: Data Standardisation in Health Information Systems.** *Proceedings of the Thirtieth European Conference on Information Systems (ECIS).*

Data standardisation is widely recognised as essential for interoperability in digital health as it provides shared languages and conventions for exchanging data across heterogeneous systems. While Paper II identifies standardising information as one of the core infrastructuring processes through which collective action is coordinated in digital health ecosystems, this paper zooms in on standardisation work to ask: *What are the different practices of data standardisation within e-healthcare?*

Drawing on a systematic literature review, we identify three clusters of standardisation practice. *Ontological development* involves building and maintaining metadata, terminologies, and semantic relationships, including techniques for mapping and term matching. *Organisational practices* include stakeholder collaboration, coordination mechanisms, training and support, and change management that make standards workable in situated settings. *Governance practices* cover the frameworks, minimum datasets, compliance requirements, and standard-selection decisions through which standardisation is authorised and sustained.

To conceptualise how these practices unfold, we mobilise the Multi-Thread Social Activity Model (Fomin et al., 2003), and show that standardisation is enacted through three interdependent activities that run in parallel: *design* (creating and selecting standards), *sense-making* (interpreting and attaching meaning to standards in context), and *negotiation* (reaching agreements among stakeholders with potentially conflicting goals). Each practice category involves all three activities, and the activities recursively shape one another. For instance, adjustments in design generate new sense-making demands and trigger fresh negotiations, which often loop back to reshape design choices. The review thus foregrounds standardisation as a sustained collective effort.

**Contribution:** Paper III conceptualises data standardisation as an ongoing accomplishment enacted through distributed work across organisational, ontological, and governance practices. It shows how this work is carried through intertwined activities of design, sense-making, and negotiation, offering a process view of how standards become workable across heterogeneous settings. In doing so, it shifts attention from standards as artefacts to standardisation as situated work, bringing into view the collective

effort through which meanings are stabilised, agreements are reached, and data is made capable of travelling across boundaries.

**Contribution to the overall thesis:** Paper III deepens the thesis's account of the informational layer by specifying what standardising information entails in practice and operationalising the infrastructuring framework for synthesis. It connects **RQ1** and **RQ2** by showing how standardisation is shaped through governance mechanisms such as authority, compliance, minimum datasets, and the selection of standards, while simultaneously conditioning what platforms and frontline actors can accomplish with data in day-to-day work. In this way, the paper clarifies how fragmentation in decentralised ecosystems takes form through distributed standardisation work carried across organisational, ontological, and governance practices.

It also strengthens the thesis's synthesis by treating standardisation as a recurring site where interdependencies are generated and reconfigured as data uses expand, actors multiply, mappings evolve, and compliance demands shift. Finally, it creates narrative continuity across the kappa by taking Paper II's concept of "standardising information" and tracing it in detail, while preparing the move to Paper IV, where collective action is coordinated in real time through platform arrangements that rely on, and place pressure on, the informational infrastructures described here.

## 6.4  Paper IV

**Saenyi B., Keller C., & Chowdhury (2026). When every second counts: Coordinating health emergency response via digital platforms (*Manuscript to be submitted to an international journal*)**

This paper presents an in-depth empirical study of Sms-Livräddare in Sweden, a digital platform that mobilises nearby volunteers to respond to out-of-hospital cardiac arrest (OHCA) alongside formal emergency medical services. While platform literature emphasises algorithmic management and boundary resources as coordination mechanisms, Emergency response platforms must coordinate urgent, life-critical collective action among distributed volunteers while adopting non-interventionist approaches to preserve volunteer autonomy. In this paper, we examine how sociotechnical arrangements mediate coordination in such contexts. The research question asks: *How do non-interventionist SMPs coordinate volunteer actions in emergency responses?*

We analyse platform-mediated emergency response as a sociotechnical accomplishment that takes shape over time. Using assemblage theory (DeLanda, 2006; Deleuze & Guattari, 1987), we trace how Sms-Livräddare coordinates volunteer action across three phases: *latent readiness, liminal activatio*n, and *post-alarm reintegration*, attending to how relations among volunteers, platform cues, and institutional arrangements are assembled, stabilised, and reworked as the response unfolds. This temporal analysis identifies two coordination mechanisms.

First, coordination is accomplished through *soft algorithmic coordination*. The platform steers action through minimal cues such as alerts, routing, and partial updates, creating direction without direct control. Volunteers complete the response through situated judgment by interpreting prompts, improvising around constraints, and coordinating with strangers on scene.

Second, coordination is sustained through *responsibilisation* that extends before and after the alarm. It begins with staying ready by maintaining competence and availability. It intensifies during the alarm, as volunteers act on partial information, navigate uncertainty, and coordinate with strangers and formal services. It continues after the event, as volunteers make sense of what happened, carry emotional residue, and work themselves back into readiness. Responsibilisation, in this sense, holds the arrangement together by placing the work of preparedness, action, and recovery onto volunteers.

Finally, we conceptualise this arrangement as a governance pattern of *asymmetric responsibilisation*. The platform relies on volunteers for preparedness, response, and even post-incident processing, while mechanisms for feedback, closure, and support remain uneven.

**Contribution:** Paper IV advances platform coordination literature by showing how health emergency response can be organised through a non-interventionist platform. It theorises coordination as the platform's capacity to steer action through Soft algorithmic prompts while delegating interpretive and operational responsibility to volunteers who must act under uncertainty. In doing so, the paper brings the governance implications of such platforms into view, raising questions of accountability, support, and sustainability in platform-mediated emergency care.

**Contribution to the overall thesis:** Paper IV anchors **RQ2** by showing how collective action is coordinated in practice through a digital platform in a time-critical healthcare setting, across the phases of response, before, during, and after alarm. In doing so, the paper strengthens the thesis's broader argument

that coordination is sustained through ongoing work that holds together technologies, people, and institutional arrangements.

It also connects back to **RQ1** by highlighting the recursive link between platform-coordinated emergency response and governance. Platform-enabled mobilisation depends on frameworks for accountability, support and resource management, generating interdependencies that governance structures must actively address and stabilise.

In the synthesis, Paper IV therefore provides an empirical grounding for the cross-layer interdependencies developed in Papers II and III.

## 6.5  Additional publications

Two additional studies (Saenyi, 2021; 2023), conducted during this period, explored related questions but ultimately fell outside the scope of this compilation. Nevertheless, the experiences gained from writing these papers and empirical encounters helped refine my thinking and gradually shaped the ideas now synthesised in the Kappa. They include:

1) Saenyi, B., 2021. Conceptualizing a Holistic Evaluation for Interoperable Health Information Systems.

2) Saenyi, B., 2023. Fostering an innovation ecosystem for a public digital health platform. In International Conference on Information Systems (ICIS 2023). AIS Electronic Library (AISeL).

# 7 Revisiting the research questions

## 7.1 Coordination through governance arrangements (RQ1)

RQ1 examined how Sweden's digital health transformation is coordinated through governance arrangements in a decentralised system. Paper I shows that collective action is formally organised through polycentric governance: multiple decision-making centres, national agencies, regional authorities, and intermediary bodies intended to enable autonomous actors to align priorities, investments, and standards. At the governance level, collective action is largely coordinated through institutional arrangements that aim to produce common direction (e.g., national visions and strategies), shared ways of working (e.g., standards and platforms), and collective investment decisions across regions (as shown ealier in figure 2).

Paper I analyses these ambitions using the COOF framework (Baldwin et al., 2023), focusing on how context and operational arrangements shape outcomes and, crucially, how feedback mechanisms enable or hinder adaptation. The empirical findings reveal a persistent mismatch between the nature of digital transformation and the assumptions embedded in the governance arrangements. Regions, municipalities, national agencies, and private actors all pursue digital transformation with different logics, mandates, and resource capacities, while simultaneously struggling to translate ecosystem-dependent outcomes into learning and change. As a result, misalignments are continually reproduced, and the ecosystem remains locked into predictable outcomes, including dependence on established EHR vendors, slow diffusion of innovations, and barriers for smaller market players.

Three challenges were identified that explain these persistent breakdowns. First, the analysis revealed *inadequate feedback mechanisms*, which prevented governance arrangements from learning from practice or adapting to emerging needs in the ecosystem. In the COOF framework, feedback mechanisms are the pathways through which outcomes from polycentric structures

systematically inform policy adjustments and structural adaptations (Baldwin et al., 2023). A consultant described how promising initiatives often stalled at the point where diffusion required collective action across regions:

*"When you have created a prototype … it's very successful… but it's like 25 people in some part of Sweden that love it… so it stays in the proof-of-concept stage at the POC Graveyard, buried, and that's a very tragic but very common end of many good ideas. I've been involved in a number of those projects myself, so I know what it is like."*

This becomes more consequential as digital initiatives expand, particularly around cross-regional data use. Moving from local solutions to ecosystem-wide services brings additional collective action around legal implications, financing questions, and uneven regional capacity, alongside technical interoperability. As one consultant noted in relation to an AI initiative:

*"It's a key obstacle, but also the legal part of it with the regulations and also the revenue, the business model, how can you finance, exchange of the data, who should pay for what and how should they pay and so on. Because it's healthcare, there are restrictions on it, and regions are normally not permitted to sell services to other regions. That is unclear water, and some obstacles as well."*

These operational experiences, though visible and documented, did not translate into governance adjustments. The absence of feedback perpetuated ineffective arrangements, as governance continued operating based on design assumptions rather than practical realities.

Second, *governance opacity* reinforced the feedback failures identified above. Stakeholders often lack clear visibility into who has the mandate to decide, where decisions are made, and how cross-regional issues can be escalated and resolved. This opacity manifested in fragmented authority across national agencies (e-eHälsomyndigheten, Inera), regional bodies (SKR, 21 regional authorities), and coordinating platforms, where overlapping responsibilities obscured accountability. Stakeholder accounts revealed how this opacity paralysed coordination efforts. Regional coordinators described being unable to determine what should be provided by the government versus what they should implement locally, explaining how government signals about expanding its role caused regions to halt investments while waiting for clarity:

*"There's a lack of shared goals for all of this work. There are many initiatives but it's hard to say, it's hard for the regions and municipalities to take the next step because they don't know where... What should be provided by the government and what should be done in the regions or municipalities? If the government is giving signals that they*

*want to do more, then everyone stops making investments regionally because they want to see where this is going."*

A public forum participant described the frustration of encountering *"a parade of government representatives from different parts of the state,"* which created confusion about who was responsible for implementation. Under these conditions, stakeholders wait, hedge, or retreat to local priorities.

Third, *over-reliance on regulation* reflects a governance approach that defaults to regulatory interpretation and compliance logics when new issues arise through digital transformation, such as expanding data use, implementing interoperability across systems, or establishing shared infrastructures. However, regulation typically lags behind technological change and can harden into rigid constraints precisely when adaptive solutions are needed. In a decentralised system where participation in shared initiatives remains voluntary, regulation can constrain action but, by itself, cannot generate the cross-actor alignment required to build and sustain shared infrastructures. As a result, regulation becomes a barrier for coordinating emerging interdependencies.

Read on its own, Paper I could be interpreted as an account of governance dysfunction with weak feedback mechanisms, unclear authority, and regulatory bottlenecks. However, a synthesis with the conceptual foundations established in Papers II and III deepens our understanding of why coordinating collective action through governance structures, especially in decentralised systems, is insufficient. Paper II's infrastructuring perspective shows that collective action in the digital transformation of healthcare is achieved when work across the technological, informational and institutional layers is sustained, aligned, and adaptive to evolving conditions. Each layer generates interdependencies across the layers. Technological capabilities require informational standards, which in turn require institutional support; institutional arrangements shape informational possibilities, which in turn shape technological implementations.

Sweden's governance arrangements operate primarily at the institutional level (mandates, strategies, roles), while the bottlenecks it seeks to address span all three layers (e.g., information semantics and standards in use, integration work, and evolving technical dependencies). As paper I shows, institutional arrangements disconnected from technological and informational realities fail to coordinate. Governance structures mandate interoperability but cannot ensure technological implementation. They establish standard-setting bodies but cannot drive alignment of information across regions.

Paper III adds further depth by illustrating how even seemingly technical activities, such as data standardisation, are inseparable from institutional work. Developing, adopting, and maintaining standards involves aligning professional vocabularies, organisational incentives, and historically embedded routines. Attempts to harmonise data models, therefore, generate new dependencies among organisations that must coordinate not only on technical specifications but on shared governance, semantic interpretation, and policy alignment.

Across these analyses, RQ1 answers that collective action in decentralised digital health ecosystems is coordinated through governance arrangements, but it is sustained (or undermined) by the system's ability to continuously respond to and adjust to the interdependencies it generates. Paper I shows what happens when that capacity is weak: decision-making becomes opaque, outcomes do not feed back into adaptation, and regulation substitutes for the ongoing work of alignment.

The broader implication is that governance structures can enable coordination capacity, create platforms, establish standards and allocate resources, but cannot substitute for the ongoing coordination work that the digital transformation of healthcare demands.

This conclusion also lays the groundwork for RQ2: If, despite formal structures, collective action still struggles, how is it achieved in practice through digital platforms that mobilise action without hierarchical authority?

## 7.2  Coordination through Digital platforms (RQ2)

Where governance arrangements represent the formal, institutional mechanisms through which digital transformation is intended to unfold, digital platforms reveal a markedly different logic, one grounded in practice, emergence, and socio-technical alignments. Paper IV's examination of SMS-Livräddare illustrates how collective action can be coordinated without hierarchical oversight, predefined roles, or formalised accountability structures, operating instead through a distributed assemblage of actors, technologies, and affective commitments.

SMS-Livräddare mobilises trained volunteers to respond to suspected cardiac arrest by combining algorithmic matching, geospatial data, and lightweight notification infrastructure. Coordination in this setting is accomplished

through soft algorithmic coordination: the platform provides minimal cues that orient action in real time, while leaving interpretation, adaptation, and on-scene role negotiation to volunteers. As a result, coordination does not depend on formal authority so much as on volunteers' situated judgment and their willingness to act on the platform's prompts.

A central insight from Paper IV is that the platform's capacity to coordinate rests not only on its technical capabilities but also on socio-affective dynamics that sustain participation over time. Volunteers describe responding out of moral commitment, emotional resonance, and a sense of civic responsibility, resources that cannot be mandated but are crucial in high-stakes contexts. The platform's legitimacy, partly conferred through its association with SOS Alarm, further supports volunteers' confidence that responding is appropriate and meaningful. Collective action thus emerges through a delicate interplay of technical capabilities, affective investment, and institutional endorsement.

At the same time, the analysis also reveals that this form of coordination has limits. The platform's success depends on *responsibilising* volunteers for preparedness, real-time decision-making, and post-event emotional processing—often without matching infrastructures for collective review, feedback, or care. As SMS-Livräddare becomes more embedded in emergency response, this arrangement generates institutional demands that cannot be resolved within the platform itself: clarity about competency and training, approaches to verification and quality assurance, liability boundaries, and mechanisms that support volunteers across repeated response cycles. These demands are best understood as generative interdependencies produced by the platform's growing role in public emergency work: as the platform enables new forms of action, it creates new dependencies and expectations that require institutional attention.

From the perspective of papers II and III, coordinating collective action in digital health ecosystems is not contained within any single "solution" (a policy, a platform, a standard), but is continuously infrastructured across interdependent layers and sustained through ongoing work such as aligning practices, standardising information, and building coordination capacity across boundaries. From this perspective, Paper IV does not describe an isolated platform phenomenon. It describes a situation in which a technological coordination mechanism (soft algorithmic cues) activates collective action while relying on and making visible the informational and institutional layers beneath it.

The platform case, therefore, offers a complementary perspective on the governance-level analysis in RQ1. It demonstrates that collective action in digital transformation can emerge powerfully from the ground up, enabled by digital infrastructures, yet it also shows why such coordination becomes fragile when the interdependencies it generates are not supported by institutions. Digital platforms can mobilise action and create new possibilities for digital transformation, but sustaining that requires broader infrastructuring work across technology, information, and institutions, which must continually negotiate responsibilities, maintain legitimacy, and build the support structures.

Taken together, the findings show that digital platforms do not offer an alternative to governance structures. Instead, they make visible a different mode of coordinating collective action in the digital transformation of healthcare while simultaneously creating new interdependencies.

# 8 Discussion

Digital transformation in healthcare reveals coordination challenges that defy traditional models of organising. In this thesis, I have conceptualised digital transformation of healthcare as a collective action problem that requires coordination among diverse actors, technologies, and institutional arrangements. Across the papers, coordination challenges consistently arose from new interdependencies generated by the introduction of digital technologies. To interpret these recurring patterns, this section draws on three defining characteristics of digital technologies; incompleteness, non-mirroring, and generativity (Gkeredakis & Constantinides, 2019). These serve as lenses for interpreting how new interdependencies arise and evolve. This analysis leads to the central theoretical contribution of the thesis, an understanding of coordination as the ongoing management of generative interdependencies in digital health ecosystems.

## 8.1 Understanding generative interdependencies in digital transformation

Digital transformation in healthcare reveals coordination challenges that defy traditional models of organising. In this thesis, I have conceptualised digital transformation of healthcare as a collective action problem that requires coordination among diverse actors, technologies, and institutional arrangements. Across the papers, coordination challenges consistently arose from new interdependencies generated by the introduction of digital technologies. To interpret these recurring patterns, this section draws on three defining characteristics of digital technologies -incompleteness, non-mirroring, and generativity (Gkeredakis & Constantinides, 2019). In doing so, it develops an understanding of generative interdependencies as dynamic, emergent dependencies that shape how diverse actors must continually align their efforts as digital transformation unfolds.

A defining characteristic of digital technologies is their *intentional incompleteness*. Unlike finished traditional products, digital artefacts are designed to evolve through ongoing use and redesign (Garud et al., 2008; Kallinikos et al., 2013). This fluidity blurs the line between implementation and design as features are added post-deployment, updates roll out iteratively, and users co-shape tools to fit emerging needs. As Star and Ruhleder (1996) note, infrastructures only become infrastructure through gradual adaptation in practice. This perpetual incompleteness challenges classic coordination assumptions, which typically treat technologies as stable, finished tools around which tasks and roles can be clearly aligned.

In digital health transformation, this manifests as continuous collaborative adaptation. Implementing digital initiatives becomes an ongoing joint problem-solving process. Throughout the thesis, this was evident in the sustained efforts required to align data definitions, reconfigure workflows, and renegotiate interoperability standards in response to changing tools. As new functionalities are introduced or standards revised, ripple effects emerge, requiring, for example, clinical teams to update practices, vendors to retool systems, or governance bodies to reinterpret mandates. In this way, incomplete digital infrastructures draw actors into ongoing relationships of co-development. Coordination shifts from implementing a fixed artefact to maintaining an evolving assemblage.

This leads naturally to the second characteristic, *non-mirroring*, which further reinforces digital transformation as a collective action challenge. In conventional systems, the architecture of a product or process often mirrors the organisation that produces it; however, digital technologies depart from this, as their layered, modular architectures do not mirror a single organisational hierarchy (Yoo et al., 2010; Colfer & Baldwin, 2016). In such a design, a digital solution (for example, a health app) might simultaneously rely on a cloud database from one provider, analytics from another, and user data generated across many clinics – an assembly that no single hierarchy fully encompasses. Coordination thus shifts from internal management to ecosystem-level alignment

Empirically, the thesis found that digital health initiatives consistently forced stakeholders to coordinate beyond their traditional organisational silos. For example, implementing a nationwide interoperability platform required regional health authorities, hospitals, software vendors, and regulators to collaborate. No single entity "owned" the whole system; instead, it relied on polycentric governance structures in the ecosystem and cross-boundary working groups to fill the gap. Coordination challenges thus took the form of

negotiating roles and interfaces as digital transformation blurred organisational boundaries. The locus of coordination "inverted" outward (Gkeredakis & Constantinides, 2019).

Finally, digital technologies are distinguished by their profound *generativity*, their capacity to spur unplanned, innovative uses beyond their original design (Gkeredakis & Constantinides, 2019). Reprogrammability, modularity, and openness (Zittrain, 2006; Yoo et al., 2010) enable loosely coupled, context-agnostic components that developers and users recombine freely. As Yoo et al. (2010, p.728) notes, APIs designed for one purpose are endlessly repurposed as designers "cannot fully anticipate all the possible ways". This open-ended landscape (Henfridsson et al., 2018) invites large, varied, uncoordinated audiences, creating unpredictable interdependencies.

For instance, Paper IV analysed the Sms-livräddare platform, which combines geolocation services with national registries of AED devices to mobilise rapid response for out-of-hospital cardiac arrest cases. Similar technologies have been deployed to coordinate emergency settings, such as fire response, but their integration into emergency healthcare introduces new interdependencies between citizens and emergency services, between private developers and public authorities, and between platform capabilities and existing care protocols. Furthermore, its continued use also raises questions regarding liability, accountability, and the evolving responsibilities of public and private actors.

Collectively, these dynamics illustrate what this thesis conceptualises as generative interdependencies. These are emergent, evolving dependencies that are not designed in advance but continually produced through interaction with digital technologies and across organisational boundaries.

## 8.2 Beyond traditional coordination theory

The emergence of generative interdependencies challenges conventional coordination theories, which assume stable, predefined relationships within organisational boundaries. Digital health ecosystems, in contrast, require responding to evolving connections across shifting technological and governance landscapes. These interdependencies emerge dynamically through use, adaptation, and recombination and without central authority.

Classical coordination theories (Fayol, 1949; Thompson, 1967; Galbraith, 1977) frame coordination as a design problem that can be solved through hierarchy, task differentiation, and control mechanisms. More recent process-based approaches (Okhuysen & Bechky, 2009; Jarzabkowski et al., 2012) have shifted toward understanding coordination as emergent and situated. Yet both traditions presume relatively stable organisational boundaries and a degree of predictability in dependencies.

The findings in this thesis challenge those assumptions. Coordination in digital health ecosystems routinely exceeds organisational boundaries, involves actors without formal authority, and unfolds around technologies that change through use. Interdependencies emerge not just from system complexity but from the generative nature of digital technologies themselves, their incompleteness, non-mirroring architectures, and openness to repurposing. Existing governance mechanisms and coordination routines often struggle to respond to these shifts, not due to poor design, but because the coordination landscape itself keeps changing.

The next section advances this argument by distinguishing between technological and structural forms of generative interdependence and how they recursively shape one another, offering a framework for understanding collective action in digital transformation.

## 8.3  Generative interdependencies in the digital transformation of healthcare

While the findings reveal the limitations of existing coordination theories, they also open a pathway toward a richer understanding of collective action in digital transformation. Building on the concept of generative interdependencies (Gkeredakis & Constantinides, 2019), I extend the idea by distinguishing two analytically useful forms of generative interdependencies that emerge in digital health ecosystems: technological and structural generative interdependencies. These forms of interdependence require distinct coordination responses yet operate through recursive dynamics that compound collective action challenges over time.

### 8.3.1 Generative technological interdependencies

Generative technological interdependencies emerge from the product-agnostic and recombinatory nature of digital technologies. Unlike traditional systems designed for stable, bounded use, digital infrastructures enable components to be reused, recombined, and repurposed across organisational and functional domains. This openness creates not only new functionalities but also new dependencies among actors who were never meant to coordinate (Yoo et al., 2010; Gkeredakis & Constantinides, 2019). For instance, EHRs originally designed for clinical documentation are repurposed for patient-centric care across regional data boundaries (Paper I), while digital platforms recombine existing tools, such as mobile alerts and GPS tracking, to create emergency response platforms that crowdsource volunteer first-responders, enabling collective action that could not exist under traditional healthcare structures (Paper 1V).

Each new recombination increases the value of participation but simultaneously introduces new interdependencies, in which stakeholders who were previously separate must now synchronise their technologies and actions, and technical components that once operated in isolation become coupled. It is this ongoing creation of novel linkages that defines technological interdependencies as generative. Each innovation increases the value of participation but simultaneously deepens the challenges of collective action. These are not residual implementation problems but challenges intrinsic to the logic of digital transformation, especially in healthcare.

Paper IV especially demonstrates how collective action emerges through mechanisms that lie outside traditional healthcare governance models. In the case of volunteer-based emergency response, alignment was achieved not through top-down control or algorithmic orchestration (Möhlmann et al., 2021; Leong et al., 2024) but through soft algorithmic coordination and the responsibilisation of volunteers. This echoes insights from Okhuysen and Bechky (2009) on emergent coordination, but extends them into an ecosystem setting where actors operate autonomously and often asynchronously.

However, the paradox of collective action enabled by such generative technological interdependencies is that the very qualities that make it powerful also render it fragile. Openness, decentralisation and voluntary engagement can only be sustained through structural support for issues such as verification, training, liability, and accountability. In this way, technological interdependencies do not remain confined to the technical layer, but they

provoke responses and governance adaptations. They generate structural interdependencies that must be addressed if innovation is to be sustained.

## 8.3.2   Generative structural interdependencies

If generative technological interdependencies arise from the evolving capabilities of digital systems, generative structural interdependencies emerge from the institutional realignments those technologies demand. These interdependencies are not deliberately designed but emerge reactively as healthcare systems, governance bodies, and professionals encounter collective needs introduced by technological change. The incompleteness of technologies often exposes gaps in governance structures around accountability, roles, funding models and policy requirements that stakeholders must collectively address. For instance, the spread of digital technologies in healthcare generates a collective demand for interoperability, data sharing, and integrated service delivery across healthcare actors (Paper I).

However, as Paper I highlighted, an AI project that succeeded regionally failed to scale nationally due to the absence of mechanisms for cross-regional data sharing, leading to financial and legal uncertainties. At the governance level, the COOF framework analysis revealed that polycentric governance structures (Ostrom, 1990; Carlisle & Gruby, 2019), while enabling local innovation, struggled to absorb the structural demands arising from stakeholders' use and recombination of digital technologies (e.g., scaling and data interoperability). In the absence of these mechanisms, stakeholders often resort to regulatory solutions that often lag behind technological advancements.

This marks a departure from conventional views in digital transformation and coordination literature, where governance is often treated as a static backdrop or as a set of implementation levers (Greenhalgh et al., 2017a; Cresswell et al., 2024). In contrast, this thesis demonstrates how governance structures are actively reshaped by the demands that emerging interdependencies place on accountability, role clarity, funding mechanisms, and system integration. Papers II and III equally show how infrastructuring work unfolds through recursive cascades of standardisation. Each alignment effort exposes new gaps and triggers further coordination demands. This dynamic aligns with Star and Ruhleder's (1996) observation that infrastructure is never fully in place but always in the making.

What becomes clear across both forms of interdependence is that they do not unfold in isolation. Rather, technological and structural generative

interdependencies operate in a recursive relationship. New digital functionalities provoke institutional adaptations, which in turn shape the conditions for further innovation. This recursive interplay aligns with research conceptualising sociotechnical change as a cascading process, in which adaptations in one layer trigger adjustments in others (Henfridsson & Bygstad, 2013; Monteiro et al., 2013). In the context of digital health transformation, it foregrounds the argument that coordinating change is not about one-time implementations, but about navigating their emerging interdependencies across entangled layers of technology and governance. This dynamic provides the foundation for a theoretical framework (shown in Figure 3) for analysing how collective action unfolds in digital health transformation.
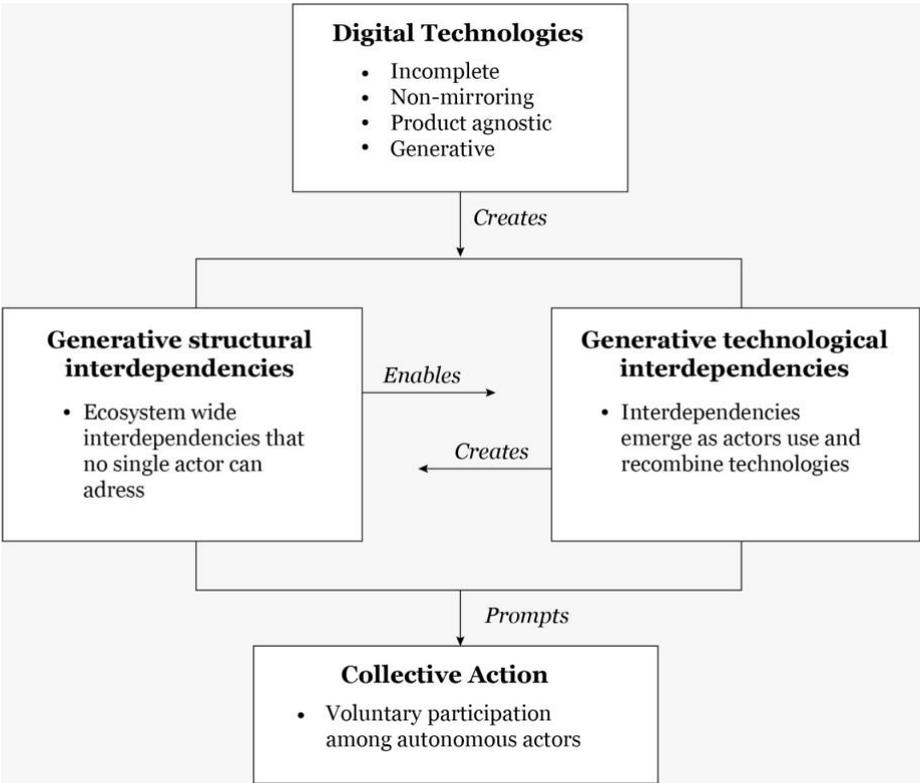


**Figure 3 Generative interdependencies in digital health transformation**

## 8.4  Implications for theory

The Generative Interdependencies Framework developed in this thesis contributes to several strands of theory in information systems and organisational research by reframing how digital transformation is understood from a coordination perspective. While prior studies have highlighted the incompleteness and open-endedness of digital technologies (Gkeredakis & Constantinides, 2019; Yoo et al., 2010) and the evolving nature of digital infrastructures (Star & Ruhleder, 1996; Hanseth & Lyytinen, 2010), this thesis advances these debates by demonstrating how digital transformation generates two distinct but recursively linked forms of interdependence: structural and technological, and by conceptualising coordinating digital transformation as the ongoing management of these emergent dependencies.

First, classic coordination theories (Malone & Crowston, 1994; Thompson, 1967) largely assume that interdependencies among actors can be identified, stabilised, and managed through mechanisms such as plans, routines, or technological artefacts. Even more recent views of coordination as an emergent practice focus on how actors achieve alignment in real time (Okhuysen & Bechky, 2009). The findings in this thesis challenge these assumptions by showing that in digital transformation contexts, interdependencies are continuously generated by the very mechanisms intended to coordinate them. Thus, coordinating digital transformation is not primarily about aligning known relationships; it is about absorbing and responding to interdependencies that arise through structural designs, technological evolution, and their recursive interaction.

Second, platform studies emphasise generativity, recombinability, and the emergence of new organisational forms (Henfridsson et al., 2018; Constantinides et al., 2018). The findings from this thesis extend digital platform and ecosystem theory by showing that platform generativity produces technological interdependencies that recursively feed back into governance structures, demanding new forms of, accountability, resource allocation, and risk management. Platforms, therefore, do not simply "enable" coordination; they redistribute coordination demands across the ecosystem, revealing the necessity of institutional scaffolding even in decentralised, volunteer-driven contexts.

Third, the thesis contributes to theoretical integration by demonstrating how concepts from infrastructuring (Monteiro et al., 2013; Pipek & Wulf, 2009), assemblage theory (Deleuze & Guattari, 1987; DeLanda, 2006), and

polycentric governance (Ostrom, 1990; Constantinides & Barrett, 2015) can be combined to explain coordination across different levels of digital transformation in healthcare. Rather than treating these frameworks as parallel, the thesis demonstrates how they operate across levels: assemblages form through infrastructuring and can be governed through polycentric mechanisms. This integrated framework allows for a more nuanced account of how coordination unfolds across different analytical levels and why alignment must be continually re-established in the face of emergent dependencies.

Finally, the thesis contributes to a growing strand of IS literature that critiques organisation-centric views of digital transformation (Majchrzak et al., 2016; Braa et al., 2023; Currie et al., 2024) by demonstrating the value of shifting the unit of analysis to digital health ecosystems. In contrast to firm-bound accounts of digital transformation as a strategy or implementation effort, this study shows how transformation unfolds across networks of autonomous actors, including public authorities, vendors, regions and citizen volunteers, none of whom can unilaterally steer change.

This ecosystem perspective is especially salient in the public sector, where accountability, political cycles, and distributed governance complicate linear implementation models. By conceptualising digital transformation as the coordinated reconfiguration of joint work across institutions and infrastructures, the thesis provides a novel lens for understanding transformation in contexts marked by high interdependence and institutional complexity (Faik et al., 2020; Majchrzak et al., 2016). This move not only broadens the empirical scope of digital transformation research in IS but also contributes to its theoretical development by positioning coordination as the central problem of ecosystem-level change.

## 8.5 Implications for practice

This thesis provides practice-oriented insights that stem directly from its conceptual and empirical contributions. The most immediate practical implication is the need to move beyond treating digital transformation as a series of isolated implementation projects. As the cases in this thesis demonstrate, every new platform or standard triggers a cascade of interdependencies across actors, data flows, and workflows. Consequently, practitioners must design with recursion in mind by recognising that each technical solution inevitably generates new coordination needs downstream.

Rather than focusing solely on implementation, the central challenge becomes identifying the specific dependencies a system creates and ensuring the capacity to coordinate them. This requires a fundamental shift toward adaptive governance through roles and forums capable of responding as these interdependencies emerge.

Building on this need for adaptability, the thesis challenges the assumption that collective action problems can be managed solely through stable and predefined governance. While polycentric structures that distribute authority across semi-autonomous regions and agencies are typically valued for local adaptability, this study reveals that such systems risk fragmentation unless they possess the mechanisms to continuously detect and respond to these emerging recursive effects. Consequently, polycentric governance must move beyond the mere distribution of authority to become generative in nature. This shift implies that governance systems must co-produce coordination mechanisms as new situations unfold, requiring an ability to anticipate the implications of technical change and recalibrate roles in real time.

In practical terms, this involves integrating feedback loops between implementation sites and policy centres alongside the development of shared learning and escalation mechanisms across jurisdictions. It further necessitates a focused investment in coordination infrastructure, specifically the shared platforms and capacities that enable institutions to govern interdependently rather than in isolation. Seen through this lens, digital transformation in healthcare is redefined not as the alignment of existing structures to new technologies but as the enablement of governance itself to evolve as an inherent part of the transformation process.

This evolution of governance is particularly critical for repositioning local innovation from peripheral experimentation to a vital source of ecosystem-wide momentum. While local actors such as innovators, clinical teams and municipalities often drive significant innovation, this local generativity risks creating an incoherent ecosystem if it lacks alignment pathways. The scaling of grassroots solutions like SMS-Livräddare illustrates this challenge, as local successes inevitably introduce new dependencies that necessitate national or cross-sector coordination.

Consequently, the research suggests that governance must explicitly scaffold bottom-up innovations. This involves creating supportive frameworks, such as shared sandboxes and interoperability toolkits, alongside flexible funding models that reward ecosystem alignment without suppressing creative autonomy. In this view, the goal of governance is to provide the shared

infrastructure that allows local breakthroughs to be standardised and integrated into the broader digital health ecosystem.

Finally, perhaps the most significant value of the generative interdependencies framework is its ability to provide a unified language for digital transformation that scales from clinical practice to national policy. A persistent challenge in healthcare digital transformations is that it spans so many professional and academic silos that discourse often remains fragmented or superficial. However, the notion of generative interdependencies reframes these challenges as fundamentally collective-action problems, regardless of whether one zooms in at the macro, meso, or micro levels of the ecosystem. This conceptual lens allows for a holistic conversation about coordinating the digital transformation of healthcare.

## 8.6  Limitations and future research

As with all research, this thesis is marked by certain limitations that offer important opportunities for further exploration. These limitations are not only methodological or empirical, but also conceptual, reflecting the inherent complexity of studying digital transformation across organisational, technical, and institutional boundaries.

First, while the thesis draws on multiple in-depth cases and complementary papers, the empirical focus remains rooted in the Swedish digital health ecosystem. Sweden's unique governance model, marked by decentralised authority, strong public institutions, and a history of regional autonomy, provides a rich site for exploring coordination in polycentric systems. However, these conditions may limit the generalisability of some findings to contexts with more centralised governance structures or different regulatory logics. That said, the conceptual framework of generative interdependencies is designed to be portable across settings where digital technologies evolve recursively.

Second, the empirical studies primarily captured moments of transformation rather than complete life cycles of digital technologies. While this enables close analysis of how coordination unfolds in real time, it also means that some longer-term dynamics, such as post-implementation reconfigurations, shifts in funding models, or the institutionalisation of new governance forms, remain beyond the current scope.

Third, while the thesis engages multiple theoretical lenses (coordination theory, infrastructuring, assemblage, polycentric governance), it does not develop a unified meta-framework for these traditions. Instead, it selectively draws on each to support specific analytical moves. This choice favours flexibility and empirical fit, but future work may seek to synthesise these perspectives into a more integrated theory of recursive coordination.

### 8.6.1.1 Future research

Building on these limitations, several promising directions for future research emerge. One important avenue is the comparative study of generative interdependencies across national or sectoral contexts. Investigating how similar coordination challenges play out across countries with different governance arrangements, or in other domains such as education, climate technology, or digital public services, could strengthen the framework's generalisability and nuance.

Second, future research could deepen the empirical study of coordination mechanisms over time: how actors detect, respond to, and institutionalise solutions to emerging interdependencies. This might involve longitudinal ethnographies, participatory design studies, or organisational experiments aimed at building generative governance capacities in practice.

Third, there is scope for developing practical tools and methods grounded in this thesis' findings. For instance, diagnostic frameworks for mapping interdependencies, scenario planning methods for recursive coordination, or evaluation tools that track the co-evolution of governance and technology could help practitioners translate conceptual insights into concrete action.

Finally, future work may further interrogate the normative dimensions of coordination. As digital technologies become more pervasive, the question is not only how to coordinate effectively, but who sets the terms of coordination, whose dependencies are prioritised, and what values are embedded in infrastructural choices. These are not merely technical questions, but deeply political ones, underscoring the need for critical, interdisciplinary research at the intersection of IS, governance, and societal transformation.

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