

ENTERPRISE ARCHITECTURE IMPLEMENTATION CHALLENGES: AN EXPLORATORY STUDY OF THE NORWEGIAN HEALTH SECTOR

Martin Nygård and Dag H. Olsen,

Dept. of Information Systems, University of Agder

ABSTRACT

Many organisations are undertaking substantial efforts to implement Enterprise Architecture (EA). EA is seen as instrumental to align ICT and business strategy. It is therefore important to drive the digital strategy, identifying innovative new business models and technologies, and realising more business value of technology investments. Recent work, however, suggest that it is a challenging task to implement enterprise architecture in an organisation. There is also very limited research on this issue, particularly related to the public sector. This study explores the implementation of enterprise architecture (EA) in the Norwegian health sector. We found a number of challenges that impeded the process toward a common EA: unclear enterprise architecture roles, ineffective communication, low EA maturity and commitment, and complicated EA tools.

Keywords: enterprise architecture, health sector, implementation

1. INTRODUCTION

IT and Communications Technology (ICT) has become the most important technology in modern organizations. Enormous amounts of money are invested in ICT to make organizations more effective and efficient. However, it is a very challenging task to realize the full benefits of such investments. An important premise is that ICT and business strategy must be aligned. Enterprise Architecture (EA) represents such an integrated perspective. Ross et al. noted that: “EA provides a long-term view of a company’s processes, systems and technologies so that individual projects can build capabilities – not just fulfil immediate needs” (Ross, Weill, & Robertson, 2006). This is also true for the health sector, where innovative use of new ICT can have large impact on the logistics and care of patients (Hovenga, Kidd, Garde, & Hullin, 2010).

Health enterprises are very complex organizations, with a high degree of specialization and a heterogeneous ensemble of different actors and interests (Bygstad, Hanseth, & Truong Le, 2015). Health enterprises have very complex ICT infrastructures, and face substantial challenges in creating appropriate enterprise architectures that can accommodate agile changes in services, processes and systems. It can therefore serve as a good example of the increasing complexity related to ICT utilization in many sectors.

Norwegian health trusts had until 2007 operated as separate enterprises that acquired ICT systems without cooperation and coordination with other health trusts. In addition, the health trusts were not allowed to share information. This had led to a jungle of different solutions, infrastructure and ways of doing things. The Norwegian health sector is now organized into four regional health authorities, and has started the process toward a common enterprise architecture for the health trusts. In 2014 Nasjonal IKT (NIKT) was established. NIKT is a health trust responsible for promoting and coordinating common ICT-related initiatives in the specialized health care services.

The effort to create a common enterprise architecture in specialized health care services is very challenging. Little research has focused on the adoption of a common EA for a sector. We know very little about the management and organizational issues and implications. We have therefore posed the following research question:

Which challenges are most important in realizing a common enterprise architecture in the specialized health care services?

The rest of this paper is organized as follows: The next sections present related work, the research method, the results and the discussion. Finally, we present the conclusion.

2. RELATED WORK

There are many definitions of EA and from a number of angles, and there is still not an universally accepted definition (Hope, 2015; Ross et al., 2006; Simon, Fischbach, & Schoder, 2013). Tamm, Seddon, Shanks, and Reynolds (2011, p. 142) define EA as “The definition and representation of a high-level view of an enterprise’s business processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared by different parts of the enterprise”. In a similar manner, Niemi and Ylimäki (2008, p. 1) define it as: “A holistic view of an organization, including the viewpoints of business, information, systems and technology”. Another definition is: “As a structured and aligned collection of plans for the integrated representation of the business and information technology landscape of the enterprise, in past, current, and future states” (Simon et al., 2013, p. 3).

Gartner group has defined EA as: «The process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key principles and models that describe the enterprise’s future state and enable its evolution» (Lapkin, 2007, p. 4). We can therefore interpret EA as a holistic view of the organisation, emphasizing the interaction between business and IT. EA can also be viewed as the process of developing and transforming the organisation. “Enterprise architecture (EA) implementation refers to a set of activities ultimately aiming to align business objectives with information technology infrastructure in an organization. EA implementation is a multidisciplinary, complicated and endless process” (Tambouris, Zotou, Kalampokis, & Tarabanis, 2012). We should therefore also expect that large organizations, with complex IT environments, and with extensive standardization and integration, will benefit most from an EA (Tamm et al., 2011).

Enterprise architecture management (EAM) has been defined as the management activities conducted to install, maintain and develop the EA in an organisation (Aier, Gleichauf, & Winter, 2011). There are three approaches to EA Management (Kotusev, Singh, & Storey, 2015): the traditional approach, the MIT approach and the DYA approach. The traditional approach (Spewak & Steven, 1993) is a four-step sequential process (Kotusev et al., 2015): Document the current state, develop the desired future state, Develop the migration plan, and implement the plan and repeat the process all over again. The MIT approach (Ross et al., 2006) advocates the development of a long-term architecture vision at the enterprise level. The DYA approach (Wagter, Van Den Berg, Luijpers, & Van Steenbergen, 2005) views EAM as a reactive response to concrete business initiatives. Kotusev et al. (2015) argues that EAM in practice rarely follows any one of these approaches, but combines various elements from each method.

Many organisations struggle to achieve the potential of EA. The literature estimates that perhaps only five percent of EA efforts succeed (Hope, 2015). EA must become better entrenched at the executive level to attain its potential as an enabler of strategic planning and business transformation (Aier, Riege, & Winter, 2008; Buckl, Ernst, Lankes, Matthes, & Schweda, 2009; Langenberg & Wegmann, 2004; Simon et al., 2013). Lucke, Krell, and Lechner (2010) found a number of challenges for EA management: missing management commitment, lack of experienced architects, difficulty for EA teams in understanding the requirements, insufficient tool support and rapidly changing environmental conditions. A substantial part of the obstruction seems to be the ambiguity of the EA concept, and that a common understanding and methodological consistency are still lacking (Simon et al., 2013).

3. SETTING AND RESEARCH METHOD

3.1 Research setting

Norway is divided into four health regions. In each of them, a regional health authority (RHF) has the responsibility to ensure that the population is offered specialized healthcare. The government owns the regional health authorities. Each health authority owns a number of health trusts (HF), which are responsible for performing a geographic and/or specialist activities of operations. There are 43 HFs in

Norway. Helse Sør-Øst RHF (HSØ) is the largest RHF and provides specialist health care to approximately 2.85 million citizens, and has approximately 78,000 employees. HSØ consists of 15 HFs.

In 2009 all the ICT staff (approx. 400) in the individual HFs in HSØ were pooled into a new trust, Sykehuspartner HF. Sykehuspartner now has the overall responsibility for ICT, HR and procurement services to all hospitals in the region. It now has approximately 1,300 employees and is one of the largest enterprises in Scandinavia in this field. In addition, in 2014, Nasjonal IKT (NIKT) was established, a health trust with the specific responsibility for promoting and coordinating common ICT-related initiatives in the specialized health care services.

The Agency for Public Management and eGovernment (Difi) is a public agency that aims to strengthen the government's work in renewing the Norwegian public sector and improve the organisation and efficiency of government administration. It is overseen by the Ministry of Local Government and Modernisation (KMD). An important task is therefore also to promote coordinated and cost-efficient use of ICT within the public sector.

Digital Renewal (Digital Fornying) is a regional program that includes renewal and standardization of work processes and technology within HSØ. The initiative will provide better quality and patient safety, increased efficiency and better coordination between agencies involved in patient care (Helse Sør-Øst RHF, 2016). The initiative was launched in 2013 and implementation of the program was led HSØ. The present program consists of a number of larger and smaller projects, organized as follows: Regional clinical solution, Enterprise Management, Infrastructure Modernization, and ICT support for research (Helse Sør-Øst RHF, 2016).

3.2 Research Method

This is an exploratory case study, and it has followed the interpretive case study approach (Walsham, 2006). Interpretive research focuses on the complexity of human sense as the situation emerges (Klein & Myers, 1999). It is imperative to understand the context of the IS in information systems (IS) research, and the interaction between the system and the context (Klein & Myers, 1999; Walsham, 1995). Interpretive design offers a flexibility that permits discoveries of new and unexpected empirical results and for increasing sophistication. This provides the researcher with an iterative design and the option of improvisation and flexibility in the research process.

Twelve open-ended and semi-structured interviews were conducted with people that were involved in the EA efforts in HSØ. The selection of interviewees started with contacting NIKT, and use information from NIKT to identify appropriate interviewees. People that had enterprise architect as their job title were contacted. Seven informants were recruited in this manner. The rest of the informants were recruited by the snowballing method.

The informants are either employed by HSØ or Sykehuspartner, or have an extensive knowledge about the EA efforts in the health region. Nine of the informants have positions that involved EA, with titles such as enterprise architect, consultant or senior consultant. These informants are located at the various health trusts. This has made it possible to obtain perspectives on the implementation of EA from both the health trusts and Sykehuspartner. The last three informants have positions as senior managers at HSØ and Sykehuspartner.

The text transcripts were reduced and major themes were identified and classified into main categories (Miles & Huberman, 1994). The analysis was performed in the following steps based on Oates (2006). First, the transcribed data was read to get an overall impression. The data was categorised into the following categories: Tools, Organizational challenges, Project challenges, Decision authority, Enterprise architecture, Communication, Governance.

4. RESULTS

This chapter presents the results of the interviews. The informants hold various consultant, architect and senior manager positions at HSØ and Sykehuspartner. Several key issues surfaced during the interviews, and we will here present the most prominent ones.

4.1 Lack of role clarity

The interviews showed that lack of role clarity is a major problem today. Eight informants stated that lacking clarity about the enterprise architect role creates significant challenges in the way EA work is done presently. They noted that clarifying the role of the EA architect is the most critical issue. This was stated by informants in both NIKT, HSØ and Sykehuspartner. The following quote from Informant 2 is illustrative: "Clarified role is in a way the most important issue. [We need to] get a clarified role that would get us as architects more effective." It was evident that the enterprise architects do not know exactly what they are supposed to provide and what the expectations are in the various projects.

There is a general lack of understanding about what the enterprise architects should do, and what is expected from them. Several informants noted that this had the implication that their competence was not utilized properly and they would sometimes be given roles where they did not contribute anything. One of the senior managers of HSØ noted that "[Enterprise architects] get assignments that they should not have, and they get a somewhat different role than intended." This was corroborated by one of the other informants: "In projects and in the line [function], everyone asks themselves when they should involve the architect. Later they ask why they needed to involve the architect so early in the project because we are not in a technical phase yet. So, there is a misunderstanding about the enterprise architect role and a very limited knowledge of [EA] in its entirety" (Informant 4).

It was noted by several informants that the lack of role clarity could be due to a lack of rules and policies. They also stated that there is not enough focus on the mandate, and that it is too weak presently.

4.2 Management knowledge and commitment

Both enterprise architects and senior managers found that the senior management of HSØ had a limited knowledge and understanding of EA. One of the senior managers of HSØ (Informant 12) remarked that: "I believe that the knowledge about enterprise architecture is way too low in the senior management" Informant 4 noted that this was a problem at all levels. "Competence and knowledge about architecture are very limited at all levels." One of the informants (Informant 5) even remarked that the senior management is critical to EA at the strategic level. Several respondents emphasized that it is a question of gradually achieving higher EA maturity: "Attitudes gradually improve over time." (Informant 4)

The informants found that top management commitment was a major challenge. Informant 4 noted that: "The biggest challenge is management buy-in, it is good in large projects but in small ones, it is limited". This was a general sentiment among the informants, and seven informants stated that they were not satisfied with the present top management commitment in minor projects. It was also an issue of management attitude. Several informants noted that the senior management does not always see the usefulness and value of EA. They may see the value in large projects, but not in the line function. The following quote from Informant 1 is illustrative: "[The management] does not completely see the value of having EA as a line function. [They] see the usefulness and value in projects and programmes." Five of the informants noted that the attitudes toward EA are not good enough, or have room for improvement, while several other informants had positive experiences with management attitudes. One of the informants even had the impression that the management had negative attitudes to EA at a strategic level (Informant 5). Two of the informants noted that this is a maturing process, and that attitudes improve over time.

4.3 Communication Challenges

The informants also perceived communication to be a major challenge. Eleven of the informants had experienced difficulties in communicating with top management and with other parts of the organization. The communication challenges relates particularly to senior management and to ICT staff. Firstly, the enterprise architects experienced challenges in communicating with senior decision makers. The informants related this to the difficulty in communicating the benefits and necessity of the architecture work. The majority of the enterprise architects found that they would often experience challenges in communicating the business value of the work they do. They saw this as mainly a product of their own inability to communicate the business value, and to the difficulty in communicating with technical EA concepts. One of the enterprise architects (informant 9) commented that: "It is too much technical mumbo-jumbo, and when those who sit on the money hear technical terms, they immediately [...] turn

off. They get a complete blackout when this architect talks.” He further added that “It is a challenge to make this understood, and actually a challenge to communicate the business value of architecture, and why money should be put into this. It is difficult to explain to [business people], who are used to think in quarterly costs and investments. They look at the short term rather than the long term. But this is a fundamental clash of cultures.” Informant 13 corroborated this: “There are challenges with mapping [EA descriptions] over to something that is understandable for the management. We must be better at keeping it simple.”

Second, it was also evident that communicating with ICT staff was also a challenge. Eight of the informants commented that EA concepts are difficult and not manageable for other stakeholders, and the discussion would easily become very technical and too detailed. One of the enterprise architects noted that: “Enterprise architecture is a completely unknown concept to ICT staff. [...] and the standard language that the enterprise architects use can create a distance between the customer or the organization - the ones you are to create value for, and yourself” (Informant 6).

4.4 Organizational challenges

The informants identified additional challenges related to the relationship between the organization and the enterprise architecture work. Several informants stressed that a lack of trust is the reason why the progress with EA has been slower than it should have been. It was noted that the regional ICT service provider, Sykehuspartner, is not well enough positioned in relation to HSØ. They have not been able to establish an appropriate level of trust as a service provider for HSØ. The enterprise architects believe that this is a result of Sykehuspartner not having been able to live up to the expectations. When the results do not materialize, there is not a good foundation for trust. Informant 12 observed that: “We are not able to deliver good enough due to lacking trust from HSØ. Sykehuspartner only becomes an implementer, and we do not get to hear the needs”

It was a general sentiment among the informants that it is important to manage the expectations. Informant 4 pointed out that: “It is important to manage the expectations to the present architecture function, so the various stakeholders don’t get disappointed when they contact us, so that they will come back.”

Several informants pointed out that it was very difficult to drive through decisions related to EA. It is a process that is dependent on decision authority and various stakeholders, as illustrated in the following quote: “As an architect, one does not always have the influence one would like, and that depends on the management – business people. There is a conflict between the ones who manage and those who would like to work long term, the architects are sitting too far away from the ones who have decision authority.” Informant 10 corroborated this: “... what enterprise architects may propose [...] get overtaken by other matters or needs, and [the EA architects] sit too far away. I believe a clearer management based on architecture would make sense.”

Several informants also noted that there should be an architecture policy across the health regions. Four of the informants stated that architecture policy at the national level would improve the situation.

4.5 Tools challenges

The informants find the adopted EA tools very difficult and cumbersome. Six of the informants noted that it was very difficult to use the selected EA tool, Troux. Informant 4 stated that: “With the more complicated tools, as with for example Troux, one needs more training to actually get anything out of the tools. The biggest disadvantage with these tools is that they really are difficult to use.” Informant 9 corroborated this: “We have a tool called Troux, which was chosen as the architecture tool. It was acquired ten years ago. I have been attending three courses with this tool, and I still cannot use it. [...] It should be noted that none of the others are able to use it either.”

5. DISCUSSION

This study explores the implementation of enterprise architecture (EA) in the Norwegian specialized health care services. We found that there are a number of challenges that impeded the process toward a common EA.

First, we saw that the enterprise architect role is not well defined and communicated in this case. Even the architects themselves do not have completely clear conceptions of their roles. When other stakeholders, such as CIOs, IT-staff and managers don't understand this role, this creates confusion and makes the EA efforts challenging. The importance of role clarity is particularly important since the regional health administration is a very complicated organisation. A large number of actors and stakeholders need to communicate and interact with each other. They are dependent on their roles being defined and understood to work effectively across the region.

This finding is consistent with one of the success factors in Ylimäki (2006)'s literature review on EA implementation success factors, *Skilled team, Training and Education*. This factor emphasises that roles and responsibilities are sufficiently defined, documented and that people are actually utilised in the appropriate roles. It is also consistent with Götze (2013) who found that the enterprise architect role is characterised by a complexity that makes it difficult to clarify their role. Götze (2013) found that the enterprise architects do not assume a particular role, but that there are as many as five possible roles. Roles that change over time or during projects may create misunderstanding and confusion in HSØ, and may be one of the reasons for the lack of clear role definition. This goes both for the architects themselves as for the other stakeholders that need to interact with the architects.

Second, communication was a challenge, and the ability to communicate was seen as one of the most important capabilities of enterprise architects. The importance of communication is consistent with findings in EA studies (Chuang & van Loggerenberg, 2010; Lucke et al., 2010; Seppänen, Heikkilä, & Liimatainen, 2009; Ylimäki, 2006). They find that communication is an important success factor and one of the most critical challenges related to EA and the role of the enterprise architect. Implementing EA is a long and challenging process, which involves many stakeholders in various parts of the enterprise. Communication is essential to share knowledge and achieve a common understanding, which is instrumental for obtaining an agreement about vision, extent and goals (Ylimäki, 2006). The communication challenges are also related to the lacking role clarity. If the enterprise architects are not able to communicate effectively, it is likely that their role is not communicated accurately to the other stakeholders in HSØ.

Three aspects of communication were challenging in this case, communication with decision makers, communicating the value of EA, and a complicated set of concepts. Architects and other stakeholders communicate in different ways (Lucke et al., 2010). According to Chuang and van Loggerenberg (2010), enterprise architects will communicate primarily at a technical level, while managers will focus on business aspects – and not be interested in the technical issues. EA architecture has a very different terminology – compared to what is taught in business schools and used by business managers (Haki, Legner, & Ahlemann, 2012). This research illustrates that communication becomes a challenge when various stakeholder groups have specialised competence. Communicating the value of EA is also complicated by the fact that HSØ has not yet realised any significant benefits from the EA efforts. Gartner group (2015) argues that you often don't realise EA benefits before you reach level 3 in their 5-point maturity scale. Based on the interviews we would place the HSØ somewhere between 1 and 2 on this scale.

Third, we found that management knowledge and commitment was a challenge. The informants experienced that the management have too little knowledge about EA, and the commitment to EA efforts are not good enough. We argue that this problem should be seen in relation to the communication challenge. We saw that the informants in this case related the inability to convey the value of EA to the lack of commitment. Effective communication is a prerequisite to management commitment. Chuang and van Loggerenberg (2010) emphasises that not living up to the expectations from the management may lead to poor commitment from the management. This seems to be a pervasive problem in EA implementation (Haki et al., 2012; Lucke et al., 2010; Seppänen et al., 2009; Wilton, 2008). Then on the other hand, low commitment may lead to less effective communication, as described in Ylimäki (2006) and Chuang and van Loggerenberg (2010). The low commitment is mainly a problem in smaller projects in HSØ.

This is an indication that the EA mind-set is not fully adopted by the senior management. EA still need to move to a higher maturity level, and free itself from the IT focus (Simon et al., 2013). It is a mistake to

perceive EA to be a project rather than a process. Architectural thinking must be continuous because enterprises are “living things” (Rhodes, Ross, & Nightingale, 2009).

The findings also show that lack of knowledge is a challenge presently. It is mainly related to TOGAF and EA. Lack of knowledge will reinforce the communication and commitment challenges. Ylimäki (2006) identified knowledge as a critical success factor, and illustrates how managers should at least be competent at a general level about EA, EA frameworks and architecture goals and vision.

Fourth, EA governance was also a challenge, and the enterprise architects in HSØ advocates a stronger EA governance. This is consistent with the finding in EA studies (Lam, 2004; Lucke et al., 2010; Seppänen et al., 2009; Shah & El Kourdi, 2007; Ylimäki, 2006), which have identified governance as an important factor. Lucke et al. (2010) found that there are a lack of governance in many EA projects, often due to ill-defined roles, responsibilities, processes and procedures. The respondents agree that Sykehuspartner is not positioned well in relation to HSØ, and that it requires a stronger governance to improve the EA efforts. The informants felt that they were too far away from decision makers, making it difficult to win support for their EA agenda. Lucke et al. (2010) also found that coordination within an organisation is a critical problem. This includes how various actors are positioned relative to each other. Seppänen et al. (2009) argues that establishing an architecture mandate is a key factor for succeeding with EA implementation in the public sector.

The governance challenges in this case illustrates that there must be a shared understanding that EA is not only limited to IT infrastructure, but also includes policy, project and organisational factors. The informants perceive a tension between the long term perspective of EA and the short term focus of managers. This is a result of the difficulty of conveying the value of EA – when the value of EA is not communicated effectively, it may be hard get the needed influence and long term commitment from top management.

Fifth, EA tools was also seen as a challenge. This comes in addition to the above finding that communication in and about EA is made difficult by a complicated set of concepts. HSØ have adopted an AE tool called Troux, which is perceived as quite difficult. It is therefore not used as intended. The enterprise architects would often use other and simpler tools. Challenges with AE tools has been found in several studies (Kaisler, Armour, & Valivullah, 2005; Lucke et al., 2010; Shah & El Kourdi, 2007; Ylimäki, 2006). Lucke et al. (2010) identified lacking tool support as a critical challenge in EA projects. Having tools that facilitate mapping and modelling the complexity in an organisation is crucial. Mapping and long term planning are important parts of EA projects. Therefore is crucial for HSØ to have the appropriate EA tools to succeed with EA. Communication will be complicated, and it will be a challenge to establish a common vision and understanding of the EA, if different tools and modelling approaches are used.

6. CONCLUSION

We have studied the implementation of Enterprise Architecture in the Norwegian specialized health care services. The implementation is a quite challenging task, and has faced some serious challenges. The implementation of EA was hampered by unclear EA architect roles, communication problems due to the specialised EA concepts and knowledge, inability to show tangible benefits, too little management knowledge and commitment, weak EA governance and complicated EA tools.

We conjecture that the EA maturity is still quite low, and the EA mind-set does not still permeate the organisation. We believe that HSØ needs a stronger EA policy and mandate. The low maturity level is not surprising given that it is a new and complex topic that is difficult to comprehend and communicate. We believe that HSØ need to build the legitimacy and organisational grounding over time by cultivating the EA practice (Hope, 2015), and gradually show benefits and usefulness.

Our research was exploratory and performed in one specific sector. It has therefore limited generalizability, providing possibilities for future research. This research can serve as input for subsequent studies of EA implementation in health enterprises as well as public sector enterprises. It would be interesting to see if our findings are generalizable to such settings. Even if we cannot generalize

the findings, the study and the findings should serve to enlighten health enterprises about the challenges related to implementing a common enterprise architecture.

7. REFERENCES

- Aier, S., Gleichauf, B., & Winter, R. (2011). *Understanding Enterprise Architecture Management Design-An Empirical Analysis*. Paper presented at the Wirtschaftsinformatik.
- Aier, S., Riege, C., & Winter, R. (2008). Classification of Enterprise Architecture Scenarios. *Enterprise Modelling and Information Systems Architectures*, 3, 14-23.
- Buckl, S., Ernst, E. M., Lankes, J., Matthes, F., & Schweda, C. M. (2009). State of the art in enterprise architecture management 2009," Technische Universität München.
- Bygstad, B., Hanseth, O., & Truong Le, D. (2015). *From IT Silos to Integrated Solutions. A Study in E-Health Complexity*. Paper presented at the Proceedings of the 23rd European Conference on Information Systems (ECIS).
- Chuang, C.-H., & van Loggerenberg, J. (2010). *Challenges facing enterprise architects: A south african perspective*. Paper presented at the 43rd Hawaii International Conference on System Sciences (HICSS)
- Gartner group. (2015). IT Score Overview for Enterprise Architecture Retrieved August 29, 2016, from <https://www.gartner.com/doc/3092223/itscore-overview-enterprise-architecture>
- Götze, J. (2013). *The changing role of the enterprise architect*. Paper presented at the 2013 17th IEEE International Enterprise Distributed Object Computing Conference Workshops.
- Haki, M. K., Legner, C., & Ahlemann, F. (2012). *Beyond EA Frameworks: Towards an Understanding of the Adoption of Enterprise Architecture Management*. Paper presented at the European Conference on Information Systems (ECIS), Barcelona.
- Helse Sør-Øst RHF. (2016). Dette er Digital fornying Retrieved August 28, 2016, from http://www.helse-sorost.no/aktuelt/_digitalfornyng/_Sider/dette-er-digital-fornyng.aspx
- Hope, T. (2015). *The critical success factors of enterprise architecture*. University of Technology, Sidney.
- Hovenga, E., Kidd, M. R., Garde, S., & Hullin, L. C. C. (2010). Health informatics-an introduction. *Studies in health technology and informatics*, 151, 9.
- Kaisler, S. H., Armour, F., & Valivullah, M. (2005). *Enterprise architecting: Critical problems*. Paper presented at the Proceedings of the 38th Annual Hawaii International Conference on System Sciences.
- Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *Mis Quarterly*, 67-93.
- Kotusev, S., Singh, M., & Storey, I. (2015). *Consolidating enterprise architecture management research*. Paper presented at the System Sciences (HICSS), 2015 48th Hawaii International Conference on.
- Lam, W. (2004). Technical risk management on enterprise integration projects. *The Communications of the Association for Information Systems*, 13(1), 59.
- Langenberg, K., & Wegmann, A. (2004). Enterprise architecture: What aspects is current research targeting.
- Lapkin, A. (2007). *Ten Best Practices of EA*. Paper presented at the Gartner Enterprise Architecture Summit.
- Lucke, C., Krell, S., & Lechner, U. (2010). Critical issues in enterprise architecting—a literature review.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*: Sage.
- Niemi, E., & Ylimäki, T. (2008). Enterprise Architecture Evaluation Components. *Evaluation of enterprise and software architectures: critical issues, metrics and practices/Eetu Niemi, Tanja*

Ylimäki & Niina Hämäläinen (eds.). *Jyväskylä: University of Jyväskylä, Information Technology Research Institute, 2008.*-(Tietotekniikan tutkimusinstituutin julkaisuja, ISSN 1236-1615; 18). ISBN 978-951-39-3108-7 (CD-ROM).

- Oates, B. (2006). *Researching Information Systems and Computing*. 2006: SAGE Publications Limited.
- Rhodes, D. H., Ross, A. M., & Nightingale, D. J. (2009). *Architecting the system of systems enterprise: Enabling constructs and methods from the field of engineering systems*. Paper presented at the Systems Conference, 2009 3rd Annual IEEE.
- Ross, J. W., Weill, P., & Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution*: Harvard Business Press.
- Seppänen, V., Heikkilä, J., & Liimatainen, K. (2009). *Key issues in EA-implementation: case study of two Finnish government agencies*. Paper presented at the Commerce and Enterprise Computing, 2009. CEC'09. IEEE Conference on.
- Shah, H., & El Kourdi, M. (2007). Frameworks for enterprise architecture. *It Professional*, 9(5), 36-41.
- Simon, D., Fischbach, K., & Schoder, D. (2013). An exploration of enterprise architecture research. *Communications of the Association for Information Systems*, 32(1), 1-72.
- Spewak, S. H., & Steven, C. (1993). Hill, *Enterprise architecture planning: developing a blueprint for data, applications and technology*, QED Information Sciences. Inc., Wellesley, MA.
- Tambouris, E., Zotou, M., Kalampokis, E., & Tarabanis, K. (2012). Fostering enterprise architecture education and training with the enterprise architecture competence framework. *International Journal of Training and Development*, 16(2), 128-136.
- Tamm, T., Seddon, P. B., Shanks, G., & Reynolds, P. (2011). How does enterprise architecture add value to organisations. *Communications of the Association for Information Systems*, 28(1), 141-168.
- Wagter, R., Van Den Berg, M., Luijpers, J., & Van Steenberghe, M. (2005). *Dynamic enterprise architecture: how to make it work*: John Wiley & Sons.
- Walsham, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4(2), 74-81.
- Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, 15(3), 320-330.
- Wilton, D. R. (2008). The relationship between IS strategic planning and enterprise architectural practice: case studies in New Zealand enterprises. *PACIS 2008 Proceedings*, 19.
- Ylimäki, T. (2006). Potential critical success factors for enterprise architecture. *Journal of Enterprise Architecture*, 2(4), 29-40.