A Survey on Enterprise Architecture Management in Small and Medium Enterprises

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Abstract: Companies need to control enterprise-wide processes and adopt matching actions. In the past, IT focused architectures failed to integrate other layers and functions of the enterprise. The connection between just business-focused and IT-focused managing has to be established in consideration to the dynamic environment, forcing for adaption and internal changing of enterprises. This paper defines important terms for understanding of Enterprise Architectures (EA) and its Management (EAM), its importance as well as its adaptability for small and medium-sized enterprises (SME). An empirical survey underlines the adaptability by researching the implementation of EAM in SME in practice. The survey shows that IT focus asserted by the literature sources is not realized in practice.

1 INTRODUCTION

Information Technology (IT) and other parts of enterprises have to act together if companies want to keep their competitive advantage and gain their shares of fast moving markets. It is essential to make the organization more sensitive towards the interaction of business strategies, customers, IT systems and organizational units. There is a need to support enterprises during the change from manufacturing to service and consulting oriented enterprises supported by IT systems. (Argente et al., 2010)

Caused by the number and variety of comparable and replaceable products, the pressure to manage the business processes and its technical support as a whole increases. One reason is the continuously accelerating development of IT as an important decisive influencing factor of companies because of its supporting, enabling and driving functionality. (Ahlemann et al., 2012)

The purpose of this paper is researching the adaptability of EAM for SME in practice by an empirical study, underlined by defining important terms in the field of EAM unambiguously, and finally to point out current gaps on this topic and understanding. After clarifying the used methodology and basic concepts, a survey design and its evaluation is presented. These findings are discussed with theoretical background.

2 RESEARCH METHODOLOGY

In the frame of this work a survey in appropriate enterprises as a quantitative data collection method. (Runeson, Höst, 2009) The results then are evaluated in respect of current EAM literature and approaches. Robson (2011, p.237) defines eight steps for designing and conducting a survey.

The following research questions were identified:

RQ1: *Do SME have a defined awareness of EAM?*
RQ2: *To which degree do they already have implemented EAM?*

Data collection was realized by means of a questionnaire. Due to the fact to enable a wide distribution in a given time frame, an internet based questionnaire was designed.

Since EAM activity in SME are investigated independently from their related industry sector, the survey's population is small and medium-sized enterprises. According to the survey's intention a non-probability sample was used. Next to being

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SME no other condition was applied for participation. Nevertheless, SMEs' top-level managements were asked to answer the questionnaire. In order to reach as many SMEs as possible, snowball sampling was applied. (cf. Browne 2005) Initially only SMEs known to the authors were addressed and asked to distribute the survey to other SMEs. Consequently, most participators were located in Germany. The questionnaire was distributed through www.soscisurvey.de[1], a free platform for online surveys and provides exporting the data in SPSS format.

3 STATE OF THE ART

In this section the most important concepts of this work are introduced as they are used by the author. These results are based on a prior conducted literature review. (blinded)

3.1 Small and Medium-sized Enterprises

Enterprises are complex and highly integrated systems comprised of processes, organizations, information and technologies, with interrelationships and –dependencies in order to reach common goals. (Razavi, Aliee, Badie, 2010, p.449ff.) Depending on the context, enterprises can be classified by quantitative and qualitative criteria.

The European Commission (2012-06-05) defines enterprises up to 250 employees with a yearly business volume of up to 50 million Euro or a balance sheet total of up to 43 million Euro as to SME. This paper uses the less restrictive definition of medium-sized enterprises by the German institute for SME research. Here, enterprises are considered medium-sized with less than 500 employees. (Institut für Mittelstandsforschung Bonn, 2012-06-23)

Qualitative characteristics are used for further analysis of the enterprises. They are used as entry points for discussions and comparisons. (Müller, 2009)To build the basis for the discussion of theory and practice in section 5, a number of such criteria relevant for SME are given.

The entrepreneur and owner of a small enterprise is often working in his own company. In medium-sized enterprises this task is often replaced and augmented by other activities like making decisions, depending on the amount of information about the environment, the risks and chances. As a result the decision processes of SME are often highly centralized. SME are typically characterized as enterprises with flat hierarchies, non-bureaucratic structures, limited resources (personnel and financial), operating in specific corners of the market or having a specific customer base, and the absence of fixed processes. The day-to-day business is specialized, but flexible to change based on the requirements of individual customers. Furthermore SME are often more focused on the operational planning and controlling than strategic aspects. The use of controlling instruments is often limited. In addition there is a big difference between the knowledge about the importance of such management models and the implementation of concrete measures. (Dörner, Rohde, 2009; Kardel, 2011; Mayer, 2011; Müller, 2009) While this criteria does not apply to every SME, statistics have shown that the majority of SME fit them. (Legenhausen, 1998)

[1] http://www.soscisurvey.de, 2014-01-28

3.2 Enterprise Architecture

No common definition of the term EA has emerged yet. Nevertheless the term Enterprise Architecture is widely distributed and accepted in science and practice. EA is commonly used if enterprise-wide IT systems have to be aligned with business processes. (Ahlemann et al., 2012; Goethals, 2006)

Enterprises focus on both cost efficiency and flexibility of the IT systems. There is interest in the long-term existence of IT systems since IT is a major element of costs and added value. (Hafner, 2006) There are persistent interrelations between organizational issues and IT. To stay competitive in providing business services, these have to be identified. (Lankhorst, 2013, Durst, 2006)

Models are developed to identify the complex dependencies within business and IT alignment. These interactions between business processes and information systems must be documented on all business levels. Therefore, EA models the elements, roles, responsibilities, systems, and their relations. (Alaeddini, Salekfard, 2011)

EA is the amount of different smaller architectures. The Open Group divides it into business, data, application and technical architecture. The specific implementation of EA is derived from a rich set of framework models and the economic situation. (The Open Group, 2011, Lankhorst, 2013)

The EA should contain strategic, organizational

and technical aspects as well as their interrelations. These aspects, its tools and effects have to be documented, consciously selected, monitored and maintained. (Targowski, 2003)

3.3 Enterprise Architecture Management

Ahlemann et al. (2012) describe the management of EA as a separate management discipline. The main challenges of EAM are understanding, controlling and managing complex EA and its implementations. (Rüter et al., 2010) EAM constitutes the process of the creation, documentation and long-term development of the Enterprise Architecture. The central task of EAM is active and target-oriented structuring due to changes of the EA. (Ahlemann et al. 2012; Lankhorst, 2013)

The expense and complexity of introducing EAM as well as the first documentation is a central problem for a variety of reasons All these difficulties can be handled, but the management should be aware of them, especially in the context of SME.

EAM is implemented due to growing IT-landscapes, internal (e.g. mergers) and external business factors, as well as increasing complexity caused by information technological, economic and social changes. (Matthes, 2011; Lankhorst, 2013)

EAM in SME

The expense of implementing EAM is affected by the company´s size. In general decisions can be made easier in small and medium-sized enterprises. Decisions on the architecture are made by specialized architects or architecting departments. In SME such resources will not be available. Regarding EAM in SME there only has been few research so far. (blinded) In order to support the transition process of growing SMEs (Jacobs et al. 2011) developed the SME EA Growth Model (SMEAG) by dint of case study research. The model enhances existing growth stage models by combining EA principles for change management, EA frameworks and operational models for business execution. By mapping several areas of concern (e.g. organizational structure) to stages of growth the work of (Jacobs et al. 2011) reveals that EA facilitates growth triggered transition for SME. The need for standardizations and integration of processes in the several growth stages becomes more transparent. This motivates this work to contribute in research for EAM in SMEs.

4 SURVEY DESIGN

This section describes the design of the questionnaire. According to RQ1 and RQ2 the main goals are the SMEs' knowledge about EAM, its current degree of implementation and perceived relevance of EAM models and its tools for the participants. As described in section 2 an online survey was conducted. A written questionnaire requires clear and unambiguous questions and answers to minimize confusion and reduce the time for taking this survey. (Lewis, Thornhill, 2009) The purpose of the questionnaire was to identify the need and importance of EAM for small and medium-sized enterprises. Based on the individual answers the degree of implementation should be identified. This points out how much EAM is already part of the business thinking in SME. As secondary goals for the questionnaire general questions about the business structure as well as the use of architecture and business tools are asked. The industry sectors of invited companies were wide-spread. The survey was anonymous. The questionnaire was accessible via link for 21 days from the 2012-06-11till 2012-07-01. The contact data was provided by online trade dictionaries. Overall there are 89 responses of the 355 distributed invitations to take part of the survey, resulting in an effective response rate of 25%.

Table 1: Department of the Respondent.

Answer	Responses	% of Responses	% of Cases
CEO/ Management	43	31%	73%
Personnel Department	12	7%	20%
Accounting	9	5%	15%
Finances	6	3%	10%
Legal department	9	5%	15%
Research and development	10	5%	17%
Manufacturing/Production	9	5%	15%
Quality assurance	11	6%	19%
Safety	3	2%	5%
Public Relations	5	3%	9%
Marketing department	14	8%	24%
IT	13	7%	22%
Hardware and technology administration	5	3%	9%
Sales/ Distribution	13	7%	22%
Logistics/ Materials	6	3%	10%
Customer Service	13	7%	22%
Property Management	2	1%	3%
Other	3	2%	5%
Total	**186**	**100%**	**315%**

The participation of organizational departments is shown in table 1 (multiple selection due to the possible combination of departments).

The questionnaire contains of maximum 58 questions (depending on optional and filter questions) and took about 12 to 15 minutes in general. The questionnaire was structure into nine logical parts as follows. The g*eneral* part asked questions about the respondent and its enterprise's organization. Then, the *enterprise's current state of EAM* was identified. The fourth part measured the respondent's understanding of EAM and its *perceived importance*. In the subsequent part the *organizational aspects* regarding planning and implementing EAM were investigated, before identifying *EAM's process instantiation* in the enterprise. Next, the respondents were asked, whether their enterprise uses means of cooperate *governance* and addresses *risk management*. In the end of the questionnaire the participants were asked, for which *purposes* they would use EAM and whether they actually use tools and methods for *business performance measurement*.

5 SURVEY EVALUATION

As recommended by the questionnaire the survey was answered mostly by personnel of the top-level management, the IT department and rarely the middle management. For companies that do not have departments the functional position can still be converted into an equivalent department. The distribution of age, centred at an age more than 40 years, reflects that for such a position skills, knowledge and life experiences are needed.

The assessment of the classification by company size is realistic: 57% were correctly classified as small, 34% as medium-sized and only 9% as intermediate forms. This agrees with the proportion of the respondents with 57% small enterprises and 42% medium-sized enterprises. The proportion of small enterprises in the study is much higher than the proportion of companies having departments. This illustrates that even small enterprises are introducing structuring elements for management. 15% of the 59 companies with departments have more than 40 employees in the department of the respondent. These companies are unlikely to be small. The majority (39%) have up to 5 employees in the department of the respondent. It can be assumed that the small companies belong to this group due to their maximum employee number of less than 50.

The participating companies are mostly active in IT, telecommunications, consulting and trade. More than half of them operate in a single country. Table 2 demonstrates that the rest mostly operates on one or more continents.

Table 2: Markets of Companies.

Answer	No. of Respondents	% of Respondents
One specific country	48	56%
Worldwide	4	5%
Combination of continents	26	30%

The structural EA components are mostly planned and decided on by the top-level management. 36% already have specific positions for an architect.

Efficiency, actuality and effectiveness of EA elements are rarely analyzed and controlled. The business operations are mostly semi-automated supported by IT. This seems to be related to the characteristics of SME: the majority of enterprises is private or family owned and for the majority the business owner is also the manager. Therefore all risks and difficulties come back to the manager and owner, who is working towards handling the important tasks like management, supplier selection as well as sales and marketing.

The majority of SME define the structural EA components (operational processes, responsibilities, IT systems, strategies, development condition) and about half of them implement them at least partially. Based on that, it is obvious that some small enterprises plan ahead in a well-organized fashion.

More than half of the responding enterprises support this understanding of architectural elements and business operations by enterprise-wide arrangements for planning, implementing and monitoring. The arrangement between appropriate departments and the IT department seems to depend on the specific tasks. Management is becoming more and more interested in such an implementation. The elements, necessary to implement the EA components, have to be coordinated and planned. The understanding of management is influenced by two factors. First, SME have to continue to work on schedule to satisfy their customers, even if there is a lack of fixed processes and production procedures. Second, the management understanding is adopting many of the recommendations like controlling, maintaining and the coordination of specific parts. Nevertheless the processes and responsibilities are mostly revised as required. 59% of the responded companies do have at least one person for the management besides the CEO, but a two-third majority does not distinguish between different management disciplines like Business or IT Management. Management does not consider IT a priority as they tend to bring in external specialists

or use standardized tools with the promise of taking care of the tasks. Business Management is understood as the alignment of capacities and orders, processes and timespans, personnel and developments. Typical controlling elements like cost-benefit-accounting are used. Specialized tools like Corporate Planner are the exception. Furthermore the costs and efforts for introducing such tools scare many companies, especially given the limited resources. Tools and methods should be flexible and adaptable (e.g. for different production lines).

EAM is understood as part of the strategic management needed to coordinate corporate and IT strategy effectively. (Ahlemann et al. 2012) It is helpful for clear responsibilities, clear structure models and the formalization and simplification of processes reaching transparency and competitiveness.

The relevance of IT and EA in general is independent of the age of the respondent, even if both fields are comparatively new developments. This is also reflected by businesses declaring their goals and the corporate philosophy.

IT is a determining factor of organizations and the management. It have to be used in the current century. It was originally assumed that IT systems are generally well-defined and controlled. The survey cannot support this assumption. The majority of responding companies have undefined IT landscapes, but assess their preparation for dealing with IT risks as medium to well. At first this seems to be paradoxical, but it does not have to. There are many standardized software products that include protection mechanism (e.g. the Windows Firewall) without user involvement. This agrees with the annual or irregular revision schedule of the systems. Backup and restore concepts and systems are often bought as integrated solutions.

The loss of key personnel is considered as a major problem due to the limited number of employees in the companies, the expert knowledge of specific positions and the decreasing flexibility to take these tasks.

As a conclusion the responding enterprises are open-minded towards the usage of EA as well as EAM to reach a long-term conceivable, integrated architecture of structuring and developing. Their commitment is demonstrated by working more and more on defining and fixing their elements and operations, even if the analysis of them is still insufficient. According to the distribution of small and medium enterprises, the development of architecture positions even in small companies can be recognized. Unfortunately many of the available management disciplines and their tools are not targeted towards SME or are not seen as candidates by them. Their interest in EA and associated methods for optimizing the daily businesses by an integrated management is increasing. Even though the IT systems are undefined by the majority of companies, an alignment of IT systems and business processes is considered when benefits are recognized. Therefore it is not surprising that the provided capability to meet this commitment is rarely undeveloped. SME are aware of costs and efforts, as well as doing essential tasks on their own and certainly not fully automated by IT support. The development is heading into the right direction by defining architects and believing in the use of tools that are flexible enough to adapt them to industry sectors, markets, targets or skills.

6 DISCUSSION

This section tries to compare theory (section 3) and practice (section 4). The importance of small and medium-sized enterprises for the economy must be stressed because most of the employees are working in this kind of companies. They are an important and large factor for the markets and the economical balance. For example, the vast majority of employees, about 99%, in Germany work in small and medium enterprises. (Legenhausen, 1998)

Research question 2 of this study was whether small and medium-sized enterprises have adapted the use of EAM. For this purpose it is important to understand what EAM is about and how it should be modified for SME (RQ1). The second issue is, what difficulties SME face when introducing EAM.

For the first issue (RQ1) it must to be stressed that EAM as an integrated management of enterprise-wide elements (e.g. processes) and the corporate components (e.g. strategy) is an accepted method for large enterprises. Business activities and the supporting IT have to be aligned. Based on the literature, the characteristics of large enterprises are quite different than the ones of SME. This results in the need to adapt the management aspects and tools to the interest, capabilities and possibilities of SME. As written in section 3, SME are characterized by flat hierarchies, limited resources, the absence of fixed processes and operating in specific corners of the market with a specific customer base. The study agrees with that by showing that not all of the responded companies have departments (table 3), choosing a combination of fields of activity and

being aware of efforts and costs to support their daily business.

Table 3: Share of Having Departments.

Answer	No. of Respondents	% of Respondents
Yes	59	69%
No	27	31%

But there is a clear tendency of introducing an integrated management by fixing the corporate components in writing and defining the EA elements, even if the majority just implemented them at least particularly. Almost half of them already use tools for business planning and having a specific architect position seems to become more prevalent. The questions relating the corporate culture show that the companies are informed about structuring and developing the organization. Surprisingly the study highlights a gap between undefined and defined and fully implemented IT systems.

To what extent the EAM elements are defined and already implemented is shown in table 4. Operational processes, responsibilities, IT systems, strategies as well as planning and implementing development conditions are mentioned as EAM elements.

Table 4: Structural Definition of EAM Elements.

Answer	No. of Respondents	% of Respondents
Defined but not implemented	4	5%
Defined and particularly implemented	47	55%
Defined and implemented	25	29%
Undefined	10	12%

As explained in the survey evaluation this might be correlated to the oversupply and standardization of IT systems. This can result in growing IT landscapes with an associated hidden cost for the daily business. This is the strongest motivation for introducing EAM. In short, SME are adaptable to use EAM.

The limitations are based on the SME characteristics. It is often mentioned that they are aware of the resources needed, the effort to select, implement and maintain such architectures, as well as the guarantee of benefits. All these doubts are substantial for the SME perspective. The cost-benefit ratio has to be right. If companies are just taking input to introduce such tools and the business is not getting more efficient, the investment was useless. As a result, the benefits have to be made clearer and the willingness of SME to invest into such tools should increase.

In accordance to the empirical study, the companies are demonstrating commitment in an advanced stage (RQ2). Defining elements and corporate components gain in importance. 77% of the responding companies believe that the importance of EA increased in the recent years. Three-third of the responded rate the importance of EA for business success as medium to high. The awareness of costs and efforts captures the underdeveloped capability to meet this commitment. The willingness to fully implement EAM is there. An introduction of enterprise-wide management can be recognized, but it is still unsystematic and unstructured.

According to the second issue, the difficulties SME face when introducing EAM are efforts and costs they have to spend on defining and implementing the specific elements, their alignment and maintenance. The willingness to invest needs to be improved.

Especially for medium-sized enterprises the EAM has an increasing importance due to the role of IT and the increased need of international competitiveness. This is explained by the large amount of information for production and value chain processes, environmental changes and developments as well as increasing international operations. Underestimating the gains in efficiency by the management, integrating EAM into the specific organization inhibit the implementation. (Mannmeusel, 2012) Finally, the respondents characterized their understanding of supporting EAM aspects by the answers illustrated in table 5.

Table 5: Characterization of EAM by SMEs.

Answer	% of Respondents
Clear responsibilities	21%
Competitiveness	13%
Clear structured models	12%
Transparency	12%
Formalization &simplification of processes	11%
Need of management for controlling and adapting	7%
Impact on the economics	6%
Quality assurance tool	6%
Tool to address specific objectives	4%
Independence from external influences	3%
Tools of business management independently of specific business objectives	3%
only usable & interpretable within the company	1%
Once developed, eternally usable	1%

7 LIMITATIONS

This work is limited by the selected literature sources due to being available at our University network, Springer Link database or the World Wide Web.

The empirical study is limited by its timeframe to access the online link. The study was done over a timeframe of 21 days. This duration was chosen to get a reasonable response rate. A longer timeframe might have provided additional responses.

The enterprises were selected based on personal and business contacts. To provide additional responses a few well known regional companies were contacted. A more thorough list of enterprises could have been created by systematically going over business contact directory, but such cold calls generally have a small response rate. This could be facilitated by dint of probability sampling designs.

The covered industry sectors are naturally limited by the aforementioned selection. The distribution of business sizes is 57% small and 34% medium enterprises. This balance could be tipped in either direction by changing the selection process.

The survey was published only in German and English. This is explained by the origin of the invited companies. It is assumed that the language selection is comprehensive and provides no unnecessary barrier.

8 CONCLUSIONS

The results of the survey form the basis of this work. The terms relevant for understanding the topic are defined. As an introduction into the field of EAM the theoretical basis is created. According to the empirical study done in this paper the adaptability of an integrated management as EAM is explained and evaluated.

The study shows that the usage of EAM is often incorrectly focused only on IT by literature sources. In contrast there is already knowledge about the importance of processes, strategies and organizational aspects in practice. The connection between business-focused and IT-focused managing has to be established in consideration to the dynamic environment, the changing markets and structural changes within the companies.

SME are struggling with the basis of organizational structuring like selecting and leading personnel, the alignment of processes to the timespans of orders to be accomplished and increasing bureaucracy.

The overwhelming offer of tools and methods, always promising benefits without efforts and costs results in many companies to two facts. At first, the supporting management tasks are currently carried on their own. At second, companies are increasingly aware of the available tools.

9 OUTLOOK

The study identified a number of issues requiring further research. The findings of this work need to be extended by validating the survey's results, which could be facilitated by a next deepening survey in SME industries.

Furthermore, this study could be extended to focus more strongly on small enterprises, or only on medium-sized enterprises. A comparison of independent evaluations for the different size classes could clarify the transitions and restrictions of implementing EAM.

Another topic is clarifying the borders and transitions between different management disciplines to point out the importance of EAM in comparison to the other ones. The challenges and advantages of EAM in comparison to single management systems in an enterprise could be stressed; unambiguous definitions of them are essential to be made. Furthermore the understanding and usage of EAM by SME could be directly compared to large companies as part of an empirical study.

The changing attitude of SME is also a promising topic. The characteristics of ownership or hierarchies cannot be eliminated that fast, but some of the criteria might be in change like the definition of elements and corporate components, as well as the increasing interest in supporting tools and the decreasing focus on IT systems. This means that the classic preconception about SME may no longer be valid.

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