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RESEARCH

Evolution of Information Infrastructures in Healthcare as Convergence of Digital Trajectories

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Abstract. In information infrastructures at hospitals, various stakeholders are responsible for specific information and communications technology (ICT) portfolios. Each portfolio represents a unique digital trajectory with a past, present, and future. This study investigated *how* stakeholders (in this study, software developers, ICT operations organizations, and users) collaborate to facilitate the convergence of different digital trajectories, thus contributing to the successful evolution of information infrastructures. Empirically, we focused on the preparatory work involved in implementing an app that would enable nurses to register and calculate National Early Warning Scores at Nordland Hospital in northern Norway. Specifically, we examined the collaboration between three stakeholders to align their respective ICT portfolios and prepare for the new solution. These stakeholders were the Finnish software developer Medanets, the Norwegian Electronic Health Record developer DIPS ASA, and the Northern Norway Regional Health Authority, which governed the regional health ICT infrastructure. These stakeholders governed three distinct portfolios that had been developed over many years and, in this sense, represented digital trajectories with a past, a present, and a possible future. This study is positioned within the computer-supported cooperative work field, and the analysis draws upon the theoretical concepts of information infrastructure and trajectories.

Keywords: Convergence, Evolution, Hospitals, Information infrastructure, Trajectories

1 Introduction

Western hospitals have become increasingly dependent on supportive information infrastructures to handle the increased costs of aging populations, constrained budgets due to reduced public revenues, and the development of life-enhancing technologies. These information infrastructures, as we define them, are complex socio-technical systems that consist of a range of information and

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communications technology systems that have been built over time and are interconnected in heterogeneous networks in various ways. Examples include electronic health records (EHRs), laboratory systems, artificial intelligence (AI) platforms, and numerous mobile apps, typically sourced from different developers. A major challenge is that the information infrastructure must continuously adapt to complex and changing circumstances and evolving healthcare requirements.

We define information infrastructure portfolios as the technical components of an information infrastructure. Strategies for changing such portfolios differ substantially. For example, large-scale EHR suites are often associated with revolutionary approaches that involve replacing significant portions of the existing infrastructure at once (Ellingsen et al. 2022). Other strategies focus on a stable platform core with replaceable apps residing on top (Bygstad 2017; de Reuver et al. 2017). In contrast, the computer-supported cooperative work (CSCW) and information infrastructure literature is concerned more with small-scale systems, on which users generally have more influence. It recommends a step-by-step evolutionary approach (Ellingsen et al. 2022) with a clear focus on the stakeholders involved, especially the users but also developers and other stakeholders.

An evolutionary strategy is not without challenges. When integrating a new ICT system into an existing infrastructure, adjustments to both the new system and the affected part of the broader information infrastructure are required. Accordingly, stakeholders responsible for the affected sub-portfolios must coordinate their activities with those responsible for the new ICT system to ensure that the portfolios fit together and that the combined ICT functionality achieves the desired goal. Examples of relevant stakeholders are software developers, ICT operations organizations, users, and managers. Over the years, various stakeholders have developed their ICT portfolios with different motivations, technologies, and ambitions. Consequently, each portfolio represents a unique digital trajectory, which we define as follows: The digital trajectory of an information infrastructure reflects a past, a present, and a potential future. It signifies the constant evolution of digital environments as they adapt, integrate, and scale over time.

These factors influence the integration process. Different digital trajectories may not interact easily and require effort to ensure that they converge to a new shared information infrastructure that can provide a broader range of functionalities. Hence, we asked the following research question: *How do stakeholders (in this case, software developers, ICT operations organizations, and users) collaborate to facilitate the convergence of different digital trajectories, thus contributing to the successful evolution of an information infrastructure?*

Empirically, we investigated the preparatory work for introducing the Medanets app into Nordland Hospital in northern Norway. The Medanets app enabled nurses to register and calculate National Early Warning Scores (NEWS) at the patients' bedsides and was regarded as a great success by the users. We focused on the three stakeholders who collaborated to align their respective

ICT portfolios to prepare for the new solution: the Finnish software developer Medanets, the Norwegian EHR developer DIPS ASA, and the Northern Norway Regional Health Authority's ICT organization (hereinafter referred to as Northern Norway ICT), which governed the regional health ICT infrastructure. These stakeholders governed three distinct portfolios that had been developed over many years and, in this sense, represented trajectories with a past, a present, and a possible future.

Conceptually, we drew on the CSCW field, which has a long tradition of attending to stakeholders' perspectives on local practices (Fitzpatrick and Ellingsen 2013). We also drew on the information infrastructure concept, particularly in relation to evolution (Aanestad and Jensen 2011; Bossen and Markussen 2010; Hanseth and Lyytinen 2010; Star and Ruhleder 1996). This framework is particularly useful for understanding how information infrastructures evolve over time and follow specific trajectories (Karasti et al. 2010; Strauss et al. 1985) that need to converge (Meier and Missonier 2012; Timmermans and Berg 1997) to achieve the desired synergies.

2 Theory

2.1 Information infrastructure in healthcare

The information infrastructure concept has frequently been used as a lens for analyzing the design, implementation, and use of large-scale information systems in healthcare (Hanseth and Lyytinen 2010; Star and Ruhleder 1996). Examples include EHR systems (Aanestad and Jensen 2011; Ellingsen et al. 2022), patient-oriented web-based solutions (Grisot et al. 2014), institutional integration (Sahay et al. 2009), laboratory systems (Ellingsen and Røed 2010), AI platforms (Silsand et al. 2023), electronic medication management systems (Hertzum and Ellingsen 2023), medication plans (Bossen and Markussen 2010), regional platforms that run basic infrastructural services, and numerous mobile apps integrated into broader infrastructure portfolios.

The different systems in an information infrastructure are not standalone entities (Aanestad et al. 2017). They are interconnected in heterogeneous networks that include both technical and nontechnical elements, such as technology, people, and contexts. Therefore, information infrastructures are deeply embedded in conventions and established practices (Aanestad and Jensen 2011). A basic principle of an information infrastructure is that it is never built from scratch but grows through the evolution of the installed base (Aanestad et al. 2017). The installed base of an information infrastructure is defined as the existing systems, and practices that form the foundation upon which new systems are built and integrated. The evolution of the installed base means that the infrastructure is constantly evolving through a continuous co-construction process that involves

both technical and social elements (Monteiro et al. 2013; Star and Ruhleder 1996). During this evolution, the installed base grows and becomes increasingly entangled in the environment, which makes it difficult to change or replace it. Thus, newer parts of the installed base should be introduced cautiously in a stepwise manner. This process requires continuous negotiations and compromises between various stakeholders to achieve alignment (Latour 1987). On the other hand, the careful cultivation of the strengths of the installed base may increase the likelihood of a successful evolution process. Star and Ruhleder (1996, 113) summarized the dual nature of the installed base as follows: 'Infrastructure does not grow de novo: it wrestles with the "inertia of the installed base" and inherits strengths and limitations from that base.'

Given the presence of the installed base, an obvious question is how to ensure the successful evolution of the information infrastructure in a manner that allows the power of the installed base to be cultivated. Hanseth and Lyytinen (2010) recommended designing simple ICT capabilities that are useful from the start and can attract many users. A related strategy is to bootstrap the infrastructure by encouraging early adopters to use it and generate network effects that reinforce further adoption (Grisot et al. 2014). Sanner et al. (2014) suggested *grafting*, which involves using available resources to collaborate with motivated stakeholders. Aanestad and Jensen (2011) recommended evolving the infrastructure in a modular manner, with relatively self-contained systems that have standardized interfaces.

While the abovementioned design strategies are compelling, they are also quite abstract or conceptual in nature. As an alternative, in this study, we examined how software developers and other stakeholders work on infrastructural evolution in practice. Specifically, we examined a situation in which several stakeholders are responsible for different ICT portfolios (such as apps, EHR systems, and platforms) and must collaborate to prepare for a new combined information infrastructure. This situation usually occurs when a hospital procures a new system that needs to be integrated into its existing information infrastructure.

2.2 Digital trajectories and convergence

Strauss et al. (1985) used the notion of illness trajectory to refer to the course of an illness, including its onset, development, and outcome. They argued that *understanding* its trajectory is essential for providing the patient with effective medical care and support. At the same time, they pointed to the difficulty of managing the trajectory due to contingencies—that is, uncertain and unpredictable factors that can influence its course.

While Strauss et al. (1985) focused on illness trajectories—that is, patients—health personnel also follow one or several professional trajectories. For example, a physician may follow a research trajectory, while a nurse may follow a trajectory related to daily activities (Timmermans and Berg 1997). Similarly,

an evolving information infrastructure has a digital trajectory. The concept of information infrastructure as a digital trajectory refers not only to its technical unfolding but also to 'the total organization of work done over that course, plus the impact on those involved with that work and its organization' (Strauss et al. 1985; p. 8). Trajectories are a particularly useful lens for explicating the multiple perspectives related to the emergence of an information infrastructure. A digital trajectory is never the result of conscious plans or a particular sequence of decisions. Rather, it is the emergent effect of the interlocking of entities performing subtasks. An information infrastructure represents a trajectory that is constantly altered or changed and negotiated in response to changes in the nodes that constitute the heterogeneous network that manages the information infrastructure.

The digital trajectory of an information infrastructure reflects a past, a present, and a potential future. It signifies the constant evolution of digital environments as they adapt, integrate, and scale over time. It inherently involves multiple stages of transformation and adaptation spurred by user needs, technological advancements, regulatory policies, and market dynamics (Dosi 1982) and is influenced by numerous stakeholders, including software developers/vendors, users, regulators, and other affiliated entities. These stakeholders shape the digital trajectory by contributing resources, influencing decision-making processes, and directly or indirectly altering functionalities and rules. By following the trajectory of an information infrastructure, we can trace historical patterns of growth and transformation, understand the interplay between technology and the social context, and anticipate future developments.

Trajectories are not linear but complex, iterative paths of development that may diverge, converge, or follow tangential routes (Meier and Missonier 2012; Timmermans and Berg 1997). In this regard, we refer to convergence as an agreement whereby actors' activities align despite their divergence (Meier and Missonier 2012). Accordingly, adding a new app to an EHR system basically requires that the different digital trajectories converge and evolve into a new shared infrastructure that provides broader and more diverse functionalities. Thus, convergence is not merely about technological integration but encompasses the alignment of differing standards, practices, and regulations that underpin an information infrastructure. It emphasizes the contingent and temporary nature of coordinating multiple trajectories, which necessitates that the stakeholders involved engage in substantial negotiations to align disparate trajectories. This suggests that the convergence of digital trajectories goes beyond mere technical integration; it requires collaboration, disparity resolution, and consensus, all of which are crucial for ensuring the effective operation of cooperative systems.

2.3 Evolution in the long and short terms

Many software developers in the healthcare market have long-term strategic ambitions, such as modernizing their current portfolios through modularization,

transitioning to the cloud, or developing platform functionality. Thus, they may face tension between creating a functional solution in the present and fulfilling their long-term ambitions for their ICT portfolios. Ribes and Finholt (2009) introduced the notion of 'the long now' of technology infrastructure, pointing to the seemingly paradoxical nature of long-term plans for ICT systems. They emphasized that designing an information infrastructure is a visionary process that requires sustainability to be considered today. Balancing the needs of today's users against those of future users is an inherently delicate act.

Karasti et al. (2010) argued along similar lines when elaborating on the temporal scale of information infrastructure development and identified two distinct temporal orientations: 'project time' and 'infrastructure time.' Without awareness of the multiple temporalities, development will largely remain influenced by the prevalent, taken-for-granted short-term temporality. The tension is manifested in the need to not only develop short-term products but also demonstrate long-term viability. Consequently, participants should allocate their time between short-term deliverables and the sustained development of a stable and scalable information infrastructure.

A characteristic example of the tension between long- and short-term temporalities is many developers' desire to transform their large and often unruly ICT portfolios into digital platforms while responding to daily user demands. Digital platforms are envisioned to manage complex ICT portfolios through a stable platform core that can support the seamless integration of third-party apps that run on top (Bygstad 2017; de Reuver et al. 2017; Islind et al. 2019). These apps are integrated with the platform core via a standardized interface provided by the platform, called an application programming interface (API), which makes it easy to add or replace apps when needed or change an app's content without affecting other parts of the platform.

However, this ideal situation stands in contrast to the hard realities on the ground. Formalizing integration processes into detailed plans has proved to be a challenging task (Berg and Goorman 1999). In the CSCW literature, multiple studies have highlighted how stakeholders tinker with a 'rigid' technology in various ways—for instance, through workarounds to ensure a better task–artifact fit (Cabitza and Simone 2013), improvisation to manage change in organizations (Orlikowski and Hofman 1997), or new patterns of action for work (Mark and Semaan 2008).

This challenge is made even more formidable by the fact that no party has exclusive control of a large-scale information infrastructure. Thus, stakeholders must find ways to collaborate, and it is far from obvious who should initiate collaboration, how it should occur, and who should enforce the progress of an information infrastructure. Nevertheless, the obvious strength of distributed control is that participation is based on motivation, interests, and profound insights into the perspective from which one sees things. For instance, in organizations with

particularly complex work practices, such as hospitals, it is generally recognized that only the users themselves know the practices sufficiently well to be able to assess the suitability of a system.

3 Method

Empirically, this study focused on the introduction of a mobile app into Nordland Hospital. This is the largest hospital of Nordland Hospital Trust, which is the second-largest health trust in northern Norway, employing 4,000 individuals and providing specialized healthcare to a regional population of 136,000. The process of introducing the app involved various stakeholders, each with their specific perspective. Our informants represented four stakeholder groups: the EHR developer DIPS ASA, the app developer Medanets, Northern Norway ICT, and user representatives from Nordland Hospital.

We adhered to the interpretive research tradition (Klein and Myers 1999; Walsham 1995) to gain insights into human thought and action in a specific organizational context. This research approach views reality as a social construct shaped by the actors involved and emphasizes human interpretation. In addition to acknowledging reality as a social construct, we aimed to detail the nuanced stories that individuals create and share in their communities. This narrative aspect foregrounds the individual and collective experiences and interpretations that inform the use and integration of a mobile app, providing a deeper, textured understanding of the phenomenon (Moen 2006). The interpretive approach is therefore well suited for broadening and deepening the understanding of a phenomenon or social process by exploring diverse perspectives in a specific context (Klein and Myers 1999; Walsham 1995). To do so, we developed a semi-structured interview guide through an iterative process. The final interview guide comprised questions covering five main topics: the history of the stakeholders, technology, the purpose of implementation, stakeholder collaboration, and implementation challenges. Each topic included 3–5 broad questions along with sub-questions that could be used for further probing. To ensure relevance across diverse informant roles, we allowed for some variation in the number of questions posed.

The interview guide was designed to keep the conversations within the topics of interest while allowing interviewees to introduce new themes and expand on their responses. The interview questions concerned the informants' perceptions of the implementation of the new system, including the phases leading to it. For instance, within the 'stakeholder collaboration' topic, we asked informants from Northern Norway ICT and DIPS ASA, 'How would you assess your organization's capacity to implement the Medanets app?' Similarly, we asked informants from Medanets, 'How do you experience the collaboration with Northern Norway ICT and DIPS ASA in terms of their willingness and capability to implement

the Medanets app?' This helped us understand the collaborative dynamics. For the 'implementation challenges' topic, we posed the question: 'Can you provide an example of how perceived dependencies between the actors shaped the progress of the project, and how any challenges were managed?' This question was designed to uncover insights into the complexities of stakeholder interactions, focusing on dependency among stakeholders and the strategies employed to navigate and resolve the challenges that arose. We were interested in the interrelationships and perceived dependencies between the involved actor groups and the ways in which potential tensions were addressed. All interviews were conducted by a combination of the 1st, 4th, and 5th authors, working in pairs of two or all three together (Table 1).

Our empirical evidence can be categorized into three types. First, we collected data from nine semi-structured individual and group interviews with a total of 13 informants between May and June 2021. While the same set of questions was employed in both individual and group interviews, some expected differences in dynamics emerged. Most notably, groups of informants collectively composed the story, sequence of events, and processes related to the implementation, complementing each other to form a collaborative narrative. No disagreements arose among the group informants, but there were some discussions that we considered constructive for the purpose of the interview.

The informants were either contacted directly on the basis of our knowledge of their connection to the implementation process or referred to us through snowball sampling. The interviews ranged in duration from 45 to 60 min, with group interviews being the longest. They were conducted using digital video conferencing tools, audio recorded, and transcribed verbatim. Second, we reviewed project documents, technical descriptions, and policy papers to provide a background description and build our case. Third,

Table 1 Summary of the interviews.

Informant's role	Stakeholder organization	Interview method
Integration developer	DIPS	Individual
Project manager	DIPS	Individual
Department manager	DIPS	Individual
Developer	Medanets	Group
Senior developer	Medanets	
Sales manager	Medanets	
Executive partner	Medanets	
Department manager	Northern Norway ICT	Individual
Integration developer	Northern Norway ICT	Individual
Project manager	Northern Norway ICT	Individual
ICT advisor #1	Nordland Hospital	Group
ICT advisor #2	Nordland Hospital	
Department manager	Nordland Hospital	Individual

to collect background data, we conducted 13 semi-structured interviews with 26 end users after the Medanets app had been implemented in clinical practice.

We analyzed the qualitative data based on the hermeneutic circle, which is widely used to interpret interview data (Klein and Myers 1999). We engaged in a cyclical process of interpretation, moving back and forth between the parts and the entirety of our dataset to uncover the underlying meanings and contexts of the interviewees' responses. This method is particularly useful for analyzing interview data that are complex, contextual, and rich in meaning. We started the analysis with a detailed reading of the entire transcript material and subsequently searched for patterns and themes in the texts. We then returned to specific passages to interpret the meanings and contexts of the informants' responses in a more detailed manner. This involved moving back and forth between the specific text and the broader context of the case, resulting in a nuanced and contextualized understanding of the interviewees' perceptions and the social and historical context of the studied setting.

The analysis of the stakeholders' perspectives revealed seven categories. From the Medanets perspective, three categories emerged: 'meeting user needs with lightweight technology,' 'finding pragmatic approaches,' and 'identifying challenges in the infrastructure.' The first category reflected the company's evolving approach as a provider of mobile clinical apps, which became evident through its history. The other two categories emerged from the interviews when respondents talked about the specifics of the integration process, in particular the ways in which challenges were navigated. From the DIPS perspective, the categories of 'transitioning to a platform' and 'expanding the platform through integration' were closely associated with the company's longitudinal strategic shift from a suite developer to a platform provider. From the Northern Norway ICT perspective, two categories emerged: 'regionalizing the local,' referring to the establishment and development of a regional ICT organization, and 'building and maintaining complexities,' representing Northern Norway ICT's ambitions for the future revealed by interviewees' descriptions of the intricacies of system integration processes. We used these categories to outline each stakeholder's interests and ambitions and to investigate the dynamics and interactions between them.

All authors participated in the analytical process and engaged in rigorous discussions about the empirical data to achieve a balanced representation of the events from each perspective. The use of information infrastructure theory, detailed in Section 2, significantly influenced our thematic categories, especially regarding strategies for dealing with flexibility and complexity in large-scale socio-technical ecosystems.

4 The NEWS project

In 2017, the NEWS procedure was introduced into all wards at Nordland Hospital as part of a national patient safety project. The NEWS is based on a quantification of vital signs (respiration rate, blood oxygen saturation, temperature, blood pressure, and heart rate) to quickly detect deterioration in a patient's

condition. Based on these key indicators, nurses produce a score ranging from 0 to 20, with higher scores representing higher clinical risks, and determine how closely a patient should be monitored.

The scores were registered every morning before the physicians' ward round. Although nurses regarded the NEWS as a valuable tool in clinical practice, it demanded a large number of time-consuming vital sign assessments and procedures using paper-based tools and manual score calculations. Nurses had to observe and measure each patient's vital signs at the bedside and write down the results. Upon returning to the office, they transferred the notes to paper-based forms and manually calculated the scores. They then entered the scores into the patients' paper-based medication charts, which were subsequently scanned and stored in the hospital's DIPS EHR system once a day. The wards were also equipped with electronic whiteboards purchased from DNV Imatis, which is known for delivering good visual overviews (Hertzum and Simonsen 2015). However, because the whiteboards were poorly integrated into the EHR system, essential clinical data, such as detailed patient information, planned procedures, examinations, test results, and treatment plans, could not be transferred from the EHRs. Consequently, the whiteboards provided only basic patient overviews, and clinicians found the displayed information to be of limited value.

Since the paper-based medication charts were entered into the EHR system only once per day, the physicians had to go to the wards and retrieve the paper-based forms to find each patient's latest NEWS. For nurses, coordination work included cross-checking before calculating a score to avoid measuring vital signs twice in case another nurse had already performed the measurements. Thus, this was a time-consuming process that entailed double or triple registration of vital signs and a high risk of errors due to the complex handling and multiple transmissions of the data.

As an organization that had made the strategic decision to proactively search for new ICT solutions that could support users in their daily work, Nordland Hospital sought a digital solution to replace the paper-based NEWS procedure and make the scores instantly available in the DIPS EHR system. The hospital had spent five years looking for a lightweight app for digitally documenting vital parameters at the bedside and had invited several developers to demonstrate potential solutions, to no avail. However, when users from Nordland Hospital watched a demonstration of the Medanets app in 2019, they were convinced that it was the right tool:

> When we went to the meeting, we were skeptical and did not think that this solution would work for us. However, after 15 min of demonstration of the app, we knew that this was the one we had been waiting for. (ICT manager, Nordland Hospital)

However, a key condition for acquiring the Medanets app was that it would be possible to integrate it with the DIPS EHR system and the electronic whiteboards

used throughout the hospital. This would ensure that NEWS data registered in Medanets would be available to the entire team of nurses and physicians in real time. A contract was signed in 2019, and the implementation started in March 2020 in the internal medicine ward, followed by the medical, surgical, and mental health wards. By fall 2021, 26 wards at Nordland Hospital had successfully incorporated the app into their clinical workflows, with more than 1,000 clinicians using it.

After the implementation period (2020–2021), an evaluation of the app showed that end users, such as nurses, physicians, and managers, were satisfied with it. Most of the desired effects had been delivered, and nurses reported that the app was intuitive, easy to use, and time saving, as it calculated the NEWS automatically. It also transferred the scores to the EHRs and electronic whiteboards automatically and instantly, eliminating the need for paper-based notes and double data registrations. Furthermore, it eliminated previously recurring issues, such as typos, bad handwriting, and miscalculations. The fact that a new digital tool was successfully used after a relatively short implementation period and without the need for comprehensive training was appealing to clinicians. Previously, they had found that the interval between the submission of a new functionality or application requirement and the time when the first users could test it and provide feedback was too long and negatively affected user satisfaction and implementation outcomes. In contrast, according to clinicians, the implementation of Medanets had been amazingly fast and successful.

5 Results

The prevalent success story of the Medanets app concealed the immense amount of collaborative work prior to its implementation in clinical practice. Behind the scenes, a complex series of preparatory work took place, which included negotiations, improvisations, and technical adaptations of various portfolios. This required substantial collaboration between stakeholders to prepare the ground for the app's successful integration into the existing information infrastructure. In this section, we provide an account of the project from the viewpoint of each of the three primary stakeholders (Medanets, DIPS, and Northern Norway ICT), each of whom had its own ICT portfolio. We also illustrate how these portfolios evolved over time, how they shaped the integration effort, and how each stakeholder engaged in improvisation.

5.1 The Medanets app

The Finnish company Medanets was founded in 2004 with the aim of improving workflows in the healthcare sector, especially related to wireless communication and medical equipment. In 2007, inspired by observations of nurses in hospital

wards, Medanets shifted its focus toward mobile apps. Nurses regularly wrote detailed patient information on paper sheets before entering it into the EHRs on office computers. Medanets realized that this process could be streamlined if nurses could enter the data directly into a mobile app. The first versions of the Medanets mobile app were developed for the Windows Mobile operating system between 2007 and 2008 and later adapted to many other operating systems, such as Android and iOS. Since 2011, the app has been integrated with EHR systems in 16 of Finland's 20 healthcare regions. Gradually, the company expanded its presence into other Nordic healthcare markets, and the Medanets app is currently being implemented in approximately 70 hospitals in Finland, Sweden, and Norway.

In its attempt to penetrate new markets, one strategy that Medanets employed was to establish connections with large EHR developers already operating in these regions, such as DIPS in Norway. This could be demanding and laborious. Medanets and DIPS had held exploratory discussions of collaboration possibilities for a decade. A Medanets executive partner recalls how the company's engagement with DIPS offered the opportunity to showcase its app for Nordland Hospital: 'A Nordland Hospital representative who had worked at DIPS some nine years previously had already engaged in discussions with our CEO. This connection allowed us to introduce our solution to Nordland Hospital, essentially through the mediation of DIPS.'

In 2019, Medanets successfully presented its app to potential users at Nordland Hospital. The hospital was keen on purchasing it, but both the users and the regional ICT organization demanded that Medanets collaborate closely with DIPS to ensure that the app and the DIPS EHR system worked seamlessly together in terms of integration, user authentication, and role-based access to information. This was particularly important since DIPS was at the time developing a new version of its EHR system, DIPS Arena, based on the openEHR architecture, which would provide increased flexibility in defining EHR content.

From previous implementations in Finland and Sweden, Medanets had proved that it could use various standards for exchanging structured data with EHR systems. However, this was impossible in this case because the existing DIPS EHR system, DIPS Classic, could not receive structured data elements from a mobile app. Moreover, the development of DIPS Arena, which would be able to handle such integrations, was prolonged. A Medanets developer stated that it would have taken several years to achieve integration if Medanets were to comply with the DIPS Arena openEHR standard, which could easily have hampered the project: 'The discussion was always about letting us integrate with DIPS Arena when the time was right and trying to get users onboard after that.' However, proactive users at Nordland Hospital suggested that data exchange between the Medanets app and DIPS Classic could be based on Portable Document Format (PDF). The app would generate a PDF

document with the calculated NEWS, which would then be exported to DIPS Classic for viewing.

In addition to data exchange, Medanets had to conduct considerable work related to user authentication and the various roles of nurses in different wards. Although it could use some existing interfaces provided by DIPS, most interfaces had to be developed for the specific implementation:

> Usually, when we carry out implementations or deliveries, we provide our product. However, in this case, about half of the integrations were not ready, so it resembled more a development project. We were in effect developing on the fly while simultaneously implementing the solution (Executive partner at Medanets).

According to a Medanets developer, DIPS contributed significantly to the development process and provided ad hoc assistance to the developer team to identify possible combinations. For a document manager responsible for storing the PDFs generated by the app, developing integrations proved to be particularly complex. DIPS successfully addressed this challenge by creating some APIs based on the Fast Healthcare Interoperability Resources standard.

Another discussion concerned the location of the master repository for the mobile app data. Generally, the EHR system would serve as the master repository that integrated third-party systems—for instance, electronic whiteboard applications with overview and status displays—could use to access data. Nordland Hospital had used the DNV Imatis digital whiteboards for several years, but they were limited to showing only patient overviews in the wards. The implementation of Medanets offered the opportunity to display NEWS and patient triaging, which proved more beneficial. However, an obstacle was that the DIPS EHR system did not support structured data, rendering the transfer of NEWS data from DIPS to the whiteboards unfeasible because they were in PDF format. This limitation led Nordland Hospital to engage with DNV Imatis to foster integration between its whiteboards and the Medanets app. As a result, Medanets sent data in PDF format to DIPS for record keeping and structured data to DNV Imatis for real-time visualization on whiteboards. A Medanets developer reflected on the many deviations from a ‘normal’ situation that they had to face:

> The idea is that the data should be in a master data repository for any system that you use […], but this was not the case at Nordland Hospital. We made an exception whereby we created PDFs for DIPS Classic and another exception whereby we fed the DNV Imatis system with the early warning score results to enable it to update the whiteboards in real time.

The entire development and implementation process required substantial coordination. As the DIPS EHR system ran on the regional platform governed by

Northern Norway ICT, changes often necessitated adaptations to the underlying regional infrastructure. In this regard, Medanets stated that it had very little interaction with Northern Norway ICT, as this was mostly handled by proactive users at Nordland Hospital: 'The hospital personnel were highly motivated. They orchestrated almost all the ICT aspects and served as liaisons between Medanets and Northern Norway ICT as well as DIPS.'

More recently, the discussion has moved toward adapting the Medanets app to the new DIPS Arena EHR system, particularly revolving around how DIPS Arena's openEHR architecture can be used to integrate structured data. This will be beneficial not only for the users but also for Medanets, as it can rely on standardized interfaces. Furthermore, Medanets recently signed a contract with DIPS stipulating that the two developers will collaborate and operate in each other's markets in Norway.

5.2 The DIPS EHR system

DIPS ASA emerged as a company in the late 1980s, originating from a local initiative at Bodø Central Hospital (now Nordland Hospital). Starting with a modest patient administrative system, DIPS was soon able to meet the hospital's basic needs for patient registration, diagnosis, and medication. Gradually, it secured contracts to implement its system in smaller and medium-sized hospitals across Norway. In 1992, it finalized a new EHR system, known as DIPS Classic, which allowed clinicians to document patient care using free text, thereby reducing the reliance on extensive paper-based routines. As DIPS also developed systems for laboratory and radiology uses, it offered its customers a seamlessly integrated package.

However, when expanding into the larger university hospital market in the early 2000s, DIPS faced increased user requirements for specialized functionalities, particularly for radiology and laboratory uses. Consequently, it narrowed its primary focus to EHR and patient administrative applications for larger hospitals and made the strategic decision to modularize its portfolio based on a service-oriented architecture.

In 2012, DIPS signed a contract with the Northern Norway Regional Health Authority to develop the new DIPS Arena EHR system over the period 2012–2016. Later, two more of the four regional health authorities in Norway signed similar contracts with DIPS. At the core of the openEHR architecture, on which DIPS Arena would be based, were so-called archetypes that supported structured data elements and technology-independent interoperability. Consequently, DIPS Arena represented a substantial departure from the largely free text–based DIPS Classic. As part of its new strategy, DIPS declared its openness to collaborating with other developers, such as Medanets, and invited them to integrate their specialized apps with DIPS Arena, which was designed with platform functionality in mind.

DIPS initially met with Medanets in 2012 at the annual DIPS Forum. The dialogue between the two companies became more serious in 2014, by which time Medanets had firmly established itself in both Sweden and Finland. However, it was not until 2019, when users at Nordland Hospital were keen on using the Medanets app, that the talks led to substantial developments. DIPS recognized that Medanets had a mobile app that could replace specific paper-based clinical tasks and was also complementary to DIPS's own portfolio.

Introducing the Medanets app into Nordland Hospital meant that it had to be integrated with the DIPS EHR system. However, a complicating factor was that in 2020, the development of DIPS Arena was still ongoing; therefore, the integration with the DIPS portfolio had to be done through DIPS Classic. As previously mentioned, since DIPS Classic could not handle the structured NEWS data sent by the Medanets app, the data had to be in PDF format, as the users at Nordland Hospital had suggested to ensure the progression of the project. Thus, DIPS found Nordland Hospital to be a proactive customer with clearly articulated requirements:

> Both the users and hospital management were driving forces in the project; they were determined to see it through […]. If all customers in Norway were equally agile, to use this term, we could have achieved much more in a shorter time and at lower costs. (DIPS Project manager)

Moreover, Nordland Hospital clearly stated that it expected DIPS and Medanets to continue their cooperation after the completion of DIPS Arena. The users were seeking a solution that would replace the PDF exchange format with structured data exchange, allowing the NEWS data to be utilized as originally intended. DIPS knew from experience that integrating systems was not just 'plug-and-play':

> Integration is not necessarily easy, no matter how simple it is presented. It requires substantial effort and close collaboration between DIPS and the other ICT developer to fully understand what the needs are and achieve a shared understanding. You must also plan production, take technical precautions, and assure good quality. (DIPS project manager)

Fortunately, DIPS found Medanets to be highly competent in terms of not only the use functionality offered but also the actual integration process:

> We have regular meetings with various developers, but what was special about the meeting with Medanets in November 2019 was that it became clear that they really knew what they were doing, and they demonstrated great flexibility in their approach to system integration. (DIPS department manager)

Another informant emphasized that DIPS and Medanets shared some fundamental values and principles concerning system development, which played a crucial role in fostering good relations between them:

> We should not underestimate the importance of personal relations. It was crucial that we got to know Medanets early and established a good relationship. Integration is not only about technology; it also depends on a common understanding of what the challenge at hand is and what it requires to address it. (DIPS project manager)

Another challenge was related to user authentication and authorization, which concerned not only DIPS and Medanets but also Northern Norway ICT. Northern Norway ICT controlled the regional platform on which the DIPS software ran and was responsible for installing and configuring the DIPS EHR system in the region. As an informant from DIPS noted, 'Nothing happens without them being involved.' Another informant emphasized, 'I would never have implemented something new in Medanets without having consulted with Northern Norway ICT.' Accordingly, DIPS had to clarify things with Northern Norway ICT to ensure that the project conformed to regional policy and was compatible with the regional platform. This particularly concerned policies on login procedures and integration. Users should be able to log in through a single interface and still have access to the same information across several applications. Therefore, logging into Medanets should provide the user with access to the same data as those stored in DIPS. To achieve this, DIPS and Medanets had to collaborate on an integrated authentication process. However, such a process hinged on the support of Northern Norway ICT and its ability to provide a regional identity management (IdM) solution (a combination of policies and technologies that ensures that users have the proper access to technology resources and patient information), which it lacked. Consequently, they had to produce an ad hoc solution for the project while simultaneously accelerating the establishment of IdM for the future.

With this prerequisite addressed, DIPS and Medanets embarked on the integration task together. DIPS facilitated the process by offering multiple APIs, selecting the relevant ones, and establishing a development and test environment tailored to Medanets. Despite the availability of APIs, however, the preparatory work for integrating the Medanets app into the DIPS system was far from simple, as it involved intricate customization and coordination. This complexity was summarized by an informant as follows:

> Even if you have established a number of standards here and there, it is not plug-and-play. Often, you must adjust the standard to suit specific requirements, which involves a lot of manual work and is time consuming. The Medanets project is a good example of this. (DIPS department manager)

5.3 The regional ICT platform

Prior to the hospital reform of 2002, each hospital in Norway had its own internal ICT portfolio and ICT department. Consequently, hospitals' technical infrastructures varied widely. The hospital reform introduced major changes. The government assumed control of hospitals through four regional health authorities and, among many other changes, initiated a process of standardization and regionalization of ICT applications and services in each health region.

By 2006, the Northern Norway Regional Health Authority had replaced four local ICT departments with one regional ICT organization, Northern Norway ICT. Soon after its formation, Northern Norway ICT started to develop a common ICT platform for the region's clinical applications. Built on a cloud infrastructure, the platform facilitated the operation and integration of all clinical applications in the region. The modernization of the infrastructure meant that Northern Norway ICT now had a solid platform on which it could build new services and solutions for the health trusts in the region.

In 2011, Northern Norway ICT collaborated closely with its technology suppliers to implement common clinical ICT systems for all 11 hospitals in the region. This included the DIPS EHR system and laboratory, radiology, pathology, and medication management systems. By 2013, nine local EHR systems had been replaced with one common EHR platform (DIPS). The transition toward shared systems required the standardization of patient pathways and work practices across hospitals to ensure the appropriate level of patient treatment quality and safety throughout the region. Between 2012 and 2013, more than 500 system users across the regional hospitals participated in this effort. Since then, Northern Norway ICT, its platform, and its ICT portfolio have evolved significantly to improve quality and integration between ICT systems. Applications have largely been migrated to centralized data centers, and patient information resides in shared databases. Northern Norway ICT currently has 350 employees, manages around 1,500 applications, and serves 18,000 users in the region.

Unsurprisingly, Northern Norway ICT would not approve the procurement of Medanets until it became compatible with the existing infrastructure and conformed to its regional policies. To obtain approval, user representatives from Nordland Hospital approached Northern Norway ICT in 2019. While being sympathetic to the requests of this highly motivated user base, Northern Norway ICT set two requirements to approve the project. First, an IdM framework should be part of the setup. Second, the app had to be seamlessly integrated with the EHR system. A Northern Norway ICT manager summarized the core points as follows: 'You do not make use of lightweight solutions if they are not integrated and if you do not have access control.' This was a greater endeavor than one could be led to believe, not least for Northern Norway ICT itself. Although it had initiated this work some years previously, Northern Norway ICT had not completed either a regional IdM solution or a technological framework for integrating apps. An

integration developer described the current state of regional infrastructure as follows: 'It is a large spiderweb of files and boxes that make the system work, and every app implementation demands a new complex setup.' Furthermore, referring to the current state of affairs, the ICT manager at Northern Norway ICT explained what they needed to do:

> We have no strategy for mobile apps. […] We need a strategy for where the data should go and how they should be integrated and specific technical requirements for all apps. This includes ensuring that each app has a login identifier [that grants access] to the integrated systems.

Nevertheless, Northern Norway ICT recognized the potential of utilizing the Medanets project as a pilot for developing a broader technological framework and policies for both IdM and app integration. Thus, in 2020, it approved the acquisition of the Medanets app and signed a contract with Medanets. A Northern Norway ICT manager became the leader of the steering group of the project, called 'Mobile Platform.' Medanets thus became the first app to be implemented as part of Northern Norway ICT's broader strategy for mobile apps.

Northern Norway ICT initiated a process of creating the necessary integrations, firewalls, and infrastructure. While some of the existing technical configurations and protocols could be adapted and reused, a substantial part was newly developed. The speed of the implementation process exceeded Northern Norway ICT's capacity to adapt the infrastructure, resulting in several ad hoc solutions in the initial phase. Usually, Northern Norway ICT ensures that data traffic between applications passes through its regional integration service. However, the rapid pace of the Medanets project meant that it did not have time to establish the required integration setup as planned. Instead, data traffic between Medanets and DIPS had to be routed through an internal integration function within the DIPS EHR system—a solution regarded as undesirable, as it deviated from Northern Norway ICT's standard operating procedure. The project team believed that developing a regional 'app store' would not be feasible unless the existing integration service was completely overhauled. A Northern Norway ICT integration developer summarized the situation as follows: 'We are not fully equipped for all these apps and solutions that are coming.' Thus, the implementation process unfolded with a blend of strategic planning and spontaneous decision-making. The initial period was characterized by a reliance on ad hoc solutions—notably, utilizing DIPS for traffic management—to accommodate the rapid deployment of Medanets until a more sustainable infrastructure was developed. This phase exemplified not only how Northern Norway ICT improvised to produce a solution but also how it allocated substantial resources and collaborative efforts to handle the complexities of the integration process. The ICT manager at Northern Norway

ICT summarized the experience as follows: 'To put it mildly, it has been a lot of work for us and for the suppliers to make this happen. The amount of resources invested at the time by both the suppliers and us was significant.' In this case, Northern Norway ICT deviated substantially from its regular policy of implementing new software. Typically, it adhered to a rather rigid bureaucratic process and structured plans, following set time windows for updates and adjustments and running thorough tests to ensure that everything worked before new technology was put into use.

6 Discussion

6.1 The convergence of digital trajectories

A fundamental principle of an information infrastructure is that it is never built from scratch but grows through the evolution of the installed base (Aanestad et al. 2017). Therefore, the installed base reflects a digital trajectory with a past, a present, and a possible future (Strauss et al. 1985). In our case, there were three distinct ICT portfolios—the Medanets app, the DIPS EHR system, and the regional ICT platform—each of which had its own trajectory. Since they were shaped by their respective histories, current capabilities, and future ambitions, these trajectories did not readily align in a simple 'plug-and-play' manner. Due to their complexity, their management by stakeholders could perhaps be better described as a shaping process (Strauss et al. 1985; p. 20). Over time, the three trajectories gradually moved in the direction of convergence although they were at different stages, evolved at varying speeds, and induced different levels of inertia in their environments.

The Medanets app was a larger system with a broad scope before it was transformed into an app for narrower and well-defined use scenarios. Because of this transformation, the developer's market strategy was to seek collaboration with established industrial partners across Scandinavia (such as DIPS ASA) to secure a platform on which the Medanets app could run.

Due to its own long-term market strategy of becoming a platform provider for third-party apps, DIPS ASA recognized the potential of collaborating with Medanets. In this regard, it certainly helped that Medanets had a complementary solution to the DIPS EHR system, which could be beneficial for both companies' market strategies. Their later agreement to operate in the same markets throughout Scandinavia clearly illustrates this point. On the other hand, DIPS hesitated to incorporate the Medanets app into its portfolio at this stage. It preferred to postpone the integration until the new DIPS Arena system was operational, which would enable the use of the openEHR architecture in the integration process. Moreover, the development of DIPS Arena was already several

years behind schedule, and the company was reluctant to commit resources to yet another project.

Finally, the trajectory of the Northern Norway ICT platform encompassed a process of regional centralization and now exercised considerable influence on related ICT projects in the region in terms of both policy and technology acquisitions. Shaping collaborating systems rather than being shaped by them, its installed base was characterized by substantial inertia. For several years, Northern Norway ICT had aspired to establish a policy for integrating apps and for authentication and access control. Inspired by the Medanets app, and in clear contrast to its usual formal policies, it now recognized the potential to realize this strategic goal.

As illustrated in Table 2, the three initially incompatible ICT portfolios have evolved in a manner that now supports their convergence, as they have become more complementary. In this sense, it is possible to see the emerging contours of a platform infrastructure (DIPS EHR system) running various apps (such as Medanets). In turn, the favorable conditions for convergence have bolstered collaboration between the three stakeholders, as convergence aligns with the strategic interests of all parties. However, we do not regard the convergence of these trajectories as the ultimate realization of genuine app and platform functionality. Rather, we consider it a stepping stone and a small part of the transformation of the broader information infrastructure.

6.2 Infrastructure time vs. project time

Karasti et al. (2010) described how information infrastructures evolve on different timescales: *infrastructure time* and *project time*. Infrastructure time represents the long-term open-ended evolving information infrastructure, while project time refers to delimited projects with specific goals. Tension arises between the two timescales when long-term ambitions conflict with short-term goals (Karasti and Blomberg 2017). This was observed in our study: the three stakeholders' long-term ambitions conflicted with the users' demand for an immediate solution.

In the long term, DIPS ASA envisioned offering platform services through the new DIPS Arena EHR system and its openEHR architecture. Similarly, Northern Norway ICT wanted a robust infrastructural platform. However, since the necessary groundwork was not yet complete, these stakeholders were reluctant to embark on an immediate integration process, which they knew would be 'messy.' Adding to the problem, the existing version of the EHR system (DIPS Classic) was incapable of receiving structured NEWS data from Medanets.

In contrast to these two stakeholders' long-term perspectives, the managers and users at Nordland Hospital had a short-term perspective. They argued that, despite the inability to have structured NEWS data in the DIPS EHR system, the Medanets app would be an immediate and substantial improvement over

Table 2 Trajectories of the three ICT portfolios at play: past, present, and possible future.

Portfolio	Past	Present	Future
Medanets app	Application for clinical workflows related to medical equipment	Lightweight mobile app for registering and calculating the NEWS at the bedside	App bundled with various EHR systems; expansionist market strategy in partnership with EHR system developers
DIPS EHR system	Small-scale suite system tailored to the needs of smaller hospitals	More modular EHR portfolio adapted to the requirements of larger hospitals	DIPS Arena platform based on the openEHR architecture, to which third-party apps can be easily added
Northern Norway ICT platform	Diverse local ICT portfolios at hospitals in the Northern Norway Health Region	Centralized platform in the Northern Norway Health Region	Streamlined platform services related to integration, authentication, and access control

the existing paper-based routines and was therefore worth implementing rather than waiting for the 'perfect' solution sometime in the future. The stakeholders were persuaded to launch the project, which required managing many fine details and improvising various solutions (Orlikowski and Hofman 1997)—for example, sending NEWS data to the DIPS EHR system in PDF format. Moreover, against prevalent policy, Medanets had to serve as a master repository for the DNV Imatis whiteboard application and send structured NEWS data to it. Finally, Northern Norway ICT showed considerable flexibility in engaging in the integration process outside a broader technological framework for app integration. Overall, the integration of Medanets into the DIPS Classic EHR system involved a continuous process of aligning, adapting, and reconfiguring both the existing systems and the new one. Through the above-mentioned improvisations, the project borrowed several design strategies from the information infrastructure literature. This included focusing on immediate usefulness, ensuring support for many users, utilizing the existing installed base, and connecting previously separate infrastructures (Aanestad et al. 2017; Hanseth and Lyytinen 2010; Star and Ruhleder 1996). The stakeholders managed to complete the project rapidly and successfully.

An essential point is that the two temporal dimensions, infrastructure time and project time, interacted successfully rather than acting as opposite extremes (Karasti et al. 2010). As previously mentioned, the three stakeholders viewed their involvement and improvised activities in the Medanets project as an investment in their long-term strategic goals. Integrating the Medanets app into the DIPS EHR system aligned with how they wanted to present themselves to healthcare organizations and policymakers—namely, as app developers and platform providers.

The inherent tension between infrastructure time and project time is always present in one form or another, and stakeholders must engage in (more or less) improvised activities to integrate various systems within the scope of a project. As our findings show, implementing the Medanets app demanded serious commitment from the stakeholders: aligned competence, mutual trust, and a willingness to engage in informal collaborative activities. Accordingly, the information systems literature's notion of a stable platform characterized by the ability to effortlessly add or remove numerous third-party apps is more an ideal than a reality. The platform concept should rather be upheld as a long-term vision—that is, as part of infrastructure time—but it should simultaneously be maintained and pushed forward through the active engagement of stakeholders during project time.

6.3 The distributed character of control

According to Hanseth and Lyytinen (2010, p. 4), an information infrastructure is 'recursively composed of other infrastructures, platforms, application and ICT

capabilities.' An information infrastructure is not a standalone system. Rather, it is constructed in a hierarchical or interconnected manner and consists of various components and layers that work together. The three portfolios in our case can be seen in this way: they were different yet interdependent.

The fact that each of the three stakeholders had its own portfolio highlights the fact that control over an information infrastructure is distributed among several actors. This distributed character of control enabled yet another stakeholder group to enter the process. Managers and users at Nordland Hospital had established close cooperation between clinical and technical professionals in relation to new technological solutions. Initially, the users at Nordland Hospital explicitly stated their desire to implement the Medanets solution in clinical work. Subsequently, user representatives undertook the necessary task of coordinating activities among Medanets, DIPS ASA, Northern Norway ICT, and DNV Imatis to ensure that they would obtain a satisfactory solution at the desired pace. They also negotiated deviations from the preferred use of a master data repository, facilitating discussions between Medanets and the whiteboard vendor DNV Imatis to ensure seamless data visibility both on the whiteboards and in the DIPS EHR system. The distributed character of these negotiations, decisions, and activities shows that an information infrastructure is never changed from the top down (Star and Ruhleder 1996). Instead, it evolves through agreements between the stakeholders involved. Each of the stakeholders in our case possessed a degree of negotiating power that provided it with the means to advance (some of) its interests during the negotiations.

Another factor that contributed to a positive negotiation climate was the trust that had been built over the years. Building trust can be a time-consuming process that involves extensive discussions and the ability to demonstrate competence (Strauss et al. 1985; p. 135). DIPS ASA and Medanets had met at the DIPS Forum as early as 2012, and the collaboration between DIPS ASA and Northern Norway ICT had an even longer history. These stakeholders had come to appreciate each other's competencies, identify common interests, and cultivate a relationship. Thus, they trusted each other to handle complex issues (Strauss et al. 1985; p. 135). A DIPS developer emphasized the importance of trust as follows: 'You must be able to trust the data provided by Medanets because we assume responsibility for these data and use them in our system.'

It is worth contrasting the distributed control approach adopted in this case with the control regime associated with an organization-wide EHR suite system, such as the recent Epic implementation in Nordic countries (Ellingsen et al. 2022; Hertzum et al. 2022). In the latter case, control is concentrated in top management, which governs through formalized decision hierarchies. This centralized control structure is intended to provide top management with the necessary means to run an organization effectively. However, a major consequence of suite systems, such as Epic, is that users, to a great extent, lose the ability to request

specific functionalities for their work (Zahlsen et al. 2022). This is because such single, monolithic systems are incapable of meeting everyone's needs. Furthermore, when organizations decide to replace their existing EHR systems with an integrated suite system, control swiftly shifts to the developer (Brunner et al. 2023). A reason for this is that developers of suite systems have installations all over the world and are reluctant to make changes to their systems unless several customers (in different countries) request the same functionality. Moreover, institutional customers have limited leverage in pressuring developers to make changes, as they may come to a dead end with no alternative solutions.

With its three loosely combined ICT portfolios, our case represents a distinctly different scenario where each portfolio is controlled by a separate stakeholder. This ensures both technical and organizational flexibility in responding to environmental changes (Sanchez and Mahoney 1996).

7 Conclusion

The task of integrating new technologies into existing healthcare infrastructures is known to be a complex undertaking that demands meticulous attention to both immediate operational requirements and long-term strategic objectives. Our findings illustrate how different actors within the healthcare ecosystem approach infrastructure development and integration from distinct temporal perspectives and demonstrate that successful integration entails considering not only current needs but also future goals. The integration of the Medanets app provides an interesting case study of how the trajectories of different actors can converge into a successful information infrastructure. Our analysis reveals the complex relationships and interactions between the stakeholders involved in this process. While healthcare personnel, as users of the app, perceived its integration as an immediate success, the other three actors faced substantial challenges in the preparatory phase. These challenges can be attributed to the stakeholders' differing interests, perspectives, expectations, and goals, as well as the influence of their distinct portfolios. Our case study uncovers the intricacies of the evolution of an information infrastructure, which necessitate a thorough understanding of how digital trajectories converge and how the installed base influences this process either by inducing inertia or offering flexibility.

Our findings have three major implications. First, preparatory work, such as that presented herein, warrants more attention in both research and practice. This kind of work often remains invisible when implementation projects are successful and only comes to light when they fail. However, it is necessary to learn not only from failures but also from successes. Second, the trajectories of the relevant actors evolve at different paces, reflecting the varying dynamics of the environments in which they operate. This temporal dimension adds a layer of

complexity to the integration process, underscoring the need for careful management and synchronization of these differential paces in a way that facilitates successful integration. Third, all stakeholders involved in this project—Medanets, DIPS ASA, Northern Norway ICT, users, and hospital managers—exercised real influence. We believe that creating a climate conducive to such distributed control is crucial for success.

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