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# Adapting IT Governance Frameworks using Domain Specific Requirements Methods: Examples from Small & Medium Enterprises and Emergency Management

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## ABSTRACT

IT Governance methods and frameworks have been applied in most large for-profit organizations since these enterprises realize the benefits of IT Governance for their business. However, former research and our own surveys show that frameworks such as ITIL and COBIT are not very well established in Small and Medium Enterprises (SME) as well as in Emergency Management (EM) organizations. Thus, we investigated what kind of barriers can be the cause for the low adoption rate. These results built the basis for our Domain Specific Engineering (DSE) approach. The research is based on the data of two research projects. The first project investigated the utilization of ITSM methods in European SMEs, and the second has researched different emergency management organizations. This paper defines similarities and differences of the two domain specific solutions, describes the engineering approach, and gives guidelines for further research in other domains.

## Keywords (Required)

Domain Specific Modeling (DSM), Domain Specific Engineering (DSE), Small and Medium Enterprises (SME), Emergency Management (EM), IT Governance, IT Service Management (ITSM), IT Infrastructure Library (ITIL), IT Business Alignment

## INTRODUCTION

This research paper is based on two research projects about the adoption of IT Governance and IT Service Management (ITSM) in specific domains. During the two research projects, the first about IT Service Management (ITSM) in Small & Medium Enterprises (SME), and the second addressed IT business alignment in Emergency Management (EM), we realized that both domains have difficulties to align and maintain their existing technologies and IT services in an appropriate matter. Thus, we concluded that managing today's complex IT and business simultaneously is a tremendously hard job for domains that differ from major industries.

The domain of SME was chosen since it represents the largest share of all enterprises in the European Union. It is therefore recognized as socially and economically important. The domain of Emergency Management was chosen since EM organizations and related public administration units become increasingly important in today's society since terrorism and natural hazards are on the rise. However, compared to large enterprises IT Governance issues have not been well researched and established in either of these domains. This let us conclude that conventional IT Governance and ITSM methods are of limited use for these domains (Di Renzo et al. 2003; Fink 1998; MFG 2011; OECD 1993; Rao et al. 2007; Santos et al. 2008; Vogt et al. 2011).

Consequently, we formulated our research question:

*What are the barriers which prevent the domains of SME and EM from a successful IT Governance implementation and how can we adapt existing IT Governance methods in order to overcome these barriers?*

The structure of the paper is as follows: First we will give a theoretical background on relevant research in IT Governance / ITSM and its application in SMEs and EM as well as a short overview of domain specific engineering approaches. This is

followed by a brief description of the methodology, which was used to collect and process the data. In the main section of this paper we will show the lessons learned from the surveys and the case studies. We will also illustrate the designed process of a domain specific ITSM / IT Governance method. Towards the end of the paper we discuss limitations of this research project and give guidance for future research. In the last section we summarize our findings.

## **THEORETICAL BACKGROUND**

### **IT Governance & ITSM Frameworks in relation to SME and EM**

#### *General*

IT Governance and IT Service Management (ITSM) have inherited much from Corporate Governance and operational IT Management, but have developed into a discrete discipline with internationally recognized frameworks and standards such as Control Objectives for Information and Related Technology (COBIT), Value of IT (VALIT), IT Infrastructure Library (ITIL), ISO20000 and ISO38500 (Bhattacharjya et al. 2007; IT Governance Institute 2003; Luftman et al. 2007). Peterson (2003) and Van Grembergen et al. (2003) suggest that IT Governance should be implemented by a framework of structures, processes, and relational mechanisms in order to be effective. According to Luftman & Kempaiha (2007), IT Governance and its related frameworks and methods are enablers of strategic IT alignment. Their goal is to enable the transition from a strategic to an operational level without losing the focus on business objectives.

The link between IT and the business is the crucial factor in IT Governance (Van Grembergen et al. 2009; Van Grembergen et al. 2003). This is not only applicable in large organizations but also in SMEs and EM organizations. Even though some of the SMEs and smaller EM organizations might not have a designated IT department, it is crucial that any person who is in charge of IT decisions (e.g. the owner of the business or the chief of a fire department) is aware that every single IT investment and IT service needs to be aligned to the business strategy. According to Porter (2008), any single action in a business needs to add value otherwise the action must not be taken. Low value adding or non-value adding activities such as over-expenditure on IT, or IT service shortfalls due to false economies are even more important for their success or failure since financial and human resources are usually very limited (Di Renzo et al. 2003; Fink 1998). In EM a false investment can even be worse since lives might be at stake. Therefore, the orchestration of IT functions and non-IT functions within these organizations should be made clear to decision makers in order to gain leverages and free resources for innovation and competitive advantage in SMEs, and add public value in EM (Duffy 2002; Luftman 2003; Weill et al. 1998).

#### *Small & Medium Enterprises (SME)*

Scientific publications about IT Governance / IT Service Management in relation to SMEs are limited. There is little evidence to suggest that the basic IT problems that trouble SMEs have been resolved, which supports our contention that new approaches are needed.

Starting in the early 1990's the "Organisation for Economic Co-operation and Development" (OECD) wrote a report about Small and Medium-sized Enterprises and their relation to technology and competitiveness. It was realized that IT would have a high influence on SME, but the accompanying special issues and opportunities were not clear (OECD 1993). The OECD paper was followed by Fink's (1998) article about IT adoption issues in SMEs. In 2003 Di Renzo & Feltus published a paper on how very small enterprises (VSE) can assess their processes with the NAOMI approach, which utilized ITIL as a basis. Mastrianni et al. (2007) discussed a flexible architecture to support the delivery of IT systems management services for SMEs. In 2009 Ayat et al. published their work on 'CMDB Implementation Approaches and Considerations in SME/SITU's Companies'. The most recent papers were written by Zhen et al. (2010), in which they talk about 'SME Oriented Service Delivery Mechanism and an Implementation', and the OECD (2010) where they reflect IT driven innovation in SMEs and talk about yet unsolved issues.

As one can see IT issues in SME's have been known for almost 20 years but they remain unsolved. Most of the literature supports the statement that a holistic approach to implement IT Governance methods in SME is still needed but is still missing.

#### *Emergency Management (EM)*

IT has been a topic in EM for decades but Van den Eede & Van de Walle (2005) were the first to investigate the utilization of IT Governance methods in EM (National Research Council (NRC) 1999). Since then, only a few other researchers have picked up the topic. Wang & Belardo (2005) wrote an article about strategic integration of knowledge management in crisis management. They concluded that there is a need for organizations to establish what they really need in order to be better prepared, but the unpredictable nature of disasters is a problem for conventional methods. Dwarkanath & Daconta (2006) wrote an article about Service Oriented Architecture (SOA) in emergency management. They concluded that in order to design a SOA for emergency management enterprises, the overlaying governance component needs to be agile and flexible to

accommodate the diverse stakeholders and their interests. In 2007 Rao et al. published a United States Federal Emergency Management Agency (FEMA) paper showing that IT has yet unrealized potential since most emergency managers cannot capture its value for their processes. Iannella et al. (2007) examined the needs and requirements for IT systems in EM organizations and identified that emergency management is not a discipline that follows well behaved rules and can be captured with standard models. More recently Weyns & Höst (2009) picked-up the topic of IT management and governance and investigated towards a maturity model for Swedish municipalities in order to measure their IT dependability in disaster situations. Latest publications in that area of research show that the application of IT Governance methods is still an issue in this domain and that existing methods are barely used by emergency managers since their unrestricted applicability to this domain is questioned (Vogt et al. 2010; Vogt et al. 2011).

These few papers show that research in this area is scarce. We concluded that IT Governance in EM has not been well researched due to its non-commercial character and the unpredictable nature of the context precludes many off the shelf commercially oriented solutions.

**Domain Specific Engineering (DSE)**

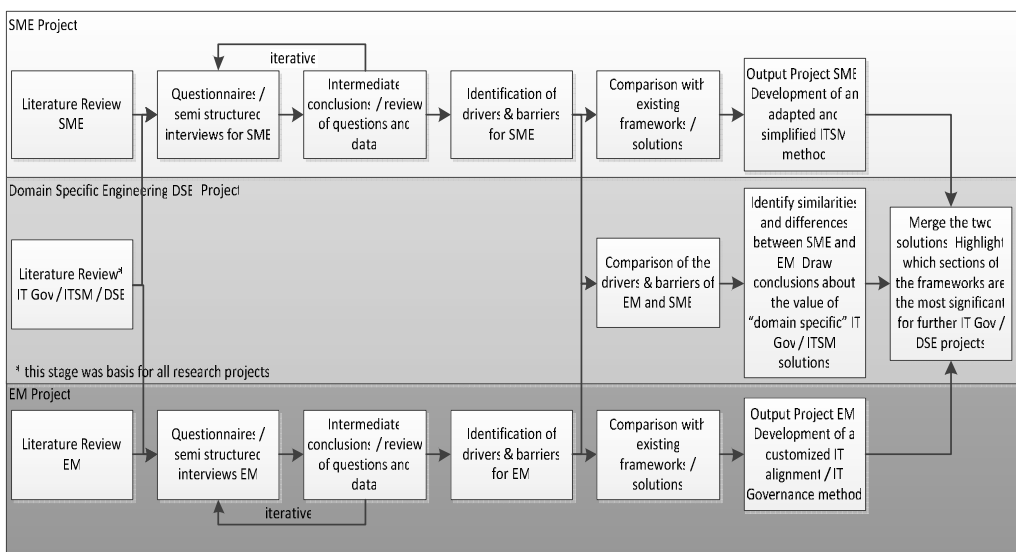
“Before processes and tools can be designed we must know the requirements. Before requirements can be expressed we must understand the domain”(Bjorner 2010), this adapted version of Bjorner’s introduction to ‘Domain Engineering’ is simple, yet it reflects the basic idea behind this modeling approach. From the literature and our own surveys we learned that the researched domains have special rules and requirements compared to large enterprises. Things which work effectively in a multi-national corporation must not necessarily work in a local carpenter’s shop or during a highly uncertain disaster scenario. We see domain specific engineering (DSE) as a method, which could help to adapt existing frameworks towards the needs and requirements of special domains. Consequently, we must first establish precise descriptions of the domains; then, from these descriptions, we “derive” the domain’s requirements; and from those we can model the appropriate processes and design the tools to support entities of this domain (Bjorner 2010).

Considerations of domains in software development have always been there. Jackson wrote about domain specific development in 1975 already. His view has been followed by a few other researchers, which explain the close association between domain knowledge and refinement of requirements. The DSE approach helps to bridge the gap from a vague requirement, often expressed as assumptions, to a more detailed and implementable specification (Jackson 1975; Zave et al. 1997).

Even though most domain specific engineering approaches focus on software development, we think it can also be used to alter existing IT Governance methods and ITSM frameworks towards the requirements of a specific domain.

**RESEARCH METHODOLOGY**

As mentioned above, starting points of this research were a project to foster ITSM in SMEs and results from an Australian / European project about IT Governance in Emergency Management organizations. Both research projects were mainly based on qualitative studies utilizing surveys, interviews and case studies as information resources.



In order to cope with the different disciplines and information resources from literature, interviews, observations, and case studies we decided to combine different research methods. We utilized qualitative and quantitative approaches as well as triangulation in order to tackle the rather complex and multi-disciplinary research project. However, the qualitative part has built the foundation of our research since qualitative research methods have become increasingly useful

**Figure 1: Research Steps**

as the focus of information systems research shifts from technological to managerial and organizational issues (Klein et al. 1999; Mayring 2000; Myers 2008).

For the iterative process of the qualitative data analysis we utilized NVIVO8 as our research tool and the Qualitative Content Analysis (QCA) as our guiding research methodology. QCA is a methodology based on hermeneutics and can deal with diverse sources of information and different abstraction levels. With QCA a researcher can summarize statements, look deeper in their meaning and then build a categorization system and structure to draw conclusions. This categorization structure enables other researchers to follow a researcher's conclusions. Such a structure also ensures validity and reliability since it shows the researcher if a conclusion is based on weak or strong evidence (Mayring 2000).

The first step in both projects was a thorough literature review to build up a sound theoretical base. Based on the theoretical foundation we built a preliminary set of questions for initial interviews. Based on these intermediate results we iteratively developed our final set of questions in order to derive domain specific requirements. Motivation of this research stage was to identify drivers and barriers in each particular domain. Since the previous research projects had already identified the drivers and barriers for each domain, the focus of the current project was to identify similarities and differences of the two domains, and highlight the most promising areas. Figure 1 illustrates the relevant research stages in more detail.

Since both projects were not entirely done by the same team and the focus of the preceding projects were not exactly the same, we had to find similarities on a more abstract level and review some of the data from a different perspective. Again the QCA helped us to restructure the primary data in order to massage the two projects together. Another issue was the dissimilar data quantity and quality. For the SME domain we had data from 160 surveys and 24 case studies; interviewees in the SME domain were IT managers and business owners of SMEs across Europe. In the EM domain we had, due to its limited accessibility, only 14 semi-structured interviews of 1-1.5 hours each, four minor case studies at first responders and critical infrastructure providers, and two major cases studies at federal/state agencies in Australia and Germany. In all cases we interviewed C-level Managers, IT Managers, IT personnel and/or EM operations personnel. However, the interviews and cases in the EM domain were much richer and more detailed compared to the data from the SME project. We kept this imbalance on quantity and quality in mind for every conclusion we drew during this research.

Based on the findings from existing literature, the surveys, and case studies, we had a detailed view on domain specific business processes in both domains and compared them with existing IT Governance frameworks in order to identify strength and weaknesses. In this stage of our research we used ADONIS and ADOit to model, analyze and compare relevant processes to draw further conclusions (Karagiannis 1995; Karagiannis et al. 2002).

## ENGINEERING PROCESS

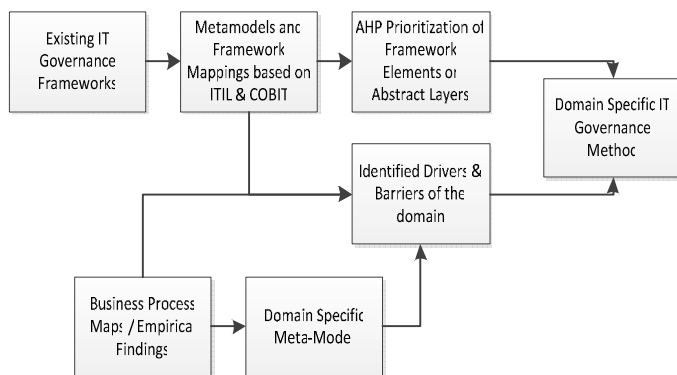


Figure 2: Engineering Process

Previous research has identified that IT Governance frameworks such as ITIL and COBIT are used in individual ways since different organizations have diverse motivations and needs. One way to tackle this problem is to build metamodels and identify recurring patterns, which lead to a better understanding of causes and effects (Looso et al. 2010).

In order to build a domain specific IT Governance method we had to get to know the domain's needs, identify their barriers and follow a suitable requirements engineering method. Our approach to design a domain specific IT Governance model is shown in Figure 2.

ITIL and COBIT metamodels, as well as framework mappings, were taken from previous research projects, which also dealt with IT Governance metamodeling and application issues (Goeken et al. 2009a; Goeken et al. 2009b; IT Service Management Forum 2008; Looso et al. 2010).

## Screening the Domains: Framework Awareness & Implementation Rate

Besides other findings the most crucial for our customized IT Governance method is the actual awareness and utilization of ITSM / IT Governance frameworks within the researched domains. The following figure shows the awareness of relevant frameworks and the implementation ratio in the domain of SMEs and EM.

As one can see in the figure below there is a big gap between knowledge of such frameworks and their application in SMEs and small to medium EM organizations. The left side of Figure 3 shows that only 52% of all SMEs are aware of frameworks like e.g. ITIL and less than 10% already use them.

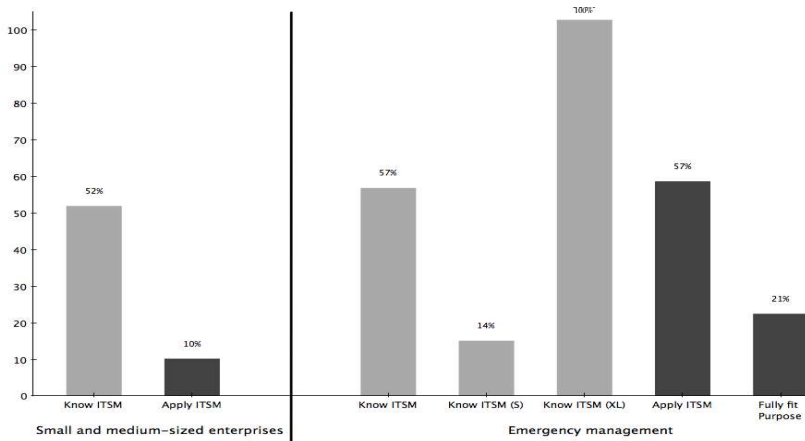


Figure 3: ITSM / IT Governance Awareness & Application in SME / EM

If we look at the right side in Figure 3, it seems to be slightly different in the EM domain. All EM organizations that were aware of ITSM / IT Governance implemented it to some degree. However, it is interesting that all large / extra-large EM organizations (marked 'XL' in Figure 3) know ITSM / IT Governance and also implemented it. But only 14% small-medium organization (marked 'S' in Figure 3) made attempts to utilize such frameworks. The most interesting part is, however, that only 21% of all EM organizations say that existing frameworks are fully applicable in their organization. Some even say they implemented ITSM only because they had to comply with the upper government body or the parent company.

Interestingly most of them are large private critical infrastructure providers or private non-for-profit organizations. Thus, we tried to analyze this phenomenon by conducting in-depth interviews with department leaders and specialists in the field and drew the following conclusions why ITSM / IT Governance isn't that well adopted in these domains.

**Drivers & Barriers**

The identified barriers and drivers influence decision makers who must decide on the adoption and usage of IT Governance

methods. Thus, the drivers must be supported and highlighted by the prospective method. Drivers can be also addressed very well as motivation for potential users of the method. The barriers we identified must not necessarily be an issue for every SME or EM organization, some of the barriers might even be an issue for larger enterprises but their effect should not be that severe. Therefore, this collection must be seen as a profile of the researched organizations only.

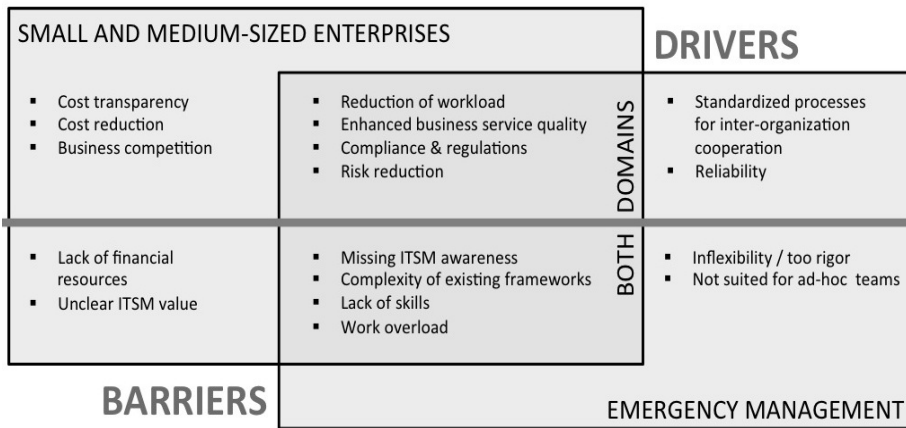


Figure 4: Drivers & Barriers in SME / EM - Similarities and Differences

Barriers are the main challenges in the two domains and have to be eliminated or at least mitigated by an ideally adjusted method. However, a particular problem is that even a single barrier can prevent a possible implementation in an organization. From a methodological point of view, the support of drivers and the elimination of barriers in a domain are the basic creation targets on which the resulting method and tool based implementation can be finally measured (Frank 2010).

Our approach addresses these barriers with a simplified ITSM / IT Governance method, which brings together business and IT strategy alignment, planning, implementation, operation and controlling of IT Services in a very simple and modular way.

**Mapping Frameworks to Domain Specific Needs**

In order to find out which of the frameworks are the most suitable for the researched domains, we started to divide the usual business process of SMEs and EM organizations into 'action phases' and then mapped suitable frameworks accordingly. The mapping process was done by analyzing business process maps from the case studies and conducting detailed interviews with stake holders in the different organizations. The findings and insights were discussed in an expert panel consisting of

researchers, IT managers, and key personnel of these domains. The panel identified COBIT and ITIL as the most suitable frameworks to begin with, so we focused our assessment on these as the predominant frameworks.

The following two tables will illustrate our actions in this phase and show the mapping of the different frameworks on a high level.

	Module	Framework	Issues
Strategic Planning	IT Business Strategy for SME	ITIL, eTOM, MOF	Complexity of existing frameworks
	IT Technology Strategy for SME	TOGAF	
	IT Service Agreement/Definition	ITIL, MOF	
	IT enabled Innovation Management		
Operations	Service and Infrastructure Operation	ITIL, MOF	Demand on specific roles
	Systems and outsourced Services Management	ITIL, COBIT, MOF	
	IT Procurement	VAL-IT	Solutions focused on large organizations
	Security and Environment	COBIT, RISK-IT	
Monitoring	Control & Audit	COBIT, MOF	Pragmatic approaches for SME's are missing
	Compliance	COBIT, RISK-IT, MOF	
	Change Management	ITIL, MOF	Concrete implementation guidelines are often lacking
	Continuous Service Improvement	ITIL, MOF, CMMI, SPICE	
	IT Project Management	PRINCE2	

Table 1: Framework Mapping in SME

Phases	Goals	Frameworks	Issues
Prevention	Define strategic goals	Weil/Ross decision matrix	often not suitable for "not-for-profit" organizations
	Show ICT value and risks	COBIT	
	Establish clear responsibilities	Val-IT	
	Optimize ICT portfolio towards different scenarios	Risk-IT	
	Build a sound and sustainable enterprise architecture	ITIL/ITSM	
	Learn from previous disaster and review ICT strategy	CMM	
Preparation	Prepare for the inevitable	COBIT	cannot cope with ad-hoc teams
	Be flexible to severity of impact	BS25999 (BCM)	
	Build a sound ICT environment to support EM operations	ITIL/ITSM	
Response	Keep "IT" running	ITIL/ITSM	cannot cope with "uncertain situations"
	Support EM operations		
Recovery	Recover damaged IT infrastructure quickly	ITIL/ITSM	give only rough guidelines, to complex to adapt to EM

Table 2: Framework Mapping in EM

**Domain Specific Frameworks: Customization Process**

To identify the most important COBIT 'control objectives' and ITIL 'best practices', we had to prioritize their impact on the domain specific business processes. In order to do this we utilized decision making methods based on AHP (Analytical Hierarchy Process).

AHP is a decision support method to simplify complex decisions and make rational decisions. The AHP-Method is "hierarchical", because the criteria which are used to solve a problem are in a

hierarchical order. Elements of a hierarchy can be divided into groups, to refine and simplify the decision-making process. It is "analytical" because it describes and analyses the constellation and dependencies of the particular problem and it is a "process" because it follows a defined and repeatable procedure. Therefore AHP supports decisions in teams to find joint solutions while it provides transparency of the process and minimized inconsistencies in decisions (e.g.  $A > B$ ,  $B > C$ , but  $C > A$ ). It enhances "gut decisions" by a qualitative weighting based on comparative decisions (Saaty 1987; Saaty 1990). Figure 5 will illustrate how we utilized AHP in the engineering process.

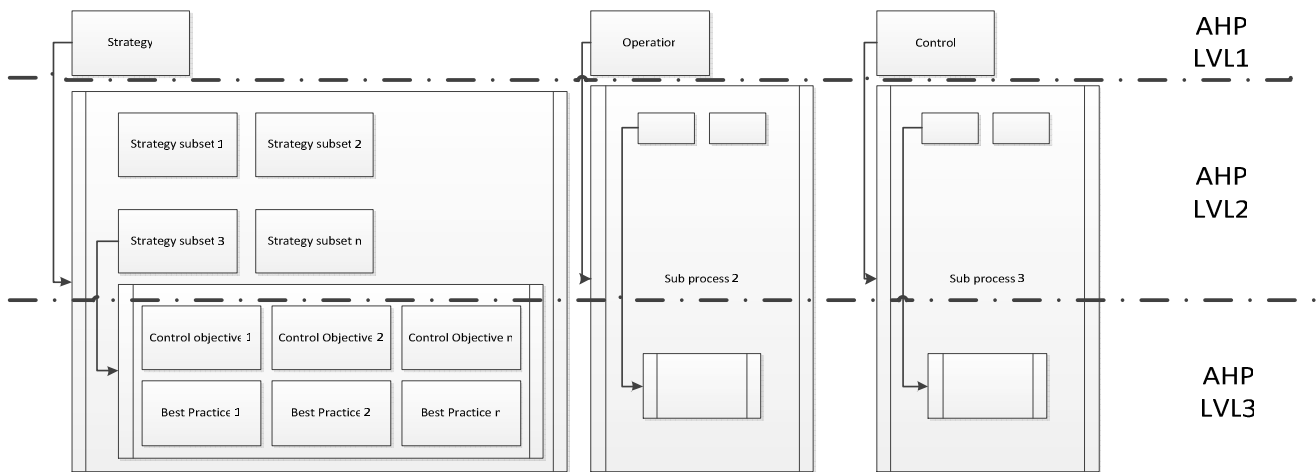
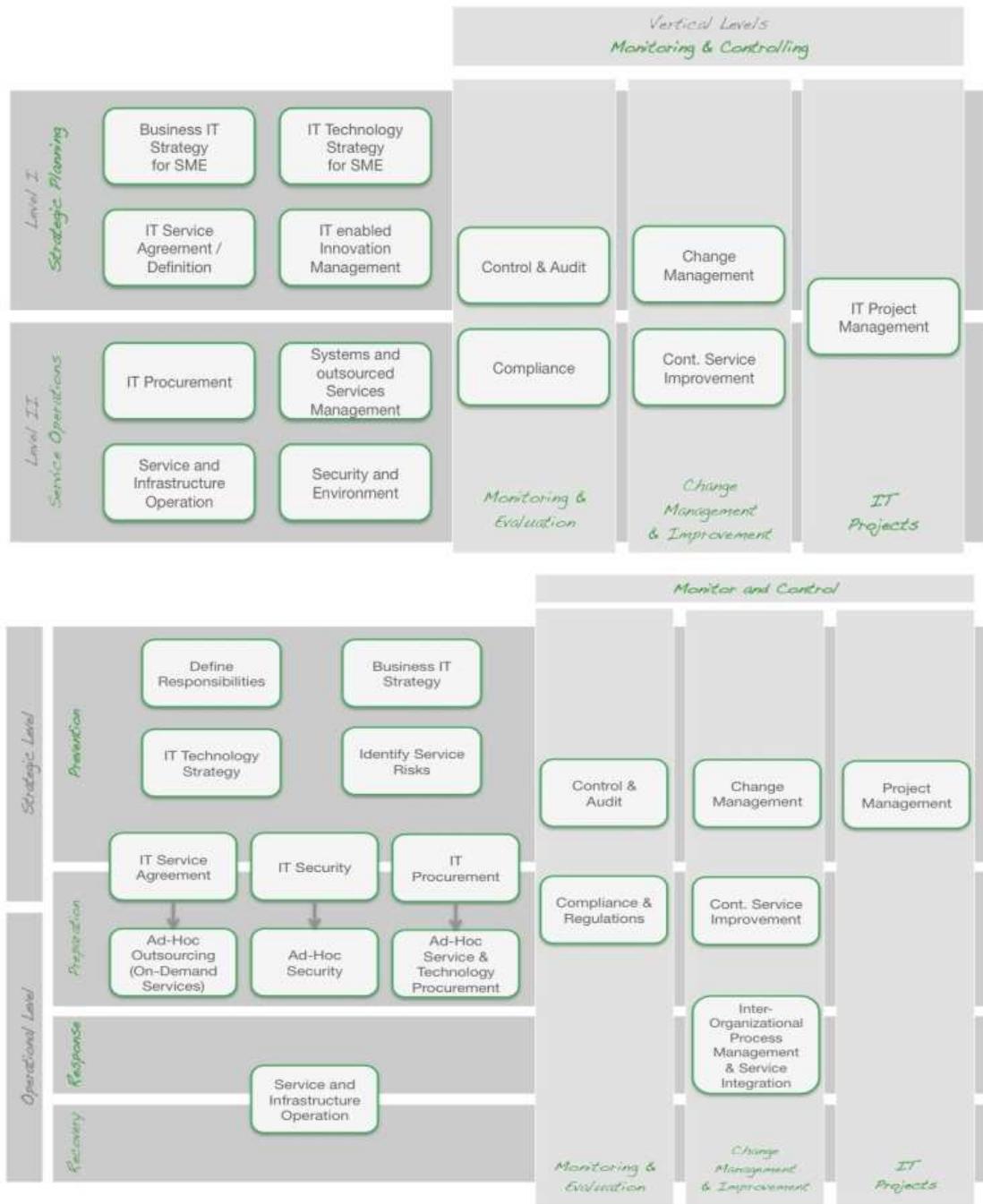


Figure 5: AHP Approach

By the means of AHP we were able to separate necessary and useful ‘control objectives’ and ‘best practices processes’ from ‘expendable practices and controls’. ‘Expendable practices and controls’ are not to be seen as useless, we believe that all elements in COBIT and ITIL are useful and have to be considered during a maturity process, however, in order to simplify a method and make it more flexible, we had to identify the most suitable parts as shown in Figure 6.



**Figure 6: SME Module Map (above) / EM Module Map (below)**

Modules in the horizontal levels describe the coordination of the IT (strategically and tactical) and the operation of the IT. The vertical areas contain modules which are related to the strategic and operational levels of the domain specific models.

It is interesting to see that both domains have overlapping areas, which let us assume that these areas are of general interest to these domains and can therefore be identified as candidates for a first implementation step.



The customized methods will not serve as an additional IT Governance framework. The goal is much more to make the targeted domains aware of the basic principles of IT Governance and ITSM. The simplified methods should help them to realize value from their IT investments and IT services more easily in order to improve their business.

Main goals of this simplified IT Governance approach are:

- Provision of a ‘cookbook’ which explains IT Governance methods in a neutral and easily understandable way
- Modularization and simplification of common patterns of various IT Governance / ITSM frameworks to design a flexible IT Governance method
- Definition of a possible implementation process and explanation of the “best of breed” approach to select, to adapt and adopt existing frameworks

### **ADVANTEAGES TO THE DOMAINS**

A domain specific IT Governance / ITSM approach shows promising results in both domains. A general feedback during the interviews was that SMEs and EM organizations are looking for tools and guidelines to optimize the utilization of IT in order to improve their business. However, conventional methods are seen as too complex and/or not fully applicable. Even though our method is not fully implemented in all participating organizations, we received positive feedback from experts in the field as well as from some of the case studies.

For instance, one of the SME cases, a medium sized company with 90 employees working in the printing and digital media production area. After the IT-manager had surveyed existing ITSM-frameworks, he realized that there is no ITSM approach that is easy accessible for SMEs. However, a simplified ITSM approach helped him to implement basic functions and measurements, which enabled the company to speed up their performance significantly without having to deal with the overhead of a full-scale ITSM framework. A domain specific IT Governance / ITSM approach can therefore avoid such an overhead and enables even small enterprises to implement basic IT Governance / ITSM functions in order to realize benefits from an improved IT utilization.

We also realized that organizations of both domains, which adopted basic IT Service Management principles, will more likely invest in new technologies and implement IT based processes since it is easier for them to see the “value of IT” to their operations. Consequently this will lead to innovative processes and IT enabled services.

### **LIMITATIONS AND FUTURE RESEARCH**

This research is based on two different projects. Some of the data sets had to be interpreted on an abstract layer in order to compare the results. The abstraction of the data was done as carefully as possible to avoid falsification of the data.

The full roll-out of the methods is still in progress in both projects. Thus, the current results reflect only the findings until March 2011. The final implementation will be finished in September 2011 which will give us more detailed feedback from participating organizations. Therefore, we are unsure how the domain specific methods will be accepted by all users. However, the current results have been discussed with a user focus group and different experts of the domains. In general all experts and members of the focus group agree that the approach seems very promising and valuable. More information about the SME project and its progress can be found on <http://www.innotrain-it.eu>. Unfortunately, we cannot grant access to detailed data from the EM project due to non-disclosure agreements with the researched EM organizations.

Due to financial limitations and time constraints we did not implement any maturity models in our current project. Nevertheless, we strongly encourage future research to focus on this issue. Even though we tailored the frameworks towards the requirements of the researched domains, we found out that some organizations are still somewhat overburdened with a full implementation of the model. We believe that a simple maturity model in combination with a graduated implementation plan should be able solve this problem. Therefore we encourage future research to investigate in that area.

### **CONCLUSION**

We have researched the domain of SME and EM thoroughly in order to define their requirements and needs. With our research we highlighted the implementation barriers and opportunities of IT Governance methods. The sum of these results enabled us to design a simplified method particularly tailored towards the capabilities and needs of the researched domains.

The results of our surveys and case studies show that both domains have many similarities, the most important are:

- The lack of awareness of IT Governance / ITSM
- The low implementation rate of IT Governance / Frameworks

- Some of the drivers & barriers
- Overlapping regarding domain specific method modules and framework elements

With a domain specific approach we were able to address almost all of the barriers and drivers. One of the most interesting findings is that not only barriers overlap, but also some of the relevant elements of the simplified method and underpinning frameworks (cf. Figure 6). The customized IT Governance methods are much simpler than a full ITIL or COBIT framework but still address the most important elements. The AHP method enabled us to prioritize the most significant controlled objectives and best practices of the existing frameworks. In combination with an adapted metamodeling approach from previous research our domain specific IT Governance method means less overhead and more flexibility for most organization within the researched domains.

We believe that a simplified and more agile IT Governance method will enable these organizations to apply IT Governance principles more easily and enable them to support their day-to-day business more efficiently and effectively. Nevertheless, since our method is based on ITIL and COBIT they can proceed to more advanced frameworks if needed.

Since this approach showed promising results for both domains, we believe that this customization method might also be valuable for other domains, which are yet not well researched or require further adaption in order to utilize IT Governance methods.

## ACKNOWLEDGMENTS

The SME project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF. We thank all participation organizations and contributors for their time and support.

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