

ENTERPRISE ARCHITECTURE CHALLENGES: A CASE STUDY OF THREE NORWEGIAN PUBLIC SECTORS

Research paper

Ajer, Anne Kristin S., University of Agder, Kristiansand, Norway, anne.k.ajer@uia.no

Olsen, Dag Håkon, University of Agder, Kristiansand, Norway, dag.h.olsen@uia.no

Abstract

Enterprise architecture (EA) is a popular approach to driving digital transformation in the public sector. Implementing EA is viewed as important in facilitating the adoption of innovative technologies and new business models. However, public sector organizations have so far been unable to gain any significant benefits from EA programs. Recent reports from the Organisation for Economic Co-operation and Development and the Norwegian Productivity Committee have pointed to health and education as sectors with significant potential for improved effectivity and efficiency. The health sector in particular suffers from poor coordination among units. In this study, we aim to provide an understanding of the central challenges for organizational acceptance of EA projects in the Norwegian public sector. We conducted three case studies in 18 enterprises and divisions in the health, higher education, and labor and welfare sectors. We find three major challenges for the EA initiative, involving the autonomy of the organizational units, the national objectives that are not followed up with financial initiatives, and the lack of understanding of EA and holistic thinking. We also illustrate how institutional theory can be used to offer insights into the EA implementation process.

Keywords: Enterprise architecture, Institutional theory, Public sector

1 Introduction

Digitalization and digital transformation are prevalent topics for both researchers and practitioners, perceived as instrumental to the modernization of the public sector (Ojo et al., 2012, Hjort-Madsen and Pries-Heje, 2009). In 2005, the then new Norwegian government's statement identified renewal and development of the public sector as a primary task, asserting that new technology and the Internet should pave the way for new and improved services (Regjeringen.no, 2005). The 2016 annual report of the Agency for Public Management and eGovernment (Difi) states the great need for continuing efforts to make the public sector more efficient, effective, user-oriented, and cooperative, and several challenges are described as hindering the government's goals (Difi, 2017).

Enterprise architecture (EA) is a method and a process used to manage the complex information and communications technology (ICT) landscape in large organizations. EA is perceived as an enabler for progressing to higher maturity states, such as from isolated silos to integrated solutions across an organization (Ross et al., 2006). Thus, EA is viewed as an important requirement for success in digital transformation (Ojo et al., 2012) and has become a common approach among European governments (Bakar and Selamat, 2016, Królikowska, 2011). EA management (EAM) is the discipline to plan and control the transformation (Aier et al., 2011).

Formal guidelines for EA were established for the Norwegian public sector ten years ago. EA was thus the instrument for achieving the national goals of ICT coordination and interoperability (Ministry-of-Local-Government-and-Modernisation, 2009, Ministry-of-Health-and-Care-Services, 2009, NICT, 2008). However, research has documented substantial challenges in obtaining appropriate results from the current EA initiatives in the Norwegian public sector (Øvrelid et al., 2017, Ulriksen et al., 2017).

This study is part of a research stream focusing on the key factors for EA implementation success in the Norwegian public sector. In our literature review, we have found case studies from several countries (e.g. Janssen and Hjort-Madsen, 2007, AlSoufi, 2014, Carota et al., 2010, Moreno et al., 2014, Bakar and Selamat, 2016, Valtonen et al., 2011, Zadeh et al., 2014). Nevertheless, Dang and Pekkola (2016b) call for more research related to problems with EA in the public sector, for example, using case studies from other countries. We find this call appropriate because many of the known challenges in EA come from studies in the private sector or in a mix of private and public sectors, and the public sector has institutional constraints that influence inter-organizational collaboration in other ways than those in the private sector (Fountain, 2004). Additionally, Aier et al. (2011) suggest that the situational design (i.e., the context) of the EAM function is necessary.

To answer the call from Dang and Pekkola (2016b), we pose the following research question: *What are the key issues and challenges for EA implementation in the public sector?* To address these challenges, we have studied them in more depth. We have examined the antecedents for the EA initiative, the mechanisms used to prepare the organizations, and how these initiatives have been met in the organizations. Institutional theory provides a framework for such analysis. This leads to our second research question: *What are the institutional indicators for EA adoption, and how is the subsequent institutional pressure addressed in the Norwegian public sector?*

We continue this paper as follows: In Section 2, we account for its theoretical grounding. Next, we describe the research context and method in Section 3. In Section 4, we present our findings from three case studies. In Section 5, we discuss the findings in light of previous research. Finally, we conclude with a brief summary and suggest some implications for the national authorities, as well as several recommendations for future work.

2 Theoretical Basis

2.1 Enterprise Architecture and Challenges

The term *enterprise architecture* has different meanings, depending on the situation it describes (Janssen, 2012). It can be a strategy, a method, or a process (Ross et al., 2006, Bernard, 2012). There is no common definition of EA yet (Sidorova and Kappelman, 2011), but it is usually perceived as the recognition of an organization's need for ICT solutions from a holistic perspective. A holistic perspective on EA provides the architecture to support the organization as a whole (e.g., enable integration and agility); however, this can conflict with optimal solutions for sub-organizations (Jonkers et al., 2006). An organization's EA describes in a hierarchical way the business, its processes, the data and applications to support these processes, and the technology to run the solutions (Bernard, 2012). EA is viewed as the enabler for making the transition from lower to higher maturity states. For example, this would aid an organization in progressing from isolated silos to integrated solutions across the organization, making the IT landscape efficient, robust, and flexible (Ross et al., 2006). Since the 1990s, EA has been used in large organizations to manage complex IT landscapes. The open group architecture framework (TOGAF) is the most common tool for managing EA (Bygstad and Pedersen, 2012, Denert-Stiftungslehrstuhl, 2015).

Governance, management, planning, and communication and support are common success factors (CSFs) in five EA implementation success models (Nikpay et al., 2013). In another literature review, Lucke et al. (2010) identify some challenges and critical issues for the EA process. Löhe and Legner (2014) describe the challenges for EAM. It requires a lot of effort, which leads to problems with measuring the benefits, and delays are common. The lack of governance, insufficient support for the EA development from the business and IT management, as well as inadequate resources and skills, are central issues.

Despite well-known CSFs and frameworks to guide the EA process, studies in the public sector worldwide demonstrate challenging implementation issues for EA concepts as such (Hjort-Madsen, 2009, Isomäki and Liimatainen, 2008, Bakar and Selamat, 2016, Dang and Pekkola, 2016b,

Banaeianjahromi and Smolander, 2016, Janssen and Hjort-Madsen, 2007, Valtonen et al., 2011). The challenges identified in these studies are brought into our discussion.

2.2 EA and Institutional Theory

Digital transformation and changes in public organizations influence many stakeholders in diverse professions. The introduction of new, deeply invasive concepts (such as EA and service-oriented architecture) and new power structures challenges the established structures and business processes. Among organizational theories, institutional theory has the potential to help researchers understand “how institutions influence the design, use and consequences of technologies, either within or across organizations” (Orlikowski and Barley, 2001, p. 153). EA is an approach to arranging technology within organizations, and institutional perspectives are thus relevant.

There are many definitions of an institution, such as the following: “Institutions comprise regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life” (Scott, 2014, p. 56). Building on the work of institutional scholars, Scott (2014) has developed an analytical framework, consisting of three pillars of institutions, to provide an understanding about the rise of institutions and how they are sustained. These are defined below.

The regulative pillar has the possibility, through laws and rules, to force actors to obey decisions. Coercive power comes from the legal environment and from standards related to the context. The rules and laws are characterized as indicators. *The normative pillar* is built on normative power, where morals and expectations from networks and from people with similar educational attainment are important forces. Indicators can be certifications and accreditation. *The cultural-cognitive pillar* emphasizes the individual actor’s interpretation of the situation. Cultural beliefs, cultural support, and taken-for-granted assumptions are the causes of action. Organizations imitate other organizations; thus, the mimetic mechanism is characteristic of this pillar (DiMaggio and Powell, 1983). Common beliefs and a shared logic for action and isomorphism are indicators.

The organizational level under investigation is important, and jurisdictional borders can identify the levels because “[...] activities and meanings occurring at one level are often linked to and activate activities and meanings at other levels” (Scott, 2014, p. 105). Agents comprise actors’ contributions to institutionalization, which can be described as ranging from individual actors to a nation, and the pillars are utilized in various ways by the different actors (Scott, 2014).

Bringing institutional and resource dependence theories together, Oliver (1991) presents a typology of strategic and tactical responses that organizations enact to enforce institutional pressure for conformity. Oliver’s proposed strategies are acquiescence, compromise, avoidance, defiance, and manipulation. She also categorizes the nature of institutional pressures (cause, constituents, content, control, and context) and discusses how these influence strategic choices. When analyzing the selected strategies, it is important to understand that the organization’s willingness and ability to implement changes are reflective of its decision.

There is limited research with a theoretical grounding in EAM, but the situation is improving (Winter et al., 2014). Institutional theory as a theoretical lens in EA has been used but to a limited extent (Dang and Pekkola, 2016a). Hjort-Madsen uses this perspective in the public sector, concluding that “[...] compliance with government guidelines and imitation of ‘best practices’ to a great extent drives EA adoption in government, while fundamental transformation to the tasks performed in government are only achieved if institutional norms and values promote transformation” (Hjort-Madsen, 2009, p. 8). Weiss et al. (2013) argue for institutionalizing EAM in the organization to be effective. They identify the following main factors for the realization of EAM benefits: social legitimacy, efficiency, organizational grounding, trust, governance, goal alignment, and enforcement. Nevertheless, there is still a call for research on how EA is institutionalized in the public sector and for the development of guidelines to more effectively address the individual institutional factors (Dang and Pekkola, 2017, Weiß, 2015). We focus on further clarifying institutional factors so that we can appropriately address these later.

3 Case and Research Method

3.1 Research Setting

In its effort to coordinate ICT investments, the Norwegian government, through the Ministry of Local Government and Modernisation (LGM), has developed principles for ICT architecture. Difi has subsequently described these as EA principles (Ministry-of-Local-Government-and-Modernisation, 2009, Difi, 2012). A directive from LGM states, “To contribute to a coherent whole in public ICT-solutions and services, governmental enterprises shall follow common architectural principles [...] elaborated by Difi” (Ministry-of-Local-Government-and-Modernisation, 2011). Difi points to TOGAF as an appropriate framework for EA (Difi, 2010). The sectors that we have studied are the hospital sector, the higher education sector (HES), and the Norwegian Labour and Welfare Administration (with the acronym NAV in Norwegian).

The hospital sector

Norwegian hospitals are organized into four independent enterprises, called regional health authorities (RHAs). This case focuses on Health South East (HSE), which serves the largest region with 10 hospital enterprises (HEs) and 220,000 employees. In addition to a department for technology and eHealth, HSE has organized its ICT operations as its own enterprise, Hospital Partner (HP).

The RHAs are owned by the Ministry of Health and Care Services (HCS). Each RHA has authority over the HEs in its region. For example, the RHA can influence and to a certain degree decide what information systems (ISs) the HEs shall use, but financing such systems is the HEs' responsibility. The National ICT (NICT) was established at the initiative of the HCS in 2003. The NICT's main work areas are strategic coordination, prioritization, and consolidation of a common approach to key ICT issues across the regions. One of the goals is to establish an EA strategy (NICT, 2012). The NICT (2011) has recommended TOGAF as the framework for the EA. In 2014, the NICT was reorganized as a separate enterprise owned by the four RHAs. The overall health sector has additional actors taking responsibility for some nationwide systems. An additional council provides advice regarding ICT strategy and architecture at the national level.

HSE has an ongoing project called Digital Renewal, which is organized into three programs that are split into smaller projects. One of the programs has focused on better coordination among HEs to improve health services. HSE spends over 400 million NOK annually on more than 340 consultants (Eide and Østby, 2014). One large project involves consolidating its electronic patient journal system.

The higher education sector

The second case involves the HES. The HES is under the authority of the Ministry of Education and Research (MER). We have studied universities and university colleges (UUCs) and their challenges in establishing an EA practice. Of the 33 independent higher education institutions, 9 are fully accredited universities, and 24 are public institutions. The sector has additional actors responsible for some nationwide core systems, such as Internet services, librarian systems, and coordinated admission to a university or an institution.

The individual institutions and their systems have developed relatively independently, and the systems are usually different and have not always been designed to interface with one another. This situation makes cooperation among these entities difficult and expensive. There has been some progress with a few administrative systems, which are now operated as common resources. Nevertheless, there remains a large potential related to a common EA, including common functions, processes, systems, and data models. Pending the establishment of a formal council, an informal architecture council has elaborated on architectural principles for the HES.

The Norwegian Labour and Welfare Administration

The NAV is the third case, which involves yet another ministry, this time the Ministry of Labour and Social Affairs. The NAV was created in 2006 through a fusion of state agencies and municipal

organizations for social services administration to make it more efficient, holistic, and client friendly. The NAV employs around 19,000 people.

The organization consists of seven departments, of which three comprise different business lines and four are support departments, one being the ICT department. We have studied the business lines and the ICT department. Each department is led by a director, who has the overall responsibility for the department and its sections. The NAV's services are innovated and developed in programs and projects. The NAV has established an EA section to align the programs and the projects with the NAV's long-term goals. An NAV report, prepared by a group with members from the departments, describes the NAV's EA approach, explaining why EA is important, the roles, and the responsibilities (NAV, 2016b). The report states that TOGAF was adopted in this work.

The NAV has considerable legacy issues, with some project failures in its history. In 2013, it had to liquidate and reorganize a modernization project at an estimated loss of 340 million NOK (NAV, 2016a). In the 1990s, a large project ended with a loss in the billions and a hearing in the Parliament.

3.2 Research Approach, Data Collection, and Analysis

We used a qualitative and interpretive research approach in this case study (Walsham, 1995). Principles from Klein and Myers (1999) work were used to gain an in-depth understanding about the phenomena. The main data collection method consisted of semi-structured interviews; for some of the cases, the questions were revised after new insights emerged. All interviews were recorded and transcribed, except for one where the informant disapproved of the recording. Table 1 provides an overview of the interviews. In this paper, we use unit as the notation for autonomous sub-organizations, such as an HE, a UUC, or a department in the NAV. Documents from each sector and documents related to the national architecture were collected from the organizations' websites.

Case and no. of units investigated	Year	No. of interviews	Type of informants	Average length (minutes)	Method
UUC 9	2015	11	5 CIOs, 2 enterprise architects, 2 chief engineers, 2 group managers	40	10 telephone 1 face-to-face
NAV 4	2017	16	4 directors, 7 enterprise architects, 1 project manager, 4 section managers	45	Face-to-face
HSE #1 2	2015	12	9 enterprise architects, 3 group managers	40	Telephone
HSE #2 5	2017	16	1 CEO in HE; 1 CIO in HE; 10 enterprise architects from NICT, HSE, HE, and HP; 3 project managers from HSE and HP	75	3 telephone 1 video 12 face-to-face

Table 1. Overview of cases and interviews (HSE#1 and HSE#2 are considered as one case). (CIO = chief information officer. CEO = chief executive officer).

The first three cases were explorative studies. In the last study, still explorative, we wanted to gain a comprehensive understanding of the challenges disclosed in the first three studies, in line with the hermeneutic approach (Klein and Myers, 1999). The interviews in HSE #2 added to the knowledge from HSE #1 and are part of a larger study. In Section 4 (Findings), we present HSE #1 and HSE #2 as one case, HSE.

The transcripts from UUC and HSE #1 were analyzed stepwise (Oates, 2006), with no predefined categories. The transcripts from NAV were analyzed in NVivo and assigned to categories taken from the studies of Banaeianjahromi and Smolander (2016) and Lucke et al. (2010). The second author was in charge of these three cases, while the transcripts from HSE #2 were coded and analyzed in NVivo by the first author, following the principles of first- and second-cycle coding (Miles et al., 2014). The themes were created on the fly. In the second cycle for HSE #2, the data was aggregated, discussed,

organized, and compared in an interpretive and iterative process to identify emerging themes and patterns. In the first iteration of the second cycle, all EA challenges were combined in one group and coded into 30 concepts. In the second iteration, the concepts were reassessed and grouped into broader categories. This analysis ended up with 5 main categories and 26 concepts as challenges (see Table 2).

The analysis continued with mapping the challenges from the other cases into the schema (see Table 2). Due to different coding and analyzing approaches, we first reviewed the challenges found in the first three cases and aligned them with the challenges found in HSE #2, so we could compare the data. Surprisingly, we discovered only a few new problems. Competition among UUCs, as a hindrance to their EA commitment was a new issue.

To find the major barriers, we first checked the number of sources and the number of references (in NVivo) for the different challenges in HSE #2. Second, we reviewed the interviewees' answers to the questions about the main challenges in their work and the main challenges in enabling conformity with ICT solutions. We found seven challenges that we mapped with those that were common for all three cases, and five challenges emerged. Third, we discussed the interrelationships among the challenges, focusing on identifying the relationships among the concepts, the antecedents, and the consequences. We drew connection lines between the challenges. We counted the number of start and end points for each concept and mapped them with the former results. The results are presented in Section 4.1, and the three major barriers are discussed in Section 5.

4 Findings

4.1 Challenges for the EA Initiative

Table 2 shows the main categories and concepts as challenges in the three case studies. As explained in Section 3.2, the HSE case had been investigated in greater depth, which might be the reason why this case yielded more issues. One additional reason might be that the UUCs had no local EA initiatives, and the NAV units were not juridical units—conceivably making them less complex cases.

The analysis yielded seven important challenges for HSE #2, as follows: 1) autonomous units, 2) financial issues, 3) lengthy processes, 4) tool support, 5) willingness to change, 6) understanding of EA, and 7) visualization of the value of EA. Five of these challenges were also found at NAV and UUC. The units' autonomy was frequently raised as an important challenge, mentioned by eight of the 16 interviewees as the main challenge in HSE #2. Understanding of EA was frequently mentioned in HSE and was perceived as the main challenge by three of the interviewees, which was likewise regarded as the main challenge in UUC. In our interpretation, financial issues were also among the major challenges, but tool support and visualized value creation were also strong candidates for the top-three list. Nevertheless, we argue that the financial aspect was a more fundamental challenge, with impacts on several other challenges. Due to the space limitation, we only present descriptions and findings from the three major challenges.

Autonomous units had control over their own decisions and how they organized themselves, and they had their own budgets. We found that this autonomy hampered the initiative for increased cooperation. For example, even if an HE was owned by an RHA, the HE would not be legally committed to follow the RHA's recommendations. Additionally, an HE could refuse to use a new IS or to set aside resources for developing an IS. Several of the informants in the HES noted the disagreement between MER and the institutions about which entity should be assigned the responsibility for the EA work and how the costs should be allocated.

A project leader in HSE explained, "Each HE is an autonomous unit, so it is difficult if some do not want to participate—there are few incentives." An enterprise architect clarified the relationship between the NICT and the RHAs, "NICT, in general, cannot require an RHA to do certain things, but recommendations from the Board of NICT, where the CIOs from the regions attend, will be followed up [...]." Nevertheless, another enterprise architect noted that the recommendations from the NICT are not always taken into account, "All regions are working to establish a system for electronic medical

records. A national coordination was suggested, but the regions wanted to work on their own. They have chosen different solutions [...], and this happened in other situations as well. It is a possibility that the governance model and economic incentives are not adjusted to the goals.”

The departments worked independently in the NAV, without much interaction. An enterprise architect noted, “NAV is a strong line-driven organization, very little matrix focus. A [horizontal perspective] has very little authority and power in practice, and the hierarchy in government organizations reinforces this.” This statement is corroborated by the following quote from a section manager: “When it comes to architecture governance, you move in different structures than you do in the line structure. So sometimes the management structures are a bit incompatible.”

The architecture principles that had been proposed for the UUCs were only advisory in nature. One of the informants stated, “Now it is based on a voluntary principle if one views the sector in its entirety.” One of the causes for this lack of collaboration was the competition among the UUC units to increase their student enrollment and obtain research funding. Nevertheless, an informant cited a potential for improvement in the administrative area, “[...] especially within the administrative part, where we should coordinate and use EA.”

Main categories	Challenges	HSE	NAV	UUC
Complexity	Changing landscape	X	X	
	Fragmented systems	X		X
	Contracts with vendors	X		
	Legacy systems	X	X	X
	Large projects	X		
Objectives, strategy, and benefit	Benefits	X	X	
	Strategy	X	X	X
	Urgent need versus strategy	X		X
Organization	Organization in general	X	X	
	Governance	X	X	
	Autonomous units	X	X	X
	Financial issues	X	X	X
People and processes	Competency	X		
	Tool support	X	X	X
	Unclear/Competing EA approach/approaches	X	X	X
	Lack of agility	X		
	Silo thinking	X	X	
	Willingness to change	X		
	Lengthy processes	X	X	
	Continuity	X		
	EA versus project management	X	X	
Understanding and trust	Transform visions into practice	X	X	
	Visualization of the value of EA	X	X	X
	Trust in the enterprise architect	X		
	Trust in the EA process	X	X	
	Understanding of EA	X	X	X

Table 2. Overview of challenges from the three cases.

We identified three prominent *financial issues* related to EA initiatives, as follows: 1) Whose budget would be involved and who would receive the benefits? 2) The ICT project cost would be difficult to predict due to the complexity. 3) There were already large investments in legacy systems. The following statement from a section manager in the NAV is illustrative: “[Legacy Systems] makes it difficult to manage these systems across departments because the money follows the department.” This view was corroborated by a CEO in HSE: “[...] we should have been committed to working systematically, guided by standardized processes that realize benefits, [...] and we should be measured on this. The central authority [HCS] needs to rearrange the way the cost is distributed since it is very demanding to take money from the daily operations related to the treatment of the patients, when the cost rises and is unpredictable.”

An enterprise architect in HSE noted, “[...] the people with the money want an annual budget, [...] but for complex systems, we don’t know everything upfront, so it is hard to estimate the costs.” The huge investments in legacy systems created a significant financial problem—incurring losses from the legacy investments. A project leader in HSE cited one reason why leaders had second thoughts about embarking on a process toward new and potentially better systems: “[...] the regions have used very much money [on legacy systems], so the investments are so high. So, if you are going to turn [around] and do something else, you [will need to absorb *very large* losses, related to both money and prestige.”

We found that *understanding of EA* was particularly important in all cases. One of the results of the limited understanding of EA was that the enterprise architects were introduced too late into the projects. Other issues were the lack of commitment and ownership of the process. We found that people working with IT management had a good understanding of EA, but there was less understanding among the other stakeholders. The following statement from an enterprise architect in HSE is illustrative: “NICT consists of people with good knowledge of EA, [...] out in the RHAs and in the HEs, people think of EA more like technical IT architecture than how to design and build an organization.” Another enterprise architect in HSE asserted, “[...] outside the circle of architects in the eHealth directorate, NICT, and HSE, EA is not very well understood, and top managers in HSE do not [...] understand the value of EA.” This opinion was corroborated by a project leader in HSE: “The term EA is a little vague; I am not quite sure of all its implications. What it means depends on who you ask and who you talk with.”

The lack of understanding of EA and the EA process among the NAV’s top management was a significant issue and led to the lack of ownership and commitment. One of the informants in UUC noted that when presented with a draft of architecture principles, the top management was unable to understand what EA was all about. Another informant in UUC commented, “EA is a strange term for very many people at this institution.” Furthermore, an enterprise architect in HSE alleged, “[It is important to] convince the enterprise leaders that there is a need to involve architecture as a discipline when assessing the changes one should invest in.”

4.2 Institutional Analysis

EA is a new and encompassing method, and it is recommended as the method and the tool for achieving the national goals of coordination and interoperability. Hence, over time, EA can be an organization-wide institution. It is interesting to unveil which institutional forces come into play when an institution is created. We limit this article to describing the indicators we found for each of the three institutional pillars (see Table 3) and the reactions to these indicators (see Table 4). Taking an agent-based perspective (Scott, 2014), we view the institution as designed by purpose, and the actors as causal agents.

Regarding *regulative indicators at the state level*, we find white papers, laws, and regulations. The white paper entitled “A government for democracy and community” emphasizes the importance for the nation to have a common ICT architecture (Ministry-of-Local-Government-and-Modernisation, 2009). This document is the first paper from the government that elaborates on the meaning of conformity as both how ICT can be used for conformity and how conformity with ICT can be achieved. The paper states and lists architectural principles that all governmental organizations shall

follow when new ICT solutions are planned or renewed; however, the architecture must allow for some locally adapted solutions to fulfill special demands. Difi is identified as the agency that will manage and implement the architectural principles.

The 2012 report entitled, “Superior IT-architecture principles for public sector” elaborates on the seven architectural principles from the LGM (Ministry-of-Local-Government-and-Modernisation (2009). Furthermore, the report highlights that the individual sectors and the organizations themselves are those responsible for implementing the principles in their own architecture.

The government’s website describes the “Digitization Circular” as “a compilation of orders and recommendations for digitization in the public sector. The circular applies to the ministries, the state’s governing bodies, and executive agencies with separate proxies and management companies” (Ministry-of-Local-Government-and-Modernisation, 2017). The first circular, issued in 2009, states the mandatory use of common architectural principles in public organizations. The “Digitization Circular” is regularly updated with decisions made by the parliament and the HCS the latest version is from 2017 and is number nine in the series.

Level and agent type	Unit	Regulative indicators	Normative indicators	Cultural-cognitive indicators
State Nation	Ministry	Regulations Guidelines		
State bureaucracy Professions – miscellaneous	Difi	National architectural guidelines	Training of leaders Councils with participants from different sectors Information activity	
Inter- organizational Professions – EA	HSE, HE, HP NAV – lines HES – institutes		Various forums with representatives from different units Participants in nationwide projects Certification, TOGAF	NICT only recruits people with comprehensive EA knowledge and education.
Autonomous unit Professions – EA	HSE, HE, HP NAV – lines HES – institutes	Adapted routines Common tools HSE, NAV: architect and design – function as controlling units	Participants in inter-regional forums Participants in regional projects Certification	
Autonomous unit Subject matter specialists	HSE, HE, HP NAV – lines HES – institutes		Participants in inter-regional forums Participants in regional projects	Historical culture of having great individual power
Autonomous unit Professions – managers	HSE, HE, HP NAV – lines HES – institutes		Problematic tension between local and central needs Participating in education initiatives under the direction of Difi	Historical culture of having great individual power

Table 3. Institutional indicators from the cases.

Concerning *normative indicators at the state level*, we find that the initiatives included in the annual Difi (2017) report have addressed the increasing need for coordination across administrative borders. The organizations from the public sector enable sector and silo thinking, making it difficult for their managers and staff to think holistically. Skate, an initiative which started in 2012, aims to establish an arena for strategic collaboration to improve the situation. Skate is an initiative from the parliament led

by Difi, where top managers from various public organizations participate. Another initiative involves the development of courses to build ICT competency, especially among top managers, so they can understand how technology can support their strategy. In 2016, Difi established a Digitalization Council, with participants from both public and private sectors. The council aims to help top managers succeed with their digitalization projects.

At the *inter-organizational level*, in the NICT’s strategy document for 2013-2016, we find that one of the goals is to establish EA as a strategy for all the RHAs (NICT, 2012). Based on the national health strategy, the NICT prepared a report with suggestions for initiatives to attain this vision. The report presents architectural principles and discusses governance methodology (NICT, 2014). The report also describes the business architecture for the main health processes. The set of NICT documents does not constitute a regulative element but is normative because the NICT’s recommendations can be overruled by the RHAs. The reason why we view these as normative is that most of the participants in the work are representatives of the various RHAs, and then they develop a mutual understanding for coordination and gain knowledge of EA that will form their logical thinking and behavior.

For the *autonomous units*, there are regulative indicators in the form of guidelines. For example, HSE’s project roadmap includes the requirement for enterprise architects to be involved. Furthermore, it has decided to use common tools for documenting the architecture. HSE and NAV have decided to use TOGAF as the framework for EA, the same framework with which the informants in the UUE sector are familiar. Both HSE and NAV have established separate functions for architecture and design that work in an interdisciplinary manner across programs and projects to help in complicated situations and ensure that architectural practices are followed. The professionals exercise a high level of authority in the autonomous units. For decades, the professionals have assumed the responsibility for their units. We perceive this historically grounded power as a *cultural-cognitive indicator*.

It is also interesting to analyze how the various rules, guidelines, and architectural decisions made by others are followed at the sub-organizational level. Table 4 shows the observed strategies to handle the institutional pressure to conform to the surroundings.

Level	Architectural decision toward coordination	Strategy and tactics To meet pressure from the level above.
State	Rules and laws	
State bureaucracy	Rules and guidelines	<i>Acquiescence</i> : laws are elaborated and communicated.
Inter-organizational	Guidelines Common architecture (artifacts, Business Process Models, and IS systems)	<i>Acquiescence</i> : the tactic is compliance. Rules and guidelines are adopted but are customized according to the context. AND <i>Compromise</i> among the cooperating units; the tactic is bargaining.
Autonomous unit	Architecture for the unit	<i>Acquiescence</i> : the tactic is compliance. OR <i>Compromise</i> among the stakeholders within the unit; the tactic is bargaining. OR <i>Defiance</i> : the tactic is dismissing.

Table 4. How sub-organizations react to institutional pressure.

Difi is at the state bureaucracy level, and the documents clearly indicate that Difi elaborates on the architectural principles from the LGM. The reviewed documents show that Difi follow its mandate, leading and taking initiatives to achieve better coordination and conformity.

At the inter-organizational level, we observe that the NICT develops its architectural principles based on Difi’s guidelines. Concerning certain solutions that the NICT suggests, the RHAs can bargain or dismiss the proposals (see Section 4.1). We recognize a similar situation between the RHAs and the

HES; as stated by a project leader, “When changing the work process, we sometimes go for compromises that gives sub-optimal solutions.” According to the CEO of an HE, “[There] should be a regional project, but only a few HTs could afford it.”

5 Discussion

We have identified three issues that are particularly important for EA implementation in three Norwegian public sectors. We conjecture that these three issues are the most significant barriers to EA implementation and discuss these further.

Coordination and collaboration challenges related to EA initiatives across sub-organizations are well-known phenomena in the public sector (Ross et al., 2006, Janssen and Hjort-Madsen, 2007, Dang and Pekkola, 2016b). The situation becomes tougher the more autonomous the sub-organizations are (Boh and Yellin, 2006); hence, it is important to address autonomy to maintain coherence in an organization (Zadeh et al., 2014). Furthermore, autonomy influences how the EA work is undertaken (Steenbergen, 2011).

For HSE and HES, autonomy comes from the organizational structures in the sectors. The NAV units are not autonomous in a juridical and economic sense. It is the NAV’s history that shapes its autonomous behavior. All units have a long history of operating separately; only over the last few decades has there been a demand for inter-organizational collaboration on ICT technology. The consequence of EA autonomy is that units in a sector can make decisions that complicate inter-sectoral coordination. Ultimately, the business lines have the strongest voice (Martin, 2012, Bakar and Selamat, 2016, Lee et al., 2013).

EA planning is imperative to achieve the goals outlined in an organization’s strategy (Schmidt and Buxmann, 2011, Jusuf and Kurnia, 2017). However, there can be conflicting goals due to different levels in the public sector (Valtonen et al., 2009), and national goals and targets are often vague (Muir and Oppenheim, 2002, Dang and Pekkola, 2016b). We find that organizations experience the goals and strategies handed down by the top level of the hierarchy as vague and not detailed enough for the units to act on. The complex organizational structures lead to challenges in EA planning (Dang and Pekkola, 2016b). Even if the target is clear, the units, especially in the health sector, can disagree about the outlined process. Additionally, UUCs are competitors on student recruitment and funding; thus, there can be forces working against conformity. An EA project opens up an organization for others, which is perceived as risky by leaders (Valtonen et al., 2011). Altogether, there are several sources for top managers to use their power of autonomy and not to commit to the EA initiative.

We find that employees respond positively to change as long as there are perceived benefits. This is consistent with the findings reported in the literature (Miller et al., 1994). Since the enterprise architects have problems with visualizing the benefits, the decision makers are not convinced to participate in change projects applying a new methodology (Chakravarti and Varma, 2008). If a value is not proven from the EA initiative, its dismissal is understandable since changing work processes is a challenging organizational operation, related to both budget allocations and organizational resistance (Drews and Schirmer, 2014, Chakravarti and Varma, 2008). Research shows that financial issues are important. “It is crucial [...] to focus on the returns from the investment of integrating business and IT” (Kamogawa and Okada, 2008, p. 435). The lack of perceived benefits from EA is one important cause of EA failure (Dang and Pekkola, 2016b). Nevertheless, clarifying the value from EA is found to be a challenging task (Tamm et al., 2011, Bygstad and Pedersen, 2012).

Even if the top management agrees on the EA target, it may be unwilling to free up key personnel to national or regional EA projects. Taking key personnel out of the daily operations makes the unit suffer in terms of both productivity and finance. The classical problem, where the cost is covered by another unit than the ones that gain the benefits (Flak et al., 2012), is also valid for EA projects (Drews and Schirmer, 2014). Additionally, the willingness to use EA is impeded if there are conflicts related to benefits (Dang and Pekkola, 2016b). Another serious consequence of the financial condition is that

it can hinder knowledgeable and legitimate people from participating in the projects (Ulriksen et al., 2017). Such people are critical to success (Drews and Schirmer, 2014, Martin, 2012).

The financial issue is reinforced by the fact that the cost of an EA project is difficult to estimate due to the complexity. Large investments in legacy systems, combined with the above-mentioned cost/benefit issue, and the implicit uncertainty about when the EA benefits will be realized (Schmidt and Buxmann, 2011), may sway top managers to prioritize short-term needs instead (Bygstad, 2016).

The informants view the principle of “money follows the unit” as an obstacle to holistic thinking in all cases. The agencies have received a directive from the government that they should facilitate coordination, but they are evaluated on other criteria, and specific financial support for EA has not been implemented by the principal. Hjort-Madsen and Burkard (2006) conclude that the lack of economic incentives is one of the reasons for interoperability challenges in the government.

A common problem in all cases is that stakeholders—other than enterprise architects and IT managers—have a limited understanding of EA and the implications of adopting it. Architectural boards are formal in the NAV, informal in the HES, and absent in HSE. However, HSE’s Digital Renewal program has a board of architects, and architecture has recently become a distinct point in the project roadmap of HSE. In UUC, the informants experience the lack of a coordination mechanism as an obstacle to a common architecture. We therefore conjecture that top managers are aware of the national EA initiative but have limited knowledge or willingness to make the necessary organizational arrangements that are prerequisites for success. This finding is consistent with that of a Finnish public agency: “The executive group has understood that EA is an important concept. Unfortunately, it seems that they do not understand the meaning and purpose of it” (Saarelainen and Hotti, 2011, p. 15). The importance of governance, with formal structures and boards, is a critical success factor in all five success models reviewed by Nikpay et al. (2013). In addition to metrics, this aspect is “required to manage EA consistently even without permanent top management attention” (Winter and Schelp, 2008, p. 551). The unclear setup of EA governance is identified as a possible reason for the failure of EA implementations in Denmark and the Netherlands (Janssen and Hjort-Madsen, 2007).

The lack of financial incentives and autonomy, combined with the lack of understanding of EA, leads to a situation where the EA initiative from the government is far from having fruitful conditions. Therefore, we suggest autonomy, financial issues, and understanding of EA as the three major concepts that must be addressed to succeed with EA.

In their research on the private sector, Löhe and Legner (2014) find similar challenges. This indicates that it is worthwhile for the top management to study the outcome of Löhe and Legner (2014) research, specifically the design theory for architecture-driven IT management (ADRIMA). We propose an additional design requirement for the challenge involving the “lack of EAM acceptance in the (IT) organization and difficulties in enforcing EA policies and standards” (Löhe and Legner, 2014, p. 116). The design requirement for this challenge is that “existing IT roles and committees should understand EA artefacts as well as assume responsibilities for EAM tasks” (Löhe and Legner, 2014, p. 116). We find this requirement partly fulfilled in all our cases. However, there is a lack of EAM acceptance in the rest of the organization, which we suggest can be addressed with the following requirement: *Managers and leaders at all levels in the organization should understand the EA concept and how EAM should be organized to achieve the overall goal for the organization.* This requirement can give rise to management commitment, which is a prerequisite for other stakeholders to perceive the usefulness of EA efforts (Ojo et al., 2012).

The preceding discussion shows that an observer can question the units’ abilities (e.g., knowledge of EA) and capabilities (e.g., incentive structures) to institutionalize EA. We have discussed the conditions described by Oliver (1991, p. 159): “The theoretical rationale underlying conformity or resistance to institutional rules and expectations surrounds both the willingness and ability of organizations to conform to the institutional environment. The scope conditions under which organizations are willing to conform are bounded by organizational scepticism, political self-interest, and organizational control.” To address the challenges that EA initiatives meet, we have investigated how some of the initiatives are handled by the units.

The coercive rules and guidelines are very general. Even if they are elaborated by Difi, the sectors need to do considerable work to apply them in practice for all their systems. When the autonomous units and the Ministry disagree on which entity shall have the authority over the architecture council (such as in the HES), it is not surprising to identify different strategies toward conformity. Hence, we suggest that the regulative pillar is weak. The normative pillar seems to be strong among the persons who are actually educated as enterprise architects or TOGAF-certified. However, other important stakeholders, such as business managers and subject matter experts, are unfamiliar with the meaning of EA. Hence, the normative pillar is weak for these stakeholders.

Because they possess autonomy, the decision makers are the most influential stakeholders, and the main decision makers in our cases are the business managers, who are often subject matter experts as well. The cultural-cognitive pillar is strong among the subject matter experts since they have a long history of making autonomous decisions, think within their silos, and seek the best for their local units. Making decisions that deviate from this thinking is not straightforward.

6 Conclusion

We have identified key challenges in EA implementation in the hospital sector, the HES, and the labor and welfare sector. EA is important for achieving better coordination of the ICT systems to provide citizens with better services. These are important goals at the ministry level. We have analyzed interviews and documents, identified 26 concepts, and grouped them into five broader categories. Our discussion shows that autonomy, financial issues, and understanding of EA are the three major issues that must be addressed to succeed with EA in the public sector. Additionally, we have explained how institutional analysis can be used to identify elements that influence the institutionalization process. We have also discussed how the organizational structure and cultural conditions influence engagement in collaboration and coordination toward common national ICT solutions.

The units' autonomy allows them to dismiss or only partly participate in the EA initiative. The top management and other stakeholders have limited understanding of EA, and the benefits and the value of EA are not clear to the decision makers. Showing the overall organizational value for the organizations is an insurmountable task for the architects alone. The implication is that the organizations must raise the competency level across the board, especially for the top management. This means that Difi has to continue its work on educating top managers, preferably at a faster pace. The different ministries should also be involved in training leaders, and the units need to educate a larger number of their employees. We argue in particular that the need for organizational changes related to EA is under-communicated. Furthermore, we recommend that the ministries assess the governance arrangements and the authority related to architectural development and decisions. Finally, the ministries also need to evaluate the current financial model.

We have studied EA implementation in three Norwegian public sectors, which together account for a major segment of the entire public sector. The respondents represent 18 different units, providing quite diversified sources of the data. However, the institutional indicators should be better investigated, with more focused interviews at every level and among all agent types. We have not examined other significant segments of the public sector, most notably municipalities, primary healthcare, and primary education. Further research should address these contexts to determine if there could be sector-specific issues, and it would yield a more complete understanding about the EA implementation issues and challenges. Despite the limitations to the generalizability of this present study, our findings should serve to enlighten government enterprises about the challenges related to EA implementation. However, the results cannot be generalized beyond the Norwegian public sector. Further research should integrate results from similar studies in other countries.

By understanding the underlying challenges of implementing EA in an organization, the importance of the different institutional elements, and the logics among the agents involved, the institutionalization process of EA can be better addressed. Further research can suggest how to speed up the institutionalization process in the public sector.

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