Emerging Knowledge Networks in the Architectural Transformation of Digital Infrastructures

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Abstract. For large incumbent organizations undergoing architectural transformation, knowledge is paramount. In the literature, knowledge is often fragmented, focusing either on individual systems or large corporate systems. Additionally, existing research tends to concentrate on how legacy systems can be made competitive or on the technical implications of transformation. In this paper, we adopt an infrastructure perspective to examine the knowledge networks that emerge during such transformations. We pose the question: How do knowledge networks emerge, and how are they organized to facilitate architectural transformation within digital infrastructures? Our study focuses on a prominent Norwegian bank that is currently undergoing an architectural transformation. We contribute by developing a framework for 'domain technical knowledge,' encompassing three types of knowledge that collectively form a cohesive knowledge network. Furthermore, we demonstrate the horizontal and vertical alignment between these different knowledge types, illustrating how knowledge networks emerge.

Keywords: Architectural Transformation, Knowledge networks, Digital Infrastructures.

1 Introduction

In today's rapidly evolving digital landscape, incumbent organizations face increasing pressure to transform their IT Architecture to remain competitive [1]. Architectural transformation is not merely a technological upgrade; it is a complex process that necessitates an integrative understanding of various knowledge domains [2]. As these organizations transition from legacy systems to modern, agile infrastructures, the role of knowledge becomes central [3]. Knowledge is often dispersed across siloed systems, and an understanding of how this knowledge can be effectively integrated is vital for a successful transformation [2].

Research on knowledge in relation to organizations and information systems is extensive. It describes the organization as a knowledge-creating system that must be managed to be used rationally [4], [5], [6]. This also entails an understanding of how the transition from physical to digital phenomena affects knowledge generation [7], [8].

We anchor ourselves in a sociotechnical tradition that views digitalization as a process in which systems and processes must interact [9], [10], [11].

Within this more specific literature, we find that knowledge is addressed in one of two ways: it either focuses on specific system-level interactions [12] or explores broad corporate systems [13] without delving into the nuances of knowledge integration during digital transformation. Furthermore, there is a tendency to emphasize either the technical aspects of transformation [14] or strategies for enhancing the competitiveness of current systems [15]. However, such fragmentation overlooks the essential interdependencies that exist within these knowledge frameworks.

Recognizing this gap, our study proposes a novel infrastructure perspective that seeks to illuminate the dynamics of knowledge networks that emerge during architectural transformation [16]. By framing our investigation around the question, *How do knowledge networks emerge and how are they organized to facilitate architectural transformation within digital infrastructures?* we aim to provide a more holistic understanding of the interplay between different types of knowledge and their roles in the transformational process.

Our research focuses on a prominent Norwegian bank that is currently undergoing a significant architectural transformation. We develop a conceptual framework for what we term "domain technical knowledge," which encompasses three distinct types of knowledge. In addition, we highlight the importance of both horizontal and vertical alignment between these knowledge types, providing insight into how such alignments facilitate the emergence of effective knowledge networks.

2 Knowledge Networks in Architectural Transformation of Digital Infrastructures

The contemporary digital landscape is not only dominated by emerging platform companies exhibiting "born-digital" characteristics, but also by large, complex organizations with extensive historical accumulations of IT portfolios [1]. A growing body of research refers to these organizations and their IT portfolios as digital infrastructures [17], [18]. Digital infrastructures are intricate organizational forms accompanied by corresponding IT portfolios that, to varying degrees, align with the needs of the organization's employees [15]. Within these organizations, knowledge about IT systems is often heterogeneous, opaque, and largely concealed.

In the competition with major platform companies, organizations with complex digital infrastructures face the necessity of replacing their portfolios with new ones [1]. This challenge is more easily stated than accomplished. Notably, the knowledge requirements to undertake such a process are significant [9].

We begin by exploring the conceptualization of knowledge within a digital infrastructure. Following this exploration, we will provide a comprehensive description of how this infrastructure operates as a knowledge network that emerges throughout the architectural transformation process.

2.1 Knowledge in Digital Infrastructures

Digital infrastructures are not merely distributed systems; they also embody complex, heterogeneous systems composed of various technological forms [15], [18]. Consequently, knowledge within and about these systems is characterized by complexity, encompassing insights into diverse technologies such as servers, routers, IT systems, integration interfaces, and databases, as well as an understanding of the dependencies and pragmatic negotiations that occur in these systems during transformation processes [19].

Building on, [16] we assert that knowledge plays a central role in architectural transformation, often acquired through practice. This perspective draws upon the debate initiated by [20] regarding knowledge as something we possess versus knowledge as practice. This dichotomy is challenged by the literature on infrastructure, which adopts a more pragmatic approach, suggesting that there is no clear distinction between knowledge as an action and knowledge as possession [16]. The infrastructure literature highlights the role of knowledge in several ways.

One stream focuses on the distinction between knowledge for cultivation and knowledge as transformation. Cultivation knowledge often targets the user perspective as a crucial prerequisite for a gradual transition from old to new systems. This concept, sometimes referred to as "installed base friendliness," emphasizes consolidation and adaptation [21].

In contrast, another body of literature is more oriented towards transformation, focusing on homogenization and platformization, often accompanied by replacement initiatives [13]. This stream considers large digital infrastructures as comprising two distinct knowledge regimes: one that emphasizes user proximity and innovation (lightweight IT), and another that focuses on system control and stabilization (heavyweight IT) [15], [22].

A third stream frames knowledge as expressed through technological discourse [18], [23]. Technological discourses enable knowledge actors to share their insights in critical forums, thereby facilitating a clearer understanding of the ideas and projects initiated within large organizations and facilitating the sharing and pragmatic negotiation of knowledge within these projects.

While these distinctions illuminate various facets of architectural transformation, knowledge regimes, and discourses, they provide limited insight into how knowledge can be effectively structured and shared across organizational units during the transformation process.

2.2 Knowledge Networks and Architectural Transformation

The literature on infrastructure significantly lacks a systems-oriented perspective on transformation, which would shed light on the various activities where knowledge is utilized and emphasize the corresponding knowledge requirements. This gap prompts an essential question: What specific types of knowledge exist within digital infrastructures, and how are they interrelated?

Drawing inspiration from the works of Giachetti [24] and Evans, [25] we concentrate on knowledge as a tangible and functional output. A foundational premise is that the focus of Giachetti and Evans is directed toward modeling novel constructs.

According to Giachetti, the design of enterprise systems, characterized by large, heterogeneous combinations of organization and technology, constitutes a vital business activity. He emphasizes that effective system modeling requires both domain experts and technical experts working collaboratively, thus identifying the critical knowledge needs inherent in this process.

On the other hand, Evans, a recognized authority in domain-driven design, underscores the importance of delineating a bounded context within which functions operate seamlessly within their context. For instance, knowledge crunching may involve the development of simplified models that still serve as a structural representation of knowledge.

The overarching goal of both Giachetti and Evans is to accurately design complex socio-technical systems, ensuring added value for the organization. This objective indicates a pressing need to strike a balance between system insights and technical insights. We specifically address two key aspects of these types of knowledge: the horizontal aspect, which defines the breadth of knowledge that must be included to meet the identified knowledge needs. The vertical aspect emphasizes the importance of addressing the knowledge needs at multiple levels. By leveraging both perspectives, we can establish a framework that characterizes knowledge about and within such systems at three different levels: the holistic level, the domain level, and the solution level (see Table 1).

Table 1. Domain technical knowledge.

Type	Characteristics	Example
Domain knowledge	Knowledge about a specific domain	A system for unemployment benefits necessitates a thorough understanding of the legal framework and the prerequisites that must be satisfied for the application to be approved.
Technical knowledge	Knowledge about the feasibility of a technical solution in a particular design	Can the system handle 1.2 million transactions in less than 10 minutes?
Domain technical knowledge	The pathway from visualization to the realization of a potential system.	BizDevOps, where knowledge of business, design, and technology converges

We frame this broad and multilayered knowledge framework as a knowledge network. Knowledge networks are constellations where diverse actors from a vast digital infrastructure come together to engage in domain-specific design and development. This approach aligns with the goals of infrastructure theory, which seeks to understand the transformation of heterogeneous knowledge systems. Architectural transformation serves as a prime example of this endeavor. We proceed with our case study and methodology, followed by an illustration of how our framework can effectively manage empirical data.

3 Case and method

3.1 Case: BankCorp

BankCorp is a major Northern European bank with over 12,000 employees, including more than 2,000 IT specialists. Its architecture has been developed over a long period, and any transformation of this architecture must take into account the various layers and the challenges they present.

The foundation of this technology began with IDA, or Integrated Data Processing, which provided a way for banks to exchange data regarding settlements and other business activities. At the core of this technology were systems designed for various mathematical calculations, often constructed in COBOL and deployed on mainframe servers. Knowledge of mainframe systems has been a crucial prerequisite for the ongoing development of these systems, which have been continuously updated to meet new demands.

From the 1990s to the 2010s, online banking, digital payments, and later mobile banking were introduced. These requirements necessitated significant architectural upgrades, including the integration of an e-platform built on the foundational IDA structure. While this solution addressed the temporal challenges, it has also created long-term complexity. Additionally, mergers and acquisitions introduce new solutions that must be onboarded and integrated, or sometimes discarded, further complicating the architectural landscape. This underscores the importance of understanding the different layers of the architecture and how they are integrated as central knowledge in the context of architectural transformation. Table 2 illustrates the various layers, the status of knowledge at each level, and the challenges they face.

Table 2. Architectural layers.

Layers	Access to knowledge	Challenge
IDA – legacy systems	Fading	Lack of flexibility, transactional efficiency, and knowledge.
Online Platform	Exists	Layered with legacy systems in the backend
Modular architecture	Strong	Transformation to replace old systems with new modular systems

Over time, the architecture gradually accumulated into layers of compensatory measures. Each new layer addresses the limitations of earlier solutions that could not easily be adapted to meet modern requirements. These compensatory layers now encapsulate the core legacy mainframe systems originating from IDA. This introduced numerous dependencies, leading to redundancy and blurring the responsibilities of the various systems. Together, the legacy systems and the API layers form the backbone for multiple value chains.

Adopting a gradual approach to transformation means establishing a process to determine what to modernize first, as it is not feasible to modernize everything at once. The process of modularization begins with identifying system domains. Informants have linked this decision-making process to the game of 'Mikado', where the objective is to remove a single stick without disrupting the others.

The Mikado principle suggests that architectural transformation cannot occur as a sudden, drastic change; it must be implemented gradually. At BankCorp, three system domains have been selected: corporate lending, customer relationships, and payments. While business needs drive corporate lending (CL), customer (CIS) is driven by both business and technology, and technology needs drive payment. In the case of CL and payment technology is primarily bought, while the CIS is developed by BankCorp.

Thus, the knowledge system dealing with architectural transformation needs to know both the condition of the existing multilayered architecture and the technology that exists on the market that must be implemented and stitched into the existing architecture.

3.2 Data collection and data analysis

To investigate complex real-life phenomena, we performed a qualitative case study. The results are based on information gained from interviews, conversations, and documents between 2023 and 2025 [26]. A case study encourages a detailed analysis of a phenomenon in a particular real-life context, and may draw on multiple data collection sources [26]. We had 15 interviews and informal conversations with experts on the subject matter, including IT architects, developers, and managers from different departments in BankCorp. BankCorps contact person referred the experts, and then a snowball sampling technique was used as we engaged with the informants [27]. The design was a combination of unstructured and structured interviews. While unstructured interviews allow participants to steer the conversation, semi-structured interviews are a more guided approach [28]. The project was registered at SIKT, and all the participants were informed about the purpose of the data collection and that they could withdraw at any time. Some of the interviews were conducted in person, while others were conducted via Microsoft Teams. The interviews were recorded and transcribed through a UIO platform based on whisper technology.

In the data analysis we first focused on understanding the case and the challenges faced by BankCorp in executing an architectural transformation, as well as identifying the knowledge requirements necessary for such a process. Then we employed a threestep approach inspired by [29] (see figure below). We coded the data and discovered the various forms of knowledge that were essential for the transformation [24], [25]. Through several iterations, we aimed to refine our understanding of the knowledge approach, realizing that the different teams and their respective families formed clustered modular structures.

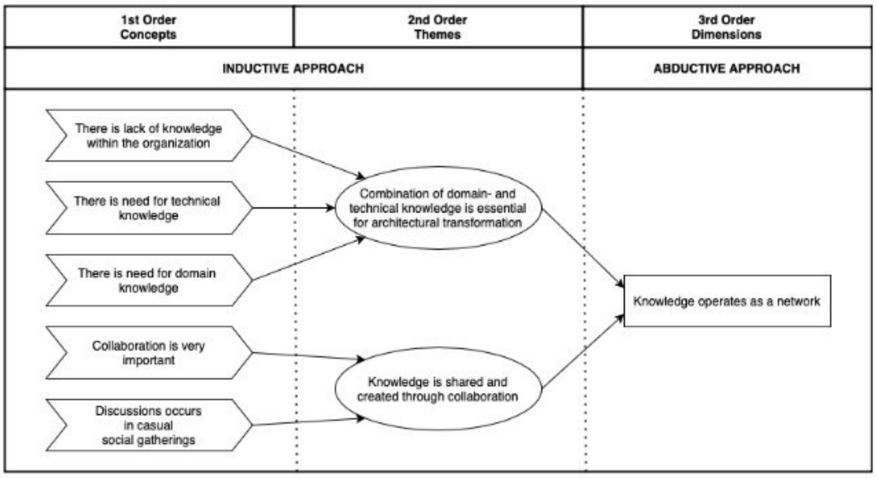

Fig. 1. An example of the coding process.

These structures not only reinforced internal cohesion within teams but also facilitated communication across teams. In the third step, we conceptualized this phenomenon as a knowledge network [16], concluding that knowledge networks are crucial collaborative forms in the architectural transformation of large digital infrastructures.

4 Findings

Knowledge networks are heterogeneous networks that integrate knowledge at three levels. This leads to the emergence of a knowledge system, a network of interconnected knowledge elements. We will utilize the framework introduced in Section 2.2 to describe the implications of this at BankCorp.

4.1 Domain Technical Knowledge

During our data collection, informants often emphasized that one of the most challenging parts of the transformation was finding individuals possessing the right knowledge. We asked them to clarify what this knowledge entailed.

"[The knowledge] around the core systems is not about knowing COBOL or DB2 or mainframe. It's about understanding the processes that are implemented there. Why things are put together, and a business understanding of it." (Head of Division, 2024).

Rather, BankCorp needs individuals who understand business processes and the context behind the creation of systems, which we refer to as domain knowledge. However, BankCorp also needs individuals who can grasp how these business processes are technically implemented and integrated. We refer to this as technical knowledge. We frame this synergy of knowledge as 'domain technical knowledge'. The informants have implicitly described that domain technical knowledge emerges through collaboration.

"[...] in a transformation initiative, you have to have a team of people who have domain knowledge, who have technical expertise, who know how to put this together. We must have really good communication lines, involving all stakeholders. [...]. If you don't manage that, the transformation will die right away." (Enterprise Architect, 2023).

Since domain technical knowledge is about interaction and collaboration, and results in a sort of synergy between various teams, it is collective. Domain technical knowledge is, however, also about individual skills. This distinction is well articulated by the Business Direction Lead.

"Someone needs to have an overarching perspective and work with enterprise architecture, looking at the [domains] we have and how these should interact. Our impression is that this is the role of the architects [...], but then again, architecture exists on many different levels. [...]. However, those working within the various domains should primarily be experts in their own [domain]. But they also need to know [...] what the standard way of doing things at BankCorp is [...] (Business Direction Lead, 2024).

As a result, transformation efforts rely on collaboration between individuals who see different parts of the bigger picture. Those with broader system oversight must work closely with those with more detailed knowledge within a single domain, ensuring that strategic decisions remain grounded in the practical realities of system implementation. This kind of cross-level collaboration plays an essential role in keeping transformation efforts aligned.

"The first challenge is to have enough domain [...] technical knowledge to be able to make the right choices." (Head of Architecture, 2024).

An Enterprise Architect described a prime example of informed decision-making. While it is impossible to predict the future with complete accuracy, a roadmap grounded in domain technical knowledge can remain relevant for years. The one he developed in 2018 had remained close to 95 percent intact, underscoring how thoughtful planning, informed by domain technical knowledge, enables organizations to adapt without losing strategic direction. We understand that domain technical knowledge is found individually, but most often emerges through collaboration.

Acquiring domain technical knowledge. Acquiring domain technical knowledge is not straightforward. This is because knowledge is scattered across the organization and shares similarities with tacit knowledge; knowledge that is hard to communicate and transfer.

"It quickly took more than six months to a year for product owners to become comfortable before [...] they could manage on their own. It depends on the person, [...], [especially] in an organization like BankCorp, where perhaps part of it is [...] getting to know the organization and the system landscape. (Business Direction Lead, 2024).

In large-scale organizations like BankCorp, the system landscape is vast and often complex, and detailed documentation is rarely sufficient to provide the depth of understanding needed. Although domain technical knowledge is embedded within the systems themselves, it often lacks the necessary contextual elements behind its creation and implementation. This includes understanding the system's original purpose, how it has evolved, which other systems it depends on, the dependence on other systems, and how the system supports specific business processes. As the Head of Architecture described, many of these systems resemble a 'big ball of mud'. Tracing a single problem doesn't lead to a clear endpoint, but rather to a tangled web of interdependent components, making it extremely difficult to uncover how things are connected and why they were designed that way. Relying on the experience of others makes social interaction a key channel for acquiring domain technical knowledge. Business Direction Lead (2024) emphasizes that it is especially important for newcomers to be curious, ask questions, and engage in dialogue with those who work with the systems daily. Even long-standing employees rely on these social networks when trying to understand new areas of the system landscape. This reinforces two earlier points: it is unrealistic for a single individual to possess comprehensive knowledge of all systems and business processes, simultaneously possessing deep knowledge of the broader digital infrastructure, and that domain technical knowledge typically emerges through collaboration.

Maintaining domain technical knowledge. Domain technical knowledge must also be maintained. When modernizing architecture, a key consideration is designing for longevity. One thing to consider is that major changes in digital infrastructures are uncommon. Small changes reduce the need for domain technical knowledge. The fact that employees retire or move to other jobs also contributes to the loss of domain technical knowledge.

"[...] these systems [...] change very rarely, [...] so you can go ten years with them [before having to do major changes]. And then you also get another challenge, because those who know something about the products and processes [...], they are not necessarily here anymore. (Head of Division, 2024).

Another factor contributing to the loss of domain technical knowledge relates to system maintenance. The Head of Architecture notes that legacy systems, designed 40–60 years ago, were initially well-structured. However, as the business evolved, these systems were continually modified to meet new demands. BankCorp initially addressed these changes by implementing compensatory measures atop the legacy systems, which gradually eroded the original architecture and purpose, resulting in significant complexity. Furthermore, many of these compensatory solutions were added without requiring a deep understanding of the underlying legacy systems. Consequently, BankCorp now faces a considerable lack of domain technical knowledge regarding its legacy systems. This accumulated complexity has made comprehending these systems increasingly difficult.

"We see this a lot in the [ongoing] project [...]. [It is] incredibly difficult to get hold of key resources and get architects who understand the value chain well enough." (Quality Assurance Lead, 2024).

To facilitate domain technical knowledge, BankCorp has adopted an organizational structure known as ’families’. These families consist of multidisciplinary teams designed to facilitate collaboration across business and technology functions. This structural shift ensures that teams are not only integrated organizationally but also colocated physically, fostering the exchange of knowledge. A key aspect of this model is the close working relationship between the technology and business. BankCorp actively avoids referring to them as separate ’sides’, as this reinforces a divide between perspectives. Instead, teams are intentionally structured to include representatives from both ’sides’.

"[...] the challenge [with the traditional project methodology] is that [...] within a project you have [a certain] time horizon. The architects who are involved in that project jump to a new project [...] before [the previous project] is finished. [...]. And then maybe some of the key people disappear [...]. Whereas when the same team both builds and lives with a solution, it is much easier to get everyone to understand that this is something that we have to [...] be able to live with for a long time." (Business Direction Lead, 2024).

Organizationally, ’families’ are directly aligned with specific system domains. This structure ensures that specialized knowledge is available to address the unique challenges and requirements of each domain. Unlike conventional projects that disband after completion, these teams remain engaged with their part of the system over time. As the Business Direction Lead (Interview, 2024) described it, the families are going to ’live’ with these systems.

4.2 Domain technical knowledge types

Domain technical knowledge operates at multiple levels. Some architects possess specialized knowledge of a specific system domain, while others have a more abstract understanding that spans multiple domains. In this section, we offer a detailed breakdown of three types of domain technical knowledge identified in our analysis: the solution type, the domain type, and the holistic type.

The solution type. The solution type of domain technical knowledge demands deep, focused knowledge, less abstract, and focuses mainly on one sub-domain. This knowledge type is the foundation for designing solutions, addressing challenges, and innovating in low-level design.

"Within my team, we have people who are part of dedicated value streams. So, their main focus is to look into the end-to-end value chain for specific streams." (Lead Solution Architect, 2024)

Domain technical knowledge can vary across different solutions within a system domain. This would mean that a single domain may encompass several value chains. For instance, during the transformation of the corporate lending domain, a debate arose over whether to purchase an off-the-shelf platform or develop one in-house. In-house development would have necessitated a dedicated sub-domain platform team equipped with the essential technical expertise specific to the solution domain.

The challenges and innovations unique to the sub-domain are best addressed by the people who have the specialized domain technical knowledge in the specific area. Still, the challenges must be addressed in the context of the whole system domain, and cannot be given full autonomy.

The domain type. This domain type represents an abstract understanding of a system domain, encompassing a broad awareness of the sub-domains within a larger framework. It addresses both technical and business aspects without delving into the intricate details of each sub-domain. The primary aim of this domain type is to ensure alignment among the sub-domains while enabling a high-level design of the entire domain as a cohesive entity.

"I do not interact with coders daily. My work is to ensure we achieve end-to-end value addition and figure out how the solution or application is going to work. We work as a bridge between the business and the IT Technical team." (Lead Architect, 2024).

The Lead Architect emphasizes that end-to-end value addition between the subdomains does not require frequent interaction with coders (solution-type of knowledge). Another example of domain-type knowledge is identifying potential integrations with other system domains. The Lead Architect (Interview, 2024) says that he often ends up "stitching up all the different lanes" of business and infrastructure together. The quote below provides an example of how individuals with domain-type knowledge collaborate at the domain level, sharing their perspective of knowledge from their respective roles. Together, they create the synergy of domain technical knowledge.

"We have a lead architect in Payments [...]. He looks at the portfolio or setup from a technical standpoint. He has a steady control over how this is put together, what technology is used [...],

and how it interacts. He also has a very important role in the [...] transformation project, because he is the one who [...] says [...] how this [...] should be done functionally. [...]. He must consider IT strategy and [...] have a very good overview of our existing applications, which must be managed at the same time while we modernize [...]. We work [...] organizationally in the same section, [...], but my role is more to think about the [...] big building blocks, the long lines of what affects us. [...] [I] know more about how, for example, a domestic payment in Scandinavia must be implemented, [...], so I can then set some premises on how this must work. And then [lead architect in Payments] must [...] draw it more down towards an actual delivery apparatus, that is, developers, suppliers, who will put this together." (Enterprise Architect, 2025).

While the Lead Architect and Enterprise Architect have different roles and responsibilities, they share responsibility for the Payment system domain. The Business Direction Lead (2024) emphasized that a key responsibility is shaping the long-term roadmap for the system domain. This involves ensuring alignment with organizational goals and defining responsibilities in collaboration with other domains. The primary focus of this type of domain technical knowledge is to align sub-domains, optimize business processes, and ensure integration with other system domains, all while maintaining a strategic direction. The emphasis is on big-picture thinking rather than intricate technical details.

The holistic type. The *holistic type* of domain technical knowledge includes having a comprehensive overview of all the system domains, understanding how the domains are interlinked and how the whole digital infrastructure is bundled with the business of the organization. Enterprise Architect (2025) emphasized that individuals should have a top-down enterprise mindset.

"There are many layers — not everyone needs to understand everything, but some people should have a superficial understanding of everything." (Head of Core Modernization Incubator, 2024).

Individuals with holistic domain technical knowledge must grasp both business and functional aspects, though their understanding of functionality need not be as detailed as that of other domain experts. This type of knowledge is crucial for transformation, as these individuals oversee the entire roadmap, not just for one domain, but for the entire transformation process. Head of Architecture (2024) explains that when a transformation initiative is launched, the organization first relies on a core group of individuals who possess key competencies and can maintain a broad, overarching perspective. This group, called "Core Modernization Incubator", has a high-level understanding of what needs to be modernized and how it relates to the organization's overall efforts. Head of Core Modernization Incubator (2024) explains the process of modularizing the legacy systems and what factors are important to consider before initiating the transformation.

"[...] the first thing [we do is to] look at what we have, [...] what is on the mainframe and what is on the core systems. And then when split it up, and think about the implementation sequence."

"[...] you have different actors in a network that you have to align, which is a pretty fruitful way to think about [the initiation of a transformation initiative]. [...] it doesn't make sense if you haven't aligned [the actors] that are important here, [because the consequence is that they can] represent resistance to such a change. [To avoid this] you have to align your actor network, ensure that there is enough common understanding of both what the problem is and what the solution is so that you can drive it forward." (Head of Core Modernization Incubator, 2024).

Head of Core Modernization Incubator emphasizes that aligning the actor network requires ongoing effort for those with the holistic type of domain technical knowledge. Since multiple domains must be modernized, the process of initiating transformation is repetitive. They must continuously re-evaluate the initiatives during the transformation and ensure that all actors agree on the problem and the proposed solution. This is to ensure that the road map for the complete transformation stays on the right track, to avoid resistance.

4.3 Aligning Domain Technical Knowledge Types

We have introduced domain technical knowledge, and its three key types required to support informed decision-making during transformation. Domain technical knowledge emerges as a synergy between individuals' domain and technical knowledge. It is not typically held by a single person, but rather formed through collaboration. Its acquisition and maintenance occur over time, through networks of people, legacy systems, and accumulated experience. We refer to this as a horizontal knowledge network. 'Horizontal alignment' then consists of the interactions between individuals with domain and technical knowledge, and the systems they have knowledge of. These interactions are essential for sharing and sustaining domain technical knowledge within the network, ultimately supporting transformation.

"[...] you're a bit everywhere [...] if you're going to be an enterprise architect, [...] that's my philosophy. So, you have to know the domains, and the best way to know the domains is that you're involved in the highest priority projects, so we as an enterprise architect group have to be involved in the most important projects." (Enterprise Architect, 2025).

As the quote above suggests, horizontal alignment alone is not sufficient. There is also a need for vertical alignment, which is understood as the way high-level design considers the various technical challenges encountered when transforming multiple architectural layers. BankCorp's organizational model is key to this alignment. Enterprise Architect (2025) explains this using his analogy in the quote below. Part of the alignment is that teams at the solution level work autonomously, but they must adhere to the system domain and infrastructure design and standards.

"We have an organizational model now that promotes agile, autonomous teams. That word, autonomous, should never have been launched in an organization like ours, because you are not autonomous. Because it [...] is practiced as if you live in a small cabin, in the middle of a field, where you have your water supply, your electricity, and you are self-sufficient. It is autonomous. But it is not [like that in] BankCorp. In BankCorp, you can compare it [...] to having an apartment. Yes, you can do whatever you want within the apartment, but you have to deal with the surrounding infrastructure, pipe systems, windows, facade, everything." (Enterprise Architect, 2025).

In summary, there is a need for both horizontal and vertical alignment between the three types of domain technical knowledge in transformation. Horizontal alignment involves collaboration among individuals at the same level, while vertical alignment ensures coordination across different types of domain technical knowledge. BankCorp's organizational model supports this by promoting autonomous teams that still operate within shared architectural standards. Aligning the knowledge both horizontally and vertically constitutes a knowledge network that facilitates the creation of the necessary domain technical knowledge to facilitate transformation.

5 Discussion

Understanding knowledge within highly complex systems poses a significant challenge, particularly in the context of critical infrastructure, where the intricacies of these systems amplify the urgency of effective management [1], [10]. To discuss these complexities, we revisit our research question: *How do knowledge networks emerge, and how are they organized to facilitate architectural transformations in digital infrastructures?* The discussion is organized into two main sections: first, we define what constitutes a knowledge network; second, we investigate how these networks are structured to execute significant transformations.

5.1 Emergence of Knowledge Networks

A knowledge network can be defined as a collection of various types of knowledge collaborating on architectural transformation. This view is based on a combination of insights from software development, engineering (as posited by Evans and Giachetti), as well as an understanding of technologies and communication forms in large digital infrastructures [11], [17]. Domain-specific technical knowledge is crucial for managing large-scale transformations.

Knowledge networks emerge in response to specific knowledge needs [24], [25]. They encompass both processes and structures, representing a depth of collaboration that goes beyond surface-level interactions; they are built on what we refer to as domain-technical knowledge, which enables synergies between domain insights and technical expertise. It is important to note that the domain focus is often directed toward building from scratch [25]. An infrastructure perspective helps frame the transformation of existing systems into something new, highlighting the necessity of understanding not only the new but also the existing systems and how they operate [16].

5.2 Knowledge Networks and Architectural Transformation

Knowledge networks play a critical role in transformation processes, providing a stable foundation during times of continuous change. These networks combine knowledge of technology and processes, contributing to the maintenance of a healthy team culture throughout the transformation.

Transformation is an ongoing process, requiring both horizontal and vertical alignment. Horizontal alignment involves breadth within teams, enabling knowledge sharing across bounded contexts. Vertical alignment encompasses knowledge across different levels within the organization. This dual alignment signifies that knowledge networks are effective in addressing the complex challenges that accompany transformation.

Moreover, knowledge networks are crucial in protecting income streams during transformational changes and managing potential knowledge loss [30]. They offer a perspective that helps demystify complexity. In this context, domain knowledge functions as an integrator, resembling the role that middle managers traditionally play in more hierarchical structures. This approach may reduce resistance and encourage collaboration rather than imposing top-down directives. In conclusion, we can refer to Yuval Noah Harari's [31] insights regarding the relationship between computer networks and information networks. Computer networks form the foundational infrastructure and automated processes, whereas information networks convert internal and external information into actionable opportunities. As noted by Overby et al. [32], the sheer volume of available information can overwhelm organizations. Therefore, it is essential to have knowledge networks that leverage their expertise to make informed trade-offs. Knowledge networks are not just important for navigating today’s complex landscape; they are essential for executing successful transformations within digital infrastructures.

6 Conclusion and Limitations

This paper emphasizes the critical role of emerging knowledge networks in facilitating architectural transformations within large organizations. By adopting an infrastructure perspective, the study reveals how these networks are not only essential for integrating various types of knowledge but also for coordinating the transformation process itself. Focusing on a prominent Norwegian bank, we develop a framework dubbed "domain technical knowledge," which encompasses three types of interconnected knowledge that emerge collaboratively. The findings illustrate how both horizontal and vertical alignments between these knowledge types are crucial for creating a cohesive knowledge network, thereby enhancing the organization's capability to navigate the complexities of transitioning from legacy systems to modern digital frameworks.

A limitation of this study is its focus on a single case, the Norwegian bank, which may limit the applicability of the findings. As such, the insights gained might not be universally applicable across diverse organizational contexts.

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