

Enterprise Architecture Practice and Organizational Agility; An Exploratory Study

Terje Fallmyr
Bodø Graduate School of Business
University of Nordland
terje.fallmyr@uin.no

Bendik Bygstad
Department of Informatics
University of Oslo
bendikby@ifi.uio.no

Abstract

As contemporary organizations experience an increasing pressure to change, organizational agility, i.e. the ability to sense and respond continuously to changes in the environment, is required. Enterprise Architecture (EA) has been proposed as an architectural and organizational approach in order to meet this challenge. In this exploratory study we discuss the usefulness of the approach, building on the contribution of Ross et al. [26]. Our research question is: to what degree can medium sized organizations use EA to build organizational agility?

Our empirical evidence is a case study with four medium sized Norwegian organizations. We find that the adoption of EA principles is pragmatic, and that maturity levels are generally low. We do, however, find reasonable support for the assumption that EA is actually increasing organizational agility, in particular the capability to respond to external changes. We identify two paths from EA to organizational agility.

1. Introduction

Top management in most companies is aware of the importance of IT, but often has a rather unclear picture of exactly how IT contributes to value creation and competitive edge in the business [20].

Enterprise architecture (EA) represents an approach that integrates information and communication technology (ICT) capabilities with strategic and organizational issues [29] [27]. Ross et al. [26] put it this way: "EA provides a long-term view of a company's processes, systems and technologies so that individual projects can build capabilities – not just fulfill immediate needs". EA may therefore be perceived as a promising approach to show how IT contributes to organizational goals, while also providing the necessary framework for developing a stable and manageable ICT architecture.

The frameworks of EA are bold concepts and many companies and organizations are currently supporting and deploying them. The success of The Open Group

Architecture Framework (TOGAF) initiative [21] is one indication of this.

Still, EA has received some skepticism and does not seem to gain acceptance among business managers [12] and tends to be under-utilized by the business units [15]. EA is considered difficult to manage, and Bloomberg [3] observed that most enterprises are not being "architected"; instead they are grown. In a longitudinal study in a pharmaceutical corporation, Martin [17] found that implementation of EA is indeed challenging. In federated organizational structures, architectural principles tend to lose against short-term business concerns. It seems that few companies actually follow the prescribed steps of the frameworks [11].

Much of the EA literature is normative rather than empirical, and tells us how we should use EA by addressing the development and revision of methodologies and tools. Little research has been done on the effects of Enterprise Architecture [27] [16] [6]. Lately, EA has expanded its focus to include joint actions of technological, organizational, and psychosocial aspects [15]. Yet we find that the organizational role of EA is not sufficiently addressed when trying to assess the effects of EA [16].

Ross and Quaadgras [25] point out that mastery of EA, e.g. in terms of achievement of high maturity scores, is not enough to achieve business value. We agree that the success of EA depends heavily on its actual use [15] and adoption by managers, as this would introduce practices in the organization. Therefore, the effects of EA should be measured by how it contributes to business value – as perceived by business managers and other stakeholders. Business value is achieved through management practices and culture throughout the organization. In the case of EA, this would include architectural thinking [25].

This paper aims to explore the usefulness of EA by addressing whether EA can help organizations to achieve an important business goal, namely agility. Business researchers have suggested that the increasing

pressures of global competition require *organizational agility* to be included in business strategies [5] [24]. We consider agility to be an organizational capability that consists of two components, namely the ability to sense and respond swiftly to changes in the environment [10] [22] [24]. The change may arise from competitors, shift in customer preferences, regulatory or legal changes, or technological advancements. Organizations need to develop their capabilities to sense and manage change both in business areas, business processes and technology beyond the normal level of flexibility based on what was envisioned when the organizational processes and systems were established.

It is relatively obvious that ICT plays a key role in the development of modern organizations [30], although the role is ambiguous. The gap between the IT organization and the rest of the business is well known [23]. ICT is a powerful enabler of organizational agility [19] by providing the technology and systems to integrate business processes across organizations, and to support innovation of new products and services. On the other hand, ICT is also often a hindrance to change, because of large installed bases of legacy systems, silo-oriented solutions and lack of competence [26].

For the purpose of our research, it is important to investigate the role of EA with a practice lens. We need to know more about how organizations actually approach the type of problems that EA proposes to deal with, how organizations relate to the EA frameworks, and to which degree their practice add value to themselves in terms of business agility. In this paper we explore how typical medium sized Norwegian organizations use the EA approach. We use the term “the EA approach” to denote that many organizations, especially small and medium enterprises (SMEs), may only use some elements of EA frameworks and apply them practically in order to solve problems and gain improvements to business processes or technological platform.

Our research question, then, is *to what degree can medium sized organizations use EA to build organizational agility?*

We address the research question by conducting an exploratory case study. Our focus is on the business value of EA in terms of agility, and we have therefore chosen to use the approach in [26], which provides a business-oriented view on EA. Besides being business oriented, it offers a practical approach containing a few, clear steps. It is also clearly grounded in the concept of business agility.

The rest of the article is structured as follows. First we briefly review research on EA, particularly detail the approach of Ross et al. [26], and discuss the

relationship between EA and agility. In section 3 we present our research method and our cases. We discuss our findings in section 4, and conclude in the last section.

2. Research review: Enterprise Architecture and Organizational Agility

The relationship between EA and organisational agility is not a straightforward matter. EA deals with some of the most stable elements of an enterprise; the business processes, the IT infrastructure and the enterprise systems. On the other hand, EA is claimed to be an enabler of agility [26] [3].

2.1. Enterprise Architecture Definition

Zachman’s point of departure when introducing EA [29] was that it is immensely complex to manage a large organization. The key to managing this complexity is classification, and the Zachman framework is a classification system to describe the knowledge about the enterprise and the services. Later, a number of frameworks have been introduced to guide EA practice, among them the Open Group’s TOGAF, which has now reached version 9.1 [21].

The field of EA comes from the IT domain. For instance, Armour et al. [1] defines EA as a holistic view of the enterprise’s IT resources, and views EA as the set of processes, tools and structures necessary to implement an enterprise-wide coherent and consistent IT architecture for supporting the enterprise’s business operations. Over the years, enterprise architecture has grown to encompass more than enterprise-wide IT architecture, and is now increasingly concerned with the architecture of the whole enterprise [7] [9]. Today, EA builds on business strategy, and covers both planning – i.e. architectures for business, information, IT services, and IT-infrastructure – as well as project-focused solution architecting [27].

According to [26], the ambition of EA is – briefly stated – to manage the complexity of organizational and technological change, at both strategic and tactical levels. The Open Group [21] defines the purpose of EA “*to optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy*”.

2.2. EA: The Ross et al. Approach

Ross, Weill and Robertson published their seminal book *Enterprise Architecture as Strategy* in 2006. They defined EA as “*the organizing logic for business*

processes and IT-infrastructure reflecting the integration and standardization requirements of the company's operating model". Furthermore: "EA provides a long-term view of a company's processes, systems and technologies so that individual projects can build capabilities – not just fulfill immediate needs".

The business orientation is rooted in the increasing demands for both company agility and for better execution while addressing the "IT problem", mainly exemplified by IT lagging behind, being complex and ad hoc, not building capabilities but rather an increasingly complex pile of solutions.

The Ross et al. approach suggests that companies must select their core operations, digitize them and execute them well on a suitable IT platform. Then, core routine activities can be executed with high reliability and high efficiency. This frees management from time-consuming problem solving on lower value activities. The digitized core is called the *operating model* and is a platform for growth and innovation. It defines two important relationships between the company strategy and the properties of the technological platform. These are the degree of reliance on shared data (integration) between business units and the required degree of company-wide business process standardization. *Business process integration* and *business process standardization* give two dimensions, each with two possible values 'high' and 'low'. The result is four general types of operating models, as shown in table 1 below. For instance, "diversification" is *low* in both dimensions, while "unification" is *high* in both.

Integration	High	Co-ordination	Unification
	Low	Diversification	Replication
		Low	High
		Standardization	

Table 1: Operating models

Each operating model represents different opportunities and challenges for growth. The idea is that new strategies and innovations may be delivered faster and more reliable as long as they can be implemented within the current operating model. If the operating model must be changed however, things may become more difficult. It is for instance very costly to establish shared data across all departments in a company that has relied on a diversified (distributed) data model. In the same way, it is costly to implement standard work practice (standardized business processes) across an entire enterprise. Both of these

changes carry large costs and risks, not only technologically, but also, and not least, in terms of organizational change.

Implementing EA is challenging, time consuming, and should follow a stepwise approach. The Ross et al. approach to building capabilities is divided into four different stages of maturity:

1. *Business silos architecture*: companies maximize individual business unit needs or functional needs.
2. *Standardized technology*: efficient IT through technology standardization and often increased centralization of technology management.
3. *Optimized core architecture*: companywide data and process standardization as appropriate for operating model.
4. *Business modularity*: companies manage and reuse loosely coupled IT-enabled business process components to preserve global standards while enabling local differences.

2.3. How Can Enterprise Architecture Support Organizational Agility?

Following Haeckel and Slywotzky [10] and Overbye et al. [22] we define organizational agility as the capability to sense and to respond to changes in the environment.

How can EA be useful for *sensing* changes? Sensing may reveal symptoms, and analysis may explain what the real problems are that cause the symptoms. EA advocates customer focus as a precursor to process orientation, well-developed business architecture with measurements (e.g. balanced scorecard) and management follow-up. TOGAF promotes for instance stakeholder analysis that may also be useful for developing systematic awareness of changing conditions in the external environment.

These could all be important for early detection and be considered part of good general management practice and also good EA practice. EA also promotes problem analysis, both when developing a model of the current situation (as-is) and analyzing possible future situations, as well as the gap to be bridged in order to get there – both in terms of new or changed deliverables (products/services) and internal capabilities.

How can EA be useful for *responding* to changes? Ross et al. [26] describe the operating model as a foundation for agility. The main reason is that it provides the necessary structure in order to respond to short and long-term challenges. Responding to short-term challenges may for example include handling of variations in customer demands, automating routine processes, managing emergency situations and conducting continuous improvement of services.

The information systems constitute the key resource for these tasks, and the operating model provides the principles for necessary integration and communication between these systems. Responding to long-term challenges includes for example product and process innovation, and to link into the value chains of vendors and customers.

2.4. Concerns and Limitations

Although we believe that these are powerful arguments for the relationship of EA and agility, there are also concerns and limitations.

First, the term EA seems to indicate that something should be “architected”, i.e. designed from scratch. In reality, organizations are not architected, but grow from the overall business efforts and results. Therefore, Bloomberg [3] argues that a successful EA initiative should recognize that EA must relate to the existing organizational structures, including the installed base of legacy systems.

Second, there are concerns about EA as a new *IT bureaucracy* producing mountains of technically oriented documentation, which is very difficult to handle and keep consistent with the evolving enterprise [14]. EA is not necessarily popular among business stakeholders, since, because of its IT roots, it represents a very different approach and terminology compared to what is taught in business schools and used by business managers [11].

Third, one may also question whether the EA approach is really used strategically by organizations. The IT industry aims at selling software solutions, and the focus on software products may lead to a limited use of EA [1]. Top managers may be disappointed that EA not necessarily pays off immediately [13].

Fourth, EA is oriented towards structure and system, and should not be mistaken for a complete approach to organizational change. Many issues, such as leadership, culture, sense making and emergence are not addressed in the EA frameworks.

We believe that only more empirical research can provide answers to these issues. We should therefore investigate a) to which degree EA will help organizations to sense changes in the environment, and b) to which degree EA will help organizations to respond quickly to changes in the environment.

3. Method

Our general approach was a case study [28] where we aimed at studying a phenomenon in its natural context. Being an exploratory study we aim for depth in the analysis rather than precision in our results. We

start from the assumption that a higher EA maturity will provide better capabilities for agility, and the research aim is to provide some initial evidence for patterns that may be investigated more fully in future research.

3.1. Case Selection

We present a case study with four cases observed at a single point in time [8]. The cases represent fairly common organizations, but they are also different in many respects. They vary in size from 35 to 500 employees and operate with regional, national or global scope. Both public and private enterprises are represented.

They were not selected because they are sophisticated practitioners of Enterprise Architecture, which may indeed be hard to find. Rather, they represent ordinary organizations that over the past years have handled their issues in how to organize themselves and use ICT for organizational improvement. The companies are presented in brief in table 2.

Company	A: Telecom service	B: Administrative agency	C: High-tech maritime	D: Energy supplier
Size (empl.)	35	500	400	105
Scope	Regional	National	Global	Regional
Sites	3	2	12	5

Table 2: Brief presentation of companies

3.2. Data Collection and Analysis

The information about the companies was gathered, from semi-structured interviews with representatives from management (one or more of CEO, CTO, and CIO), publicly available material, and student projects. The guiding questions correspond to the rows in table 3, except the last row. The cases were analyzed in two steps.

First, each case was analyzed, aiming to understand how the organization was approaching the EA concept, and which opportunities the informants had identified. We analyzed their operating models and assessed their EA maturity level, and also their processes and lateral coordination [18] to reveal some information about process implementation. In order to assess to what degree EA has increased their organizational agility, we tried to find evidence for sensing and responding capability.

Second, we did a cross case analysis [8], comparing the key issues described above. From this comparison we cautiously investigated the evidence for some

possible patterns, in particular the relationship between EA maturity and agility. In analyzing this evidence we did not focus on the correlation between two finite “states” (EA maturity and agility), but rather we compared the causal chains in each company; i.e. *how* the elements of EA influences on the companies’ capabilities to sense and respond.

4. Case presentation and Analysis

In this section we present the results of the case analysis. In order to assess the EA maturity for each company we documented their operating model [25], and a number of other attributes; the degree of formal process definition, how lateral coordination was conducted, the use of shared enterprise data – all of which positioned the company at a maturity level. Then we assessed whether the company consciously built enterprise capabilities with IT, such as a holistic and long-term view on IT architecture and governance mechanisms.

Then we investigated the levels of organizational agility through detailed analyses of how the company senses changes in the environment and how it responds, and in particular the use of IT capabilities in doing so.

4.1. Case A: Telecom

Description

Company A provides telecom services on optical fiber, including Internet access to private homes and businesses, TV, phone, etc. It has a regional market scope, with 35 employees on 3 geographical locations. We have evaluated the current operating model as “Diversified”, although the company says that they aim for standardization and coordination as in unification.

Some enterprise processes are defined but they are not formally documented and they have no end-to-end ownership. The lateral coordination is mostly personal and informal [18]. Each geographical location uses the same standardized package of systems, including some legacy systems that are rather silo oriented.

This situation creates sources of process problems and also some dissatisfied customers. The company is aware of their process problems, and is eager to improve customer satisfaction as well as improve process effectiveness and efficiency.

Analysis

The EA maturity level is considered to be mostly level 1 (silos) since each department controls their own systems and data. The company is approaching level 2 in some areas because there is standardized technology in the various functions and IT decisions are centralized. The silos still dominate. The IT (or technical) department is aiming to establish a standardized IT platform. The CEO is involved in this and supports it – at some distance, but the change process is run by the CIO/CTO.

IT tries to build capabilities for the enterprise and does not focus on short-term solutions. This work is based on a general overview and guidelines – not a full strategy. Short-term solutions are still made in order to keep up a functioning production system, and preliminary solutions also tend to be integrated into the production system.

When it comes to sensing capability, the management is alert as in any competing company, even though there are no specific described procedures for sensing that is related to EA. Responding is based on respect for the building of IT capabilities and goal to achieve a unification model, even though quick solutions may be implemented to achieve results fast enough. Responding may be slow in some cases because a large part of the product base relies on third party support systems and request for change in those systems takes time.

4.2. Case B: Administrative Agency

Description

Case B is a national administrative agency with 500 employees in two geographical sites. It provides national digital registry services to public and private enterprises, and to private persons. The organization is based on departments and the services owned and delivered by each department. We have evaluated the current operating model as “Coordination”. The CIO aims to move towards unification.

The company has few formally defined processes. The processes mostly stay within departments, which also define the services, so the need for lateral coordination is low. An important principle for data management is to store only one copy of shared data. However, the CIO says, there is yet no common data model for the processes and this creates challenges regarding integration and maintenance of systems.

	A: Telecom	B: Administrative	C: Maritime	D: Energy
Operating model	Diversified Aims for unification	Coordination	Largely diversified	Unification
Formally defined processes	Few	Few	Some	All
Lateral coordination	Mostly personal and informal	Low: few crosscutting processes	Mostly personal and informal	Formal: matrix. Process owners
Shared enterprise data	Some shared data	Some shared data	Administrative and project data	Administrative data
EA-maturity level	Level 1, approaching level 2	Level 1, approaching level 2	Largely level 1. Some level 2	Level 3
IT builds enterprise capabilities?	Some Centralized IT decisions	Some IT plans long term IT decisions by team	Yes IT is enterprise level function. Centralized IT decisions	Yes
Sensing capability	Normal, little use of IT	Normal	OK, some use of IT	Good
Responding capability	Weak	Normal, sufficient	OK, improving	Very good
Causal links between EA and agility	No examples of agility from EA	High ambitions, but few examples of agility from EA	Initiatives on IT architecture and governance, and some examples	Many examples of agility from EA

Table 3: Summary of case analysis

Analysis

The company has started to standardize the processes underlying the different services. This requires an extensive change of the information systems since the process models (including support for government regulations) are coded directly into the support systems. This obviously hampers responding capabilities that involve software change.

The CIO says that future architectures will be based on components and service orientation. EA maturity is largely level one (silos) although the company is moving towards level 2 (standardized technology). IT is aware of the necessity of building capabilities, and this has been the policy all the time. However, over the years, short-time change requests from the government or introduction of new services have made the architecture and the systems rather messy. This is also a challenge for the ability change, for instance to introduce new standard processes that involve several systems.

According to the CIO, the approach to these challenges is based on “common sense” and respects the demands from continuously running services. They have discussed EA opportunities with external consultants, but do not consider using EA extensively, particularly not a demanding top-down approach.

The IT department has barely started with EA, according to the CIO. They focus more on SOA but are

well aware of the business needs, and IT and top management communicate well. A team where unit leaders (process owners) are represented normally makes decisions concerning new IT developments. We find that the top management is a good partner, but no driver in the EA-related development.

This company is at the forefront of public e-services and has therefore a quite well developed sensing capability. The fact that rules and regulations are coded directly into the software systems and that the architecture and systems have become rather messy do no good for the responding capabilities. In summary, this company is in the lower end concerning agility.

4.3. Case C: High-tech Maritime

Description

Case C is a producer of high-tech equipment for the global maritime market. It has 400 employees at 12 sites around the world. This is a corporation containing semi-autonomous companies, all working in the maritime area, but with no common customers. The corporation fits a “Diversified” operating model.

Some common processes are described, especially for the Norwegian companies, mainly due to demands from public authorities but also from customers

regarding transparency of quality management and quality systems.

Process descriptions are available on a web-based system, and are supported by the quality management system (QMS) and the production management system (which is an ERP system).

The lateral coordination is mostly personal and informal. Each customer order is sold, designed, manufactured and delivered as one large project, and the project leader has the responsibility for all necessary coordination. The projects are in effect processes that cut across several departments, and the project leader is process owner. The new QMS and ERP systems have improved project resource planning and inventory control and caused substantial savings in terms of cost and time in the projects. Common administrative data have been specified for the Norwegian companies. Some common project data, especially within Norway also exist, but otherwise data are largely diversified and distributed.

The EA maturity level is largely 1 (silos) due to heritage of old systems, acquisitions and a diversified operating model. At enterprise level there is development towards level 2, especially due to the ERP system.

IT has developed into a critical enterprise level function. The enterprise is completely dependent on the QMS and ERP systems, and they have in practice become the platform for future development. All IT investments and developments are considered in the light of this platform. The quality system QMS is also used for standardization of processes.

Analysis

The IT department is very active in building capabilities for the enterprise. IT decisions are centralized, with corporate top management and unit leaders closely involved.

The approach to problems where EA could be used as a tool is bottom-up and based on a general overview, not a detailed strategy. The reason is that since they are competing in a mature industry they need the power from their current production to drive further development. The top management decision team must see short and medium term business benefits of EA. They build IT solutions and competence in the organization step by step. Now, they are at a stage where they fully recognize that the ERP and QMS systems are of crucial importance for the enterprise. They also recognize that these systems are vital parts of the platform for further development. No IT decisions are made unless the relevance to the company-wide strategy is clear.

The company has established a platform for growth with a couple of central IT systems and the

centralization of IT decisions. In addition, they have a very active and competent CIO. The CEO, however, is confident that they are on the right path to increased agility.

The ERP and QMS systems have led to improvements in terms of centralized IT decisions, defined processes and better project performance (especially planning and inventory control). These steps seem to help the company to solve their problems, and also represent improvements in EA maturity.

Our judgment is that they are as good as any competing company when it comes to sensing. Responding is not faster than before, but actions focus more on building capabilities due to centralized IT decisions and better defined processes.

4.4. Case D: Energy Company

Description

Case D is a regional energy producer and supplier with 105 employees in five geographical locations. There are 8 companies in the group. The company has adopted an operating model that approaches “Unification”, meaning that all processes are standardized and all enterprise data is shared.

Enterprise processes cover all 8 companies and they are described in detail and continuously maintained. Process descriptions are available in the quality management system, and they have lately been made available on web for all employees. The planned introduction of hand-held devices for mobile field workers will make all this information available to all employees wherever they are located.

Lateral coordination is achieved by a matrix-structured organization based on processes and resource management.

Analysis

The development of a quality management system started the transformation from a standard department-based organization. The combination of increased customer focus and the process descriptions provided strong arguments to change the organization completely. With the CEO as primary sponsor, they decided to reorganize and increase focus on the needs of the business processes, and hence the matrix structure.

Every process is assigned an owner, and process owners make up the top management level together with the resource managers. In our assessment, the company is at EA maturity level three (optimized core architecture). IT is concerned with building capabilities as well as ensuring that relevant data is made available

to all. Process owners and CIO prepare decisions about IT to CEO, and decisions are made as a team.

Process models are used both in the quality management system and for management purposes as well as to communicate between levels in the organization. The CEO says that process models contribute to a common understanding that supports better balancing of workload and flow. Employees at all levels understand the company and can contribute to modeling and improving processes. The CEO claims to be able to prove that they produce more “power for each ‘krone’” than similar companies. He also remarks that they have very few internal complaints or resistance about change, as change has become usual.

The fact that the CEO has been a proponent for this development all the time must be considered a requirement for the development. Management has spent much time and resources on changing attitude and culture. The fixed hierarchies that we find in most organizations are gone and employees must be prepared to take on different roles in different processes. Only a few persons are leaders all the time.

Existing full documentation of processes makes it easy for them to produce documentation to authorities and to implement new regulations. The CEO states that when a request for change is decided, they soon know exactly where to start, and can easily estimate what is involved. Hence, responding to new issues is fast. Complete process models also make it easy for employees at all levels to participate in modeling and planning.

All informants of case D claim increased company agility and that it is easier to stay compliant. They are confident that their way of doing business promotes company agility. Since their way of handling problems includes much of EA thinking, we believe this company stands as a supportive argument that EA promotes agility.

4.5. Cross-Case Analysis

Comparing the four case organizations, we note a clear difference between companies A, B and C, and company D. The three first organizations had low EA maturity and also relatively low agility, in terms of sense and respond capabilities, although they report that their ability to respond to external changes is increasing. What characterized company D?

The case analysis concluded that Case D experienced a high degree of agility. Based on statements from key informants, this company was able to respond quickly to challenges. A regional energy producer is required to report to authorities and implement changes according to new regulations, as

well as respond to strategic and operational challenges, the latter requiring sensing capabilities.

The sensing capabilities of case D may be considered increased since all employees contribute to modeling and improving processes. Management practice now involves a considerable amount of architectural thinking. Everybody in the company is involved and knows the processes and goals, and has been trained in this mind-set through participation. Informants emphasized that the whole culture also includes customer orientation throughout the organization.

The history or journey for this company started with the CEO asking questions concerning documentation of how customer deliveries were made and how hazardous equipment and procedures were performed. The process mapping and quality system implementation followed, then the reorganization into a matrix structure. Along with this, employees have all the time been involved in process modeling.

5. Discussion

Our approach has been to try to analyze the effects of the EA approach on company agility from a practical point of view. Our key findings are as follows.

First, we find that all organizations in our study approach “EA thinking” in pragmatic and practical ways, consistent with earlier EA research [17]. None of them has followed a specific EA methodology or framework, and most of them start with quality management projects. Three of the organizations approach EA in a bottom-up style.

Second, the EA maturity levels are generally low. Only one of the companies (case D) took the full consequences of their approach and findings, and decided to reorganize completely. This company followed a path from a quality systems project into a full-scale top-down project including a complete reorganization. However, all companies seem to appreciate some of the central propositions of the approach described in Ross et al. [26] and have started on the job to determine their operating model in terms of the need for standardized processes and shared data.

Third, there are indications that EA increases organizational agility, as exemplified by case D. This should not, however, be attributed to particular skills in modeling or other EA practices, but to the fact that case D has institutionalized management practice and a culture for participation throughout the company. This is consistent with the findings in [25].

The other companies in the study have found that documented process models and higher maturity is

useful, although we cannot find increased agility. With higher maturity we mean a particular focus on standardized processes, shared data, and centralized IT decisions. This seems to provide a good tool for communication between top management and IT. Senior management supports the work in all companies, but the extent to which top management is able to drive the work seems to be very important, as we find in case D.

5.1. Two Paths from EA to Organizational Agility

We conclude that medium sized organizations indeed can use EA to build organizational agility under certain conditions. Considering our findings, we suggest two different paths from EA to organizational agility.

The first path we could call *evolutionary learning* (of which organizations A, B, C are examples), characterized by local initiatives and often grounded in quality improvement activities. The role of EA is to enable the linking of IT resources with specific sense and respond capabilities. For example, linking to external processes and systems may increase the sensing capabilities in some limited areas of an organization. We noted such examples in organization B.

The second path we could call *top-down design* (of which organization D is an example), characterized by holistic governance and a change of business culture. This is the general recommendation from the EA literature [26]. Companies with sufficient human and financial resources, and with top management commitment, may succeed, and profit from a top-down approach. The role of EA is more planned and comprehensive, and systematically linked to the business processes, as shown in the D case. Sensing and responding capabilities arise in this approach not from the direct linking with IT resources, but rather from the transparency of the enterprise through models and views of processes and information [2].

From this study it appears that SMEs with small profit margins and high dependency on continuous production for driving development will choose an evolutionary approach rather than a top-down approach. The same evolutionary path is followed by the quite big public company in case B, although for different reasons. In contrast, company D chose the top-down approach, with considerable success.

5.2. Limitations and Further Research

As this is an exploratory study we see that many questions remain. We acknowledge that the cases were

not selected on particular properties, and the depth of the case investigations could have been better. One threat to validity is subjectivity; we asked the opinions of people, and to a certain extent we relied on their assessment to evaluate the maturity of their own organization. We do not, however, believe that these weaknesses invalidate our results, but we agree that further research is needed.

As this study has shown, the relationship between EA and agility is a complex one, but the topic is theoretically worthwhile to investigate, and the practical implications may be very important for the IT community. In our future research we will continue to investigate the links between organizational agility and EA by selecting a larger sets of comparable cases across industries. Since organizational agility certainly may have other causes than EA, further research needs to investigate, in more depth, how contextual factors influence on the relationship between EA and agility.

6. Conclusion

This paper reported from an exploratory study on Enterprise Architecture, which has been proposed as an architectural and organizational foundation for organizational agility. Our research question was: *to what degree can medium sized organizations use EA to build organizational agility?*

Based on a case study with four organizations in Northern Norway we find that the adoption of EA principles is contingent and pragmatic, and that maturity levels are generally low. We do, however, find reasonable evidence for the assumption that EA (or EA thinking) is actually increasing organizational agility, in particular the capability to respond to external changes.

From our findings we identified two possible paths for organizations that aim to use EA for organizational agility. The first path, *evolutionary learning*, is characterized by local initiatives and often grounded in quality improvement activities. The role of EA is to enable the linking of IT resources with specific sense and respond capabilities. The second path, called *top-down design*, is characterized by holistic governance and a change of business culture.

7. References

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