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Institute of Data Science and
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L I T H U A N I A**



INFORMATICS ENGINEERING (T007)

**AGILE ENTERPRISE APPLICATION
SOFTWARE DEVELOPMENT
EVALUATION USING ENHANCED
ENTERPRISE ARCHITECTURE
FRAMEWORK**

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1 Foreword

Results presented in this technical report are directly related to the research aims and object of doctoral studies and future dissertation.

RESEARCH OBJECT, AIM AND OBJECTIVES OF DOCTORAL STUDIES

Research object:

Alignment of Enterprise Application Software (EAS) design (functional requirements, system architecture) to strategy driven capabilities and business process including changes to functional requirements in an Agile environment.

Research aim:

Present an alignment method and a prototype of software for aligning EAS functional requirements, system architecture to strategy driven capabilities (constraints for EAS) that would ensure continuous alignment.

Research objectives:

- 1 Investigate methods and software tools for alignment of EAS development in an Agile environment to requirements for business management.
- 2 Investigate possibilities to utilize enterprise architecture frameworks to solve the problem of alignment.
- 3 Present business activities and EAS development alignment method, which includes evaluation of alignment and ensures continuous alignment of software being built by using modified enterprise architecture frameworks.
- 4 Present a software prototype for evaluating alignment of EAS development to business management requirements.
- 5 Conduct an experimental evaluation of proposed method and a comparison of created software prototype to tools of other authors in this field and evaluate results obtained.

2 Introduction

Business strategy execution has been identified as a problem a long time ago. In 2008 R.S. Kaplan and D.P. Norton presented their research [1] where they state that “various surveys <...> indicate that 60 to 80 percent of companies fall far short of the targets expressed in their strategic plans.” Various research by Hrebiniak [2], Kaplan and Norton [3] and others [4, 5, 6] identify that the problem is still valid and relevant. This means that a lot of resources (money, time) is wasted trying to unsuccessfully implement business strategy and there needs to be a solution found to solve this problem. Business strategy execution has a direct impact on utilizing business capabilities.

Organizational capability in the context of business capability dates back to 1987 when Ulrich [7] described organizational capability as “the firm's ability to

manage people to gain competitive advantage”. Organizational capability is what connects the financial, strategic and technological capability of the organization. Business capability is any endeavor that helps an organization to achieve its goals. The most efficient business strategy execution is utilizing key organizational capabilities often based on the level of competence in a department in the organization or individual domain knowledge of people in the organization.

There are various researches on how business strategy execution could be supported in utilizing IT capabilities. Henderson and Venkatraman presented business strategy alignment with the IT strategy model thus providing an analysis method aimed for competitive advantage [8]. Another approach is to use enterprise architecture frameworks such as MoDAF [9], TOGAF [10], Archimate [11] and others to overview and utilize overall organizational capabilities.

Quite often business strategy execution is based on various project implementation. Usually, Agile approach is used to achieve organizational goals or deliver the value for the customer and improve time to market for IT-related product development whether it is a new entertainment application or complex IT system. However, using an Agile approach means business decisions need to be taken quickly, on-demand when the development team needs to know business decisions that impact their product or project development. Such a quick pace means that business must be always ready to provide support (knowledge of project related problem domain) to IT development, and if it's not, that might cause IT development to be stopped because it is not aligned with organizational goals as identified in business strategy and captured in enterprise architecture frameworks, therefore it was decided to do a research based on aligning information captured in the enterprise architecture models with delivery lifecycle of business strategy utilization through delivering IT projects in Agile environment to find out does the alignment bring improvement of project delivery efficiency in terms of time and cost savings. It was found out through a case study of 3 enterprise application software projects that the suggested method improves the project delivery by 15% on average by reducing the number of tasks that is done throughout the project by still keeping the same level of scope.

Organizational capabilities and overall organizational “map” from the as-is situation and to-be situation is best described using enterprise architecture frameworks.

Enterprise architecture is a well-defined framework for conducting enterprise analysis, design and implementation of relevant IT necessary to execute their strategies, to guide organizations through the business and technology changes. The history of “Enterprise Architecture” started in 1987 when J. Zachman coined the term [12]. The first version of one of the most widely known frameworks TOGAF – was created in 1995. Different enterprise architecture frameworks emphasize different aspects of the enterprise. Recent researches show the topicality of enterprise architecture and a need for even further research [13]. However, enterprise architecture is often perceived as high-level overview that does not bring value to daily business strategy execution – specifically projects delivery, where ongoing questions arise that require quick response in order not to have delays in project deliveries while waiting for reference how the requirement in project is related with any part of enterprise architecture and what action should be taken project-wise to adhere to organizational goals in the best way. However, I believe that information captured in enterprise architecture

models has most if not all information needed to answer the questions that arise executing business strategy through IT projects in agile project delivery.

The agile approach for software development is becoming an increasingly popular software development methodology. Agile approach could be used not only in software development but in most product development-oriented business cases. So-called traditional or “waterfall” project management approach becomes less and less efficient when it comes to accepting changes that emerge during the lifetime of the project.

As Pikkarainen et al. states [14] companies are becoming Agile in order to improve the productivity of product development teams. Business development teams are also making business-related product development decisions based on the Agile methodology approach. For a company to become Agile means changing the mindset of employees or orienting them towards accepting emerging changes instead of strictly following product development plans or roadmaps. It also means that employees in all levels of organization needs to adapt to the new way of working, which is getting the results of their daily duties evaluated much faster than in the traditional way of working. However, when “going Agile”, the overall goals of the organization are not always supported with an organizational change. There are researches that emphasize the importance of supporting the agile way of working from an organizational perspective (provide appropriate physical atmosphere, work environment that encourages creativity) [15]. The gaps between business and IT strategies appear. It might result in not sufficient quality of software products, that are not in line with the overall goals of the organization both short and long term.

As Portman has described in his book “Scaling Agile in organizations - Guide for project managers and Agile leaders” Agile has over 15 different frameworks [16]. The most popular Agile software development frameworks for team level are Scrum and Kanban. For enterprise or large scale Agile LeSS, SAF’e and others are used.

3 Related works

There is a significant number of research done in the IT and business alignment area where the starting point could be identified in Henderson’s and Venkatraman’s alignment framework distinguishing two alignment dimensions (business strategy and IT strategy) [8]. One of the most well-known methods is Guidelines Regarding Architecture Alignment (GRAAL). The GRAAL is a conceptual framework providing a collection of concepts and relations among them [17]. But these and other notable methods are conceptual and not adapted to be used in most popular enterprise architecture modelling tools.

Other approach is service-oriented architecture (SOA) based methods like BITAM by Chen et al. [18]. BITAM uses a twelve-step process for managing, detecting and correcting the misalignment at the architecture level. Also, SBISAF framework by Morkevicius et al. [19] is a SOA based framework that has its implementation in MagicDraw CASE tool using UPDM enterprise modeling language and proved to significantly reduce the misalignment between business and IS in the enterprise model.

However, most of the suggested methods take significant time to evaluate the misalignments, and although they provide metrics to track misalignments, models still need to be translated to project requirements or the requirements themselves should be adjusted manually, therefore more automated solution is demanded.

4 Case study

The problem was researched using inductive method. Once delivering IT projects there was a pattern observed between similar enterprise application software project that they tend to have requirements late in the project delivery lifecycle that are based on organizational strategy implementation (i.e. “Leading customer experience”) which is translated into several priorities or capabilities (i.e. “Interactive sense of digital experience”). Based on the observations a method was created to identify the misalignment of information between information captured from organizational strategy to enterprise architecture framework and the information the development team has that works on executing the projects to utilize organizational capabilities and execute business strategy. Based on the method, a case study as an analysis method was done to prove the effectiveness of the method.

Once delivering projects in a Scaled Agile framework (SAF’e) [20] environment there were observations done on 3 enterprise application software projects. The project specifics are that they are delivered in an Agile environment using Scrum framework on a team level and on enterprise level – Scaled agile framework (SAF’e). The input for project requirements is gathered from 4 different Nordic countries working on one core process for each project. There are minor deviations in the detailed process of each country and the enterprise application software project must also address these deviations in final version of the solution. Also from enterprise perspective the dependencies between other teams working in the same area on their own project deliveries must be addressed and aligned as part of SAF’e.

The requirements in the format of user stories, change requests and bugs were analyzed during the project lifecycle of 8 to 12 months. The results are displayed in Table 1 below.

Table 1. Enterprise application software projects requirement distribution

Parameter	Project #1	Project #2	Project #3
Initial requirements	138	224	236
Change requests	273	173	36
Bugs	135	252	304
Project duration	8 months	12 months	10 months

When manually using the suggested method to minimize the information gap in business strategy execution and Enterprise application software development project delivery the data was analyzed and findings are displayed in Table 2.

Table 2. Enterprise application software projects requirement distribution when using suggested method

Parameter	Project #1	Project #2	Project #3
Initial requirements	138	224	236
Change requests	238	146	30
Bugs	107	238	304
Project duration	8 months	11 months	10 months

As it was observed, the initial set of requirements did not change due to the fact, that the information gap between business strategy execution and enterprise application software development project delivery arises during sprints or product development. But in change request and bugs categories, the differences are quite significant as in the 1st project the number of bugs was reduced by more than 20 % and in project 3 the number of change requests was reduced by more than 16 %. The comparison results are displayed in Table 3.

Table 3. Enterprise application software projects requirement distribution comparison

Parameter, %	Project #1	Project #2	Project #3
Initial requirements	0	0	0
Change requests	-12,82	-15,61	-16,67
Bugs	-20,74	-5,56	0
Project duration	0 months	-1 months	0 months

The results of the research above are presented in figure 1 below.



Fig. 1 Research results

The savings observed should be evaluated based on their required development effort and based on the average hourly cost of developer, the cost savings can be calculated.

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