





ABSTRACT

Hirvonen, Ari

Enterprise Architecture Planning in Practice: the Perspectives of Information and Communication Technology Service Provider and End-user

Jyväskylä: University of Jyväskylä, 2005, 44 p.

(Jyväskylä Studies in Computing

ISSN 1456-5390; 48)

ISBN 951-39-2043-7

Finnish summary

Diss.

The role of ICT (Information and Communication Technology) has changed dramatically during the recent years. ICT is enabling new businesses and is also one of the key means in organisations' efficiency improvements. Its strategic role has inspired organisation management to get involved in ICT management, and Enterprise Architecture (EA) has emerged as a framework for planning and managing organisations' business, information, systems and technologies. Because of the changing role of ICT and new requirements for its development and management, new business oriented consulting services are increasingly requested from ICT services providers. The target of this study was the EA consulting methodology development for TietoEnator, the largest ICT service provider in the Nordic countries. As a starting point, the service provider's service offerings, its consulting project participation profiles and its project risk and success factors as well as the requirements for EA consulting methodology are analysed. Some of the current academic and commercial methodologies and their usability for EA consulting are studied. Current EA methodologies seem to support the end-users' continuous EA management process better than they support diverse ICT consulting cases with more variability. Therefore, the EA management grid is proposed as a planning framework for EA consulting. V-model for EA testing and evaluation is developed to support both the end-users and the service providers in EA related testing and evaluation. Project participation profiles for the end-user and the service provider is proposed as the means to support project planning. Usability of Application portfolios for information and communication technologies management, planning and evaluation purposes is analysed. This study was a company wide action research effort. All results presented here were tried out in practice.

Keywords: Enterprise architecture, Strategy, consulting, ICT service provider, methodology, evaluation

ACM Computing Review Categories

K.1 Computing milieux: Computing Industry

K.6 Computing milieux: Management of Computing and Information systems

Author's Address

Ari Hirvonen
TietoEnator Corporation
P.O.Box 203
FIN-40520 JYVÄSKYLÄ
Finland
e-mail: ari.p.hirvonen@tietoenator.com
Fax: +358 14 415 7440

Supervisors

Prof. Jarmo J. Ahonen
Department of Computer Science
University of Kuopio, Finland

Prof. Jari Veijalainen
Information Technology Research Institute
University of Jyväskylä, Finland

Reviewers

Prof. Jan Bosch
Software and Application Technologies Lab
Nokia Research Center

Prof. Per Runeson
Institution of Telecommunication systems
University of Lund

Opponent

Prof. Veikko Seppänen
Department of Information Processing Science
University of Oulu

ACKNOWLEDGEMENTS

I want to thank Jarmo Ahonen, who was responsible for motivating me to start this thesis in the first place and who helped me all the way through the process. I also want to thank Mirja Pulkkinen for her central effort in this project. All other project members in the LARKKI project, both in the University of Jyväskylä and in TietoEnator have done a great job. Among others I would like to mention Veikko Halttunen, Markku Sakkinen and Pekka Neittaanmäki from the University of Jyväskylä and Seppo Lamminmäki, Jari Isokallio and Seija Rouhinen from TietoEnator. My thanks also to Jari Veijalainen for his valuable help in the final phases of the research process. Juhani Strömberg gave me great comments on all the published articles, for which I'm very grateful.

In addition to those mentioned here, many other people have contributed to this work in workshops, discussions and other project working practices. My heartfelt thanks to all of them.

I would like to dedicate this work to my family. My wife Asta and my kids Helmi, Heikki and Heljä have been my inspiration during the research process. I would like also to thank my parents for all their support during my school and university studies. Psalm 127:1.

Jyväskylä, 8th of December 2004
Ari Hirvonen

FIGURES

FIGURE 1.1	Changing role of ICT in the organisations and ICT planning styles	11
FIGURE 1.2	ICT Service provider and ICT end-user relationship in system development	15
FIGURE 1.3	The relation between full-scale ICT service provider and ICT end-user organisation	16
FIGURE 1.4	The research process	20
FIGURE 1.5	A high-level process continuum	26

TABLES

TABLE 1.1	Some tasks and results of TietoEnator subproject in the LARKKI-project	21
-----------	--	----

CONTENTS

ABSTRACT

ACKNOWLEDGEMENT

FIGURES AND TABLES

CONTENTS

1	INTRODUCTION AND BACKGROUND	9
1.1	Outline of the thesis.....	9
1.2	Main concepts.....	9
1.3	Background and motivation	11
1.4	The case environment for this study.....	14
1.5	EA Planning and ICT services provider.....	14
1.6	Research Questions.....	17
1.7	Research Approach.....	18
1.8	Research Process	19
2	SUMMARY OF PAPERS.....	23
2.1	The Profiles of Projects Supplied by a Full-scale ICT-Services Provider.....	24
2.2	The Gap between Strategies and Implementation – Methodic Support for EA Projects as a Bridge.....	26
2.3	The Effect of Some Risk Factors and Client Effort on Project Success.....	28
2.4	A Practical Approach to EA Planning and Development: the EA Management Grid.....	29
2.5	Evaluation of enterprise IT architecture solutions – How can an ICT consultant tell what is the best for you?	31
2.6	Application Portfolios in Practice – Tools for ICT planning, management and business value evaluation.....	32
2.7	User Participation in Consulting Projects: Client and Provider Role Variations	34
2.8	About the joint articles	35
3	LIMITATIONS OF THIS STUDY.....	36
4	CONCLUSIONS.....	37
	REFERENCES.....	40
	FINNISH SUMMARY	43
	ORIGINAL PAPERS	

1 INTRODUCTION AND BACKGROUND

1.1 Outline of the thesis

This thesis consists of an introductory section and seven research papers. In the first section the research area and the research problem is described. The section presents the main concepts used in this thesis, gives an overview of the area, and presents the research questions, research approach, research process and the results of the thesis. A short summary of the papers and an outline of how each of them is related to the research questions are included in section 2. Limitations of the study are discussed and finally the main conclusions are summed up in sections 3 and 4.

1.2 Main concepts

Research questions in this thesis are the foundation for the concepts used. These research questions, which are discussed in more detail in Section 1.1.6, are:

1. How are Enterprise Architecture (EA) consulting, management and planning conducted at TietoEnator and what are the requirements for methodological support for this activity?
2. How do currently available methodologies support the activity?
3. What kind of methodological support and approach is needed by an ICT services provider in EA consulting and how to implement it?

The general term **architecture** is defined as the design of any type of structure whether physical or conceptual, real or virtual (O'Rourke *et al.* 2003). **Enterprise** means a group of people organized for a particular purpose to produce a product or provide a service (O'Rourke *et al.* 2003).

We agree with The Open Group's **Enterprise Architecture** definition (TOGAF 2003):

There are four types of architecture that are commonly accepted as subsets of an overall Enterprise Architecture:

business architecture: this defines the business strategy, governance, organisation, and key business processes.

data/information architecture: this describes the structure of an organization's logical and physical data assets and data management resources.

application (systems) architecture: this kind of architecture provides a blueprint for the individual application systems to be deployed, their interactions, and their relationships to the core business processes of the organization.

Information Technology (IT) architecture: the software infrastructure intended to support the deployment of core, mission-critical applications.

Enterprise architecture planning refers to the planning whereas **enterprise architecture management** refers to the management of the above-mentioned areas.

ICT services provider is an organisation offering ICT related services. With **ICT end-user** I mean organisations utilising ICT in their operations. ICT end-users are clients of ICT services providers.

In its broad meaning **consultant** is a person in a position to have some influence over an individual, a group, or an organisation, but no direct powers to make changes or implement programs (Block 2000). In this study, consultants are persons working in an ICT service provider organisation offering consulting services. **Consulting** is a service and actions performed for the ICT end-user organisation by the consultant.

The terms 'method' and 'methodology' are used for the same purpose in some sources. Olle *et al.* (1988, p. 1) define the term information systems methodology as

a methodical approach to information systems planning, analysis and design.

Moreover, they recognize that the term methodology should be used to mean a 'study of method' but they conform to the common practice commonly adopted during the past decades and use 'methodology' in place of 'method'. In this thesis I use the term methodology in the following meaning: **methodology** is a collection of practices, processes, and rules used by those who work in a discipline (O'Rourke *et al.* 2003). The term **method** is defined by Mayer *et al.* (1995, p. 13) as follows:

A method is an organized, single-purpose discipline or practice. A method may have a formal theoretical foundation, although this is not a requirement. Generally, methods evolve as a distillation of the best-practice experience in a particular domain of activity.

Software Engineering (SE) is defined by IEEE Standard 610-1990 (IEEE 1990, p. 186) as

(1) application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is application of engineering to software. (2) The study of approaches as in (1).

Cohen (1999, p. 213) defined **Information Systems (IS)** as

a field of inquiry that attempts to provide the business client with information in a form, format, and schedule that maximizes its effectiveness.

1.3 Background and motivation

With global, horizontal information systems (Ives and Jarvenpaa 1991, Braa and Rolland 2000), the starting points for information and communication technology (ICT) planning have changed from a single system's scope and effectiveness optimisation to enterprise level and strategic planning. This has also changed ICT development related planning approaches and roles.

The main development phases in implementing ICT support for an organisation are presented in Figure 1.1 that combines Ward and Peppard's (2002) three-era model, which is oriented towards the role of ICT in organisations, and Dickson's (2003) five-era model, which is more technology oriented.

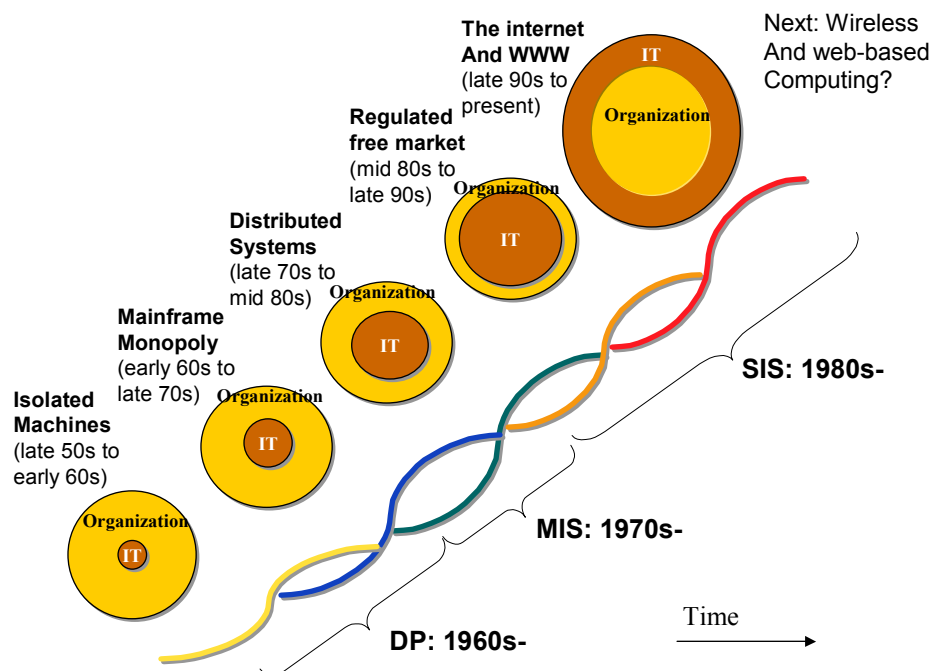


FIGURE 1.1 Changing role of ICT in the organisations and ICT planning styles

The first IT era was the Data Processing (DP) era (Ward and Peppard 2002). First computers were isolated machines and communication was in a minor role. New technologies and their adaptation is the key enabler of the new ICT eras. The first such enablement took place at the end of the isolated machines' era, when mainframes entered the mainstream (Dickson 2003). During these first eras, ICT was a support instrument for data processing. Dummy character based terminals and low data processing power made some basic calculations more effective than was manually possible. Operational efficiency was a key target of information systems (IS).

Management's interest toward ICT increased already during the mainframe era (Ward and Peppard 2002). With technology advancements and new requirements, new ways of utilizing ICT emerged. Distributed systems followed the mainframes during the Management Information Systems (MIS) era, which focused on improving management effectiveness, but brought also many other new ways of ICT utilization.

End-user empowerment resulted from the use of graphical desktop operating systems in the regulated free market era, which also started the Strategic Information Systems (SIS) era proposed by Ward and Peppard (2002). Common for the first four eras presented by Dickson (2003) was an intra-organizational focus. Most systems were built to be used only internally by the organisations' staff.

The strategic importance of ICT and management interest towards strategic use of information technology have increased during the whole SIS era (Somogyi and Galliers 1987, Earl 1989, Weill and Broadbent 1998, Ward and Peppard 2002). During recent years, with advancements in network computing technologies, new ways in utilizing ICT became possible: The Internet and the WWW era had started. The users of information systems include the organization's customers, partners and other stakeholder groups. ICT is enabling new business and service opportunities and is influencing organisations' strategies directly (Henderson and Venkatraman 1999, Seltsikas 2000, Ward and Peppard 2002). Public organisations are also affected (Johansen 1988). It is being argued that the influence of ICT is even more profound in public organisations than in business organisations (Holmes 2001).

Today, business strategy and information technology are highly related. An organization's vision, mission and strategy are the starting point and the basis for all information technology and information systems development in an organization. The organization's information technology should primarily support more foundational business goals now and in the future. ICT utilization should have a vision: how it will evolve to support the future strategy and vision, and higher level plans to enable a transition to that direction. The most important ICT decision factors are derived from the foundation level strategic and mission alignment, and affect all levels from the services and business processes up to a single module or the basic technology selection. Weill and Broadbent (1998, p. 24) have summarized this very well:

The concepts fundamental to managing information technology are those of business, not of technology: portfolios, business value, investment, and alignment of resources with strategic goals. The objective of information technology investment is to provide business value in two related ways: to successfully implement current strategies and to use the technology to enable new strategies.

Even in companies where ICT is in utility role (Weill and Broadbent 1998), strategy and strategic intent should be key factors in ICT decision making. These conceptual interdependencies are apparent in numerous customer cases and the research community supports this view also (e.g. Robson 1997, Ward and Peppard 2002).

Architecture is a key element at all levels as a means to reach the strategic goals. Information systems are, no longer, isolated islands; they form a fundamental part of any organization's business, and are integrated at many levels. Enterprise architecture is the adhesive that actually makes the relations of ICT and business transparent. Without enterprise architecture planning and management, an organization will end up with many overlapping, complex applications and technologies hard to integrate and maintain. ICT may support separate activities, but it seems there are no guiding principles related to the strategic goals for its use – i.e., what an organization should be able to perform with information technology in the near future. The goals of individual systems can be even contradictory. The importance of enterprise architecture has also been argued for in the literature (e.g. Spewak 1992, Robson 1997, Ward and Peppard 2002, Perks and Beveridge 2003).

Because of the changes described above, the management and development of ICT has become a part of an organisation's management agenda, and consultants are used in order to benefit from their experiences in similar cases (Spewak 1992, Hirvonen and Pulkkinen 2003). In addition to ICT end-user organizations' EA management needs, EA planning and consulting has become vital for the service providers. This is the main motivation for this study. In this study we will examine the differences in EA approaches between the end-user and the services provider. Our results indicate that the end-user organization perspective is better covered in current EA methodologies, but support for EA consulting is low. Therefore methodological EA approaches will also be studied and developed.

Other perspectives also motivate EA methodology development. The target organisation of this study has a well-established system development methodology. One should not forget, however, that management consulting that focuses on business architecture development has been one of the organisations' core services. Our study indicates that EA methodology is needed to bind these areas together, to better serve the clients in their intertwined business and ICT development. Next we will discuss about the case environment for this study and about the ICT service provider and ICT end-user relationship.

1.4 The case environment for this study

This study has been conducted mostly at TietoEnator Corporation. The company dates back to the early 60's, which was known as the isolated machines era. Today, TietoEnator is the largest ICT provider in Scandinavia with over 13 000 employees and with activities in over 20 countries. TietoEnator's mission statement is "Building the information society". TietoEnator defines Information society as an economy where the major part of all products and services is produced, distributed and consumed in a digital form over data networks. This requires architecting, developing, hosting and consulting services for the partners' digital businesses. This section is based on TietoEnator annual report 2003 (TietoEnator 2003).

The role of the ICT services provider has changed as a result of the changes in their clients' ICT usage. In the past, systems development services were the main service area. Consulting and other direct support for the clients' business were later added to the provider's service portfolio. TietoEnator as well as other ICT service providers seek long-term partnerships and stable growth with their clients. In these partnerships, the success of the services provider can often be evaluated in terms of how well the clients succeed in their businesses.

For TietoEnator, the focus area is the vertical markets of the strongest Nordic industries, where they have accumulated deep expertise. The target is to be the world's leading provider of selected services for banking and finance, telecom and media, public and healthcare as well as for energy and forest. TietoEnator aims to leadership in expertise, market share and profitability in these areas.

TietoEnator focuses on services that have a high value to the client, which means high leverage and profitability for both the clients and the provider. This requires close and strategic relationships with the clients. Additionally, expertise in ICT value creation, knowledge about the clients and their industry sector, process competencies, technological knowledge and partnerships with major vendors and ability to apply off-the-self software is needed.

1.5 EA Planning and ICT services provider

As mentioned before, EA development is both the ICT end-user and the services provider arena. Our research results indicate that ICT and EA development projects and approaches are different in a services provider and an end-user organisation, which sets also different requirements for the methodology support services (Hirvonen and Pulkkinen 2003, Hirvonen *et al.* 2003, Hirvonen 2004). The end-user organisation manages it's ICT assets as a

whole, whereas the services provider gets projects varying in size and scope from different areas of the client's EA.

Figure 1.2 depicts an end-user organization EA and ICT in its entirety with the upper arrow, the lower arrow represents an ICT services provider with its services and resources. The projects A, B and C in Figure 1.2 are system development projects, which the client has ordered from the provider. The client has also other systems and projects and may also use other providers for its development projects. Some of the system development projects consist of analysis, design and development phases. Some of the projects are limited to the analysis phase. In these projects, analysis and other system development phases are dealt with separately both from the commercial and the system development perspective (Hirvonen *et al.* 2003). System development projects are mostly carried out in the services provider's environment. Developed and tested systems are installed in the client's environment.

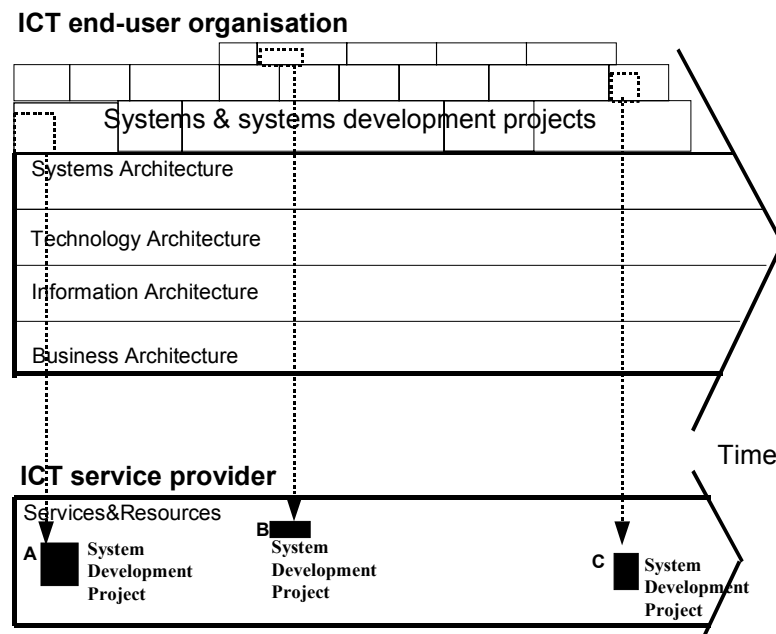


FIGURE 1.2 ICT Service provider and ICT end-user relationship in system development

Because the role of ICT has changed and it has become a strategic element in the organisation, also other kinds of projects and services are offered by a full scale ICT services provider. Enterprise Architecture development and management is an end-user organisation's critical success factor. The management and development of EA is a continuous process. Nevertheless, one must point out that not all end-user organisations can manage their ICT environment strategically. Their organisational maturity may be too low, and, because of this, the development must focus on more fundamental areas (Hirvonen 2004).

Development projects in EA area are typically carried out in the client organisation (Figure 1.3, projects G and F). Planning and developing the enterprise architecture with business operational requirements as the

foundation is a very challenging task. This is why the task is typically carried out partly by ICT end-user organizations and partly by consultancy firms. I agree with Spewak (Spewak 1992, p. 70) in that

external consultants can provide experience from previous successful enterprise architecture engagements, ensure quality, bring credibility, overcome political obstacles, offer an objective point of view, and supply manpower to accomplish some of the steps.

Increasing demand for consultancy work is an indication that the ICT end-user organisations have understood this also.

In a few areas, most of the work can be carried out also within the provider organisation. Limited technology architecture consulting cases (project E in Figure 1.3), like technology evaluations, are an example of this. A precondition is that the client's requirements and the current technology architecture are well described.

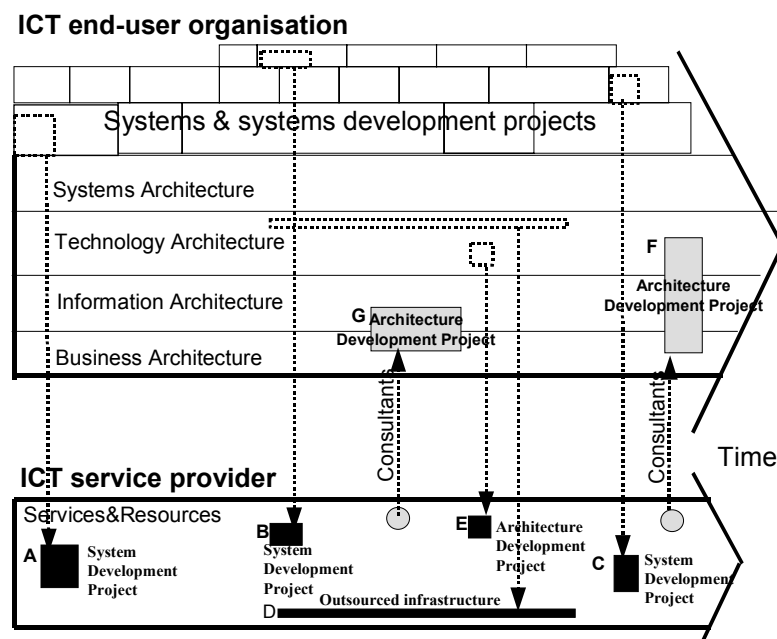


FIGURE 1.3 The relation between full-scale ICT service provider and ICT end-user organisation

In addition to system development and consulting cases, systems and infrastructure can also be outsourced to the ICT services provider's environment (Project D in Figure 1.3). Outsourcing is a continued service, not a project. Maintenance deals have similarities with this. Maintenance is a continuing, often long lasting process that focuses on the client's information systems' rectification and enhancement.

Our investigations have shown that customers have different kinds of cultures in their consultant use, and their maturity and situation in enterprise architecture management are varying. This is why "one size does not fit all" in

consultancy services (Hirvonen and Pulkkinen 2003, Hirvonen *et al.* 2003, Hirvonen 2004). A consultant's role and participation in the client's development process vary also. There is no optimal participation model, instead, the requirements of the case should be understood to determine the consulting approach (Hirvonen and Pulkkinen 2004).

This study, which focuses on the previously discussed issues, was conducted in parallel and as a part of the LARKKI project. LARKKI project was conducted at the Information Technology Research Institute (ITRI), in the University of Jyväskylä. The researcher group from the university provided the external point of view to the research process. Consultants and other specialists from TietoEnator and other participating companies, IBM and Yomi Solutions, gave the internal and practical view to the development. The author acted as the integrator combining different viewpoints in a TietoEnator's subproject. The university part of the project was financed by the National Technology Agency of Finland (TEKES) and by the participating companies. So far we have described the starting points for this study. Next we will look at the research questions and the research process.

1.6 Research Questions

The objective of the LARKKI project was to study the role of architecture management in the target organisations, to build a meta- and process model for the architecture management and find a notation and tools support for it. Each participating company had their own specific interest areas. These areas were developed in separate pilot phases, which produced public results.

The emerging need for EA consulting, which is also one of the TietoEnator's services, and limitations in current EA planning methodologies were the main motivations for this study for TietoEnator. The ultimate goal was to improve the company's capabilities and practices in the enterprise architecture area by developing methodological support for EA consulting and by improving the competence in the area.

The research questions were:

1. How are Enterprise Architecture (EA) consulting, management and planning conducted at TietoEnator and what are the requirements for methodological support for this activity?
2. How do currently available methodologies support the activity?
3. What kind of methodological support and approach is needed by an ICT services provider in EA consulting and how to implement it?

The first question must be answered before the actual methodology development can be started. We should understand what kinds of services and projects the ICT

service-provider can offer, and how the provider's and the end-user organisation's perspectives on ICT differ. Behind this was the observation that consulting differs from EA management in the ICT end-user organisations. Other characteristics such as the success and risk factors of the projects delivered by a full-scale ICT service provider would also be useful to understand. Because TietoEnator already offers EA consulting services, a very important starting point for the development is to understand how the current consulting cases are conducted and what the contents of these cases are. Problems in the current EA consulting approaches should also be understood. Based on these, the requirements for an EA methodology for consulting use should be analysed.

The second question focuses on already available work in the area. What kinds of EA related methodologies are available and how do they fit to the previously mentioned requirements?

The third question focuses on the actual EA consulting methodology. What kinds of frameworks, processes, tools and notations would be needed and what would be the best way to implement such a methodology?

1.7 Research Approach

Research method selection should be based on the research setting and the problem. From the individual point of view, the relevant research problem depends on the intuition of the world (i.e. ontology) and on how relevant information can be found (i.e. epistemology). Thus researchers can be understood as one factor in selecting a research approach. In this case the development target area is quite well known: An EA consulting methodology should be developed – and, in the company, there are already activities in this area. The project participants from TietoEnator already work with EA consulting and are thus developing their own and their colleagues' working practices.

Baskerville and Wood-Harper (1996) propose that action research (AR) is the primary methodology for organisational development. They claim that action research is (Baskerville and Wood-Harper 1996, p. 8)

one of the few valid research approaches that researchers can legitimately employ to study the effects of specific alterations in systems development methodologies.

According to them, AR merges theory and practice and is thus relevant and rigorous. They further state that new methodologies should be introduced to the practitioner by intervening some way with the target environment.

This is even more relevant for consulting methodologies due to their less formal processes and descriptions produced. Without participation in the actual consulting cases and without iterative cumulative learning by studying these cases from different perspectives, many of the undocumented aspects of the process will not emerge under scrutiny, and methodology development

becomes impossible. Participative approach is important to enable a new methodology usage by the target users and to initiate a feedback loop.

Based on this action research was selected as the research approach (Argyris *et al.* 1985, Gabel 1995). According to Action Research Resources (2004):

Action research can be described as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. In most of its forms it does this by using a cyclic or spiral process, which alternates between action and critical reflection and in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles.

It is thus an **emergent** process, which takes shape as understanding increases; it is an **iterative** process, which converges towards a better understanding of what happens.

In most of its forms it is also participative (among other reasons, change is usually easier to achieve when those affected by the change are involved) and qualitative.

We followed this research approach in the LARKKI-project. The approach had similarities with the PISKO project conducted by TietoEnator, ITRI and other participating companies in 2000-2002 with very good experiences. In the PISKO project, action research approach and Mathianssen's (1998) Reflective Systems Development, were used in particular.

The selected research approach was integrated to the organisation's internal methodology development where one of the key targets is ensuring practical applicability of methodologies in real business cases. Thus the organisation's own evaluation and validation procedures were used to validate the final results. We could conclude that the selected research approach was the right one: the produced results were taken into use in the actual business. Research and praxis were merged producing both significant results from the practical and the research perspective (Baskerville and Wood-Harper, 1996).

1.8 Research Process

The research process in this study started with the problem perception and research topic identification (Figure 1.4). Data was collected from the target organisation to understand the nature of EA consulting and related services (Figure 1.4, 1. and 2.). The techniques for data collection were a questionnaire for project managers, and semi-structured interviews (Yin 1994, Fontana and Frey 2000) with EA architects.

The questionnaire was aimed to collect a considerable number of cases to get a wide perspective to the problem and to enable statistical analysis with an R-statistical analysis tool (R-Project 2004). The questionnaire was sent to project managers and EA consultants in the participating business units. The questions in the questionnaire were focused on familiar issues from the respondent perspective.

Semi-structured interviews were used to analyse the problems which seemed not to be well known and had greater variability. The interviews were

documented and the results were reviewed and discussed with the interviewee so that the interpretation could be characterised as a negotiated text (Fontana and Frey, 2000). Some interviews were also recorded and transcribed.

The company in-house methodologies were analysed by the researchers. Project descriptions and documentation were collected both to get a more balanced picture and to get a deeper understanding of the topic area (Hodder 2000). The research methods and data collection techniques are described in detail in the research papers (Sections 2-8) and in Section 2.

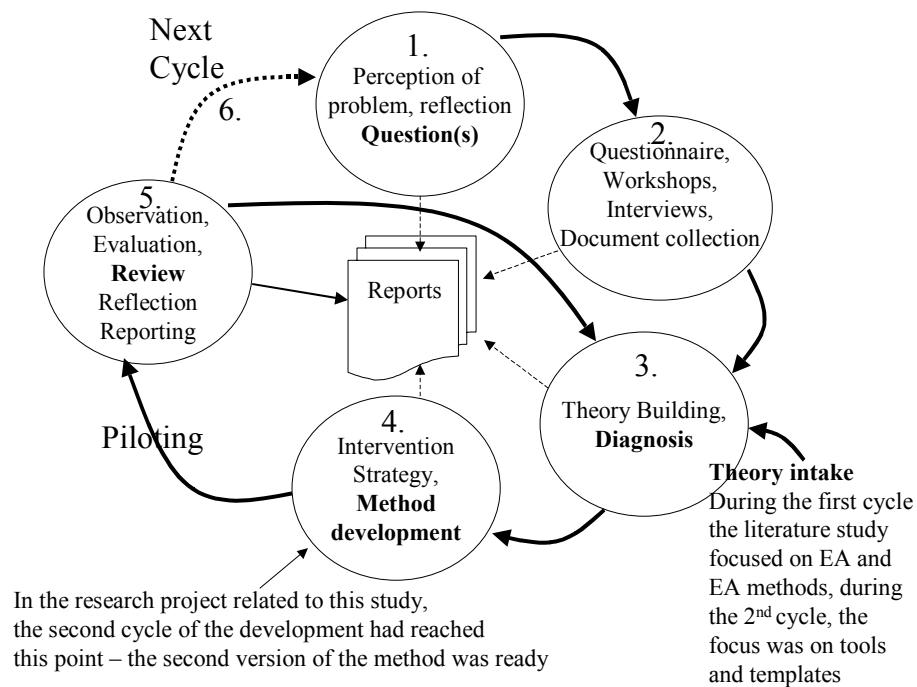


FIGURE 1.4 The research process

Information collection from the company ranged from practical EA project anatomy to generalized EA consulting methodology development. In parallel with the investigation of the EA consulting activities, related literature was analysed to find available academic and commercial methodologies (Figure 1.4: 3.). The sources of literature study were IEEE and ACM electronic libraries as well as the Internet. This activity continued as the project proceeded and the understanding of the problem increased. As a result, the first version of the methodology was developed during the second project year of the LARKKI project (Figure 1.4: 4.). During the development, research project documentation was reviewed by a specialist group in the company and revised by the document authors. One useful input were the review comments from academic conferences. The company specialists reviewed and piloted the methodology version developed in the first development cycle (Figure 1.4: 5.). The methodology was presented also to a larger international specialist group and was published in the corporate intranet. The comments, the review results

and the piloting experiences were collected and documented for the next development cycle.

The second development cycle was started and documentation, including the review reports from the previous cycle, were analysed to identify problems and development targets (Figure 1.4: 6. and 1.). Seven new EA planning cases were analysed in depth to get a deeper understanding of the problem area (Figure 1.4: 2.). Tools and templates were one of the identified improvement areas, in addition to EA methodology process definition. Literature study during the second development cycle was focusing on these issues (Figure 1.4: 3.). As a result, a new version of the methodology was produced.

TietoEnator's own systems development methodology included some architecture and business development tasks, and was seen as overlapping with the first EA methodology version. A decision was made to integrate the two methodologies to avoid confusion among the users. The LARKKI project developed the first integrated methodology version (Figure 1.4: 4.).

The new integrated methodology version was further developed in the workshops and comments were collected in discussions. This gave also new perspectives to TietoEnator's systems development methodology developers – the planning phases before systems development can be much more varying and complex than expected. The EA methodology developers gained some new perspectives to project types that follow EA planning. As a result, a consensus about the content and integration points were found, and new foundational principles for company's methodology development were created. At that point, this thesis was written and the new version of the EA consulting methodology went to the piloting phase.

Next, we will present the research papers that were written during the development cycles. In addition to these papers, numerous project reports, other documentation and the actual EA consulting methodology-working drafts were produced. These materials are not included in this thesis, but the most important materials are briefly presented in Table 1.1.

TABLE 1.1 Some tasks and results of TietoEnator subproject in the LARKKI-project

Task	Goal	Results	Project year
Preliminary analysis and "learning to know each other"	Establishing an understanding of the problem area and among the project participants	Report: Problem areas and development needs	1 st
Developing the methodology: telephone interviews, workshops	Getting deeper understanding of actual EA consulting and producing the first versions of the methodology	"Map" of possible EA project paths, Preliminary model of EA area, Report: Enterprise Architecture Development for TietoEnator	1 st

(Continues)

TABLE 1.1 Continues

Defining targets for the 2 nd project year	Plan for the 2 nd project year development	Project plan	1 st
Methodology development	Defining the EA planning framework (1 st version of EA Grid (see section 5), the dimensions were agreed on)	Report: EADM2, the first draft of the Grid	2 nd
Methodology development	Defining the levels of the EA planning framework	Presentations: Levels of Examination, Managing Preliminaries and Requirements	2 nd
Packing the second version of the methodology	Analysing comments on the previous work and producing the new methodology version, piloting	Internationally presented and published methodology within TietoEnator	2 nd
Defining targets for the 3 rd project year	Plan for the 3 rd project year development	Project plan, Evaluation report	2 nd
Defining the process of EA methodology	Defining how to proceed in the Grid in various consulting cases	Presentation	3 rd
Methodology development	Defining activity deliverables, tasks' inputs/outputs	New methodology version	3 rd
Integration to the TietoEnator's systems development methodology	Integrating EA methodology to the business development phase of the corporate systems development method	New TE Object version	3 rd

2 SUMMARY OF PAPERS

This thesis includes seven research papers, which structurally follow the selected research approach:

- Hirvonen, A., Ahonen, J. & Pulkkinen, M. 2004. The Profiles of Projects Supplied by a Full-scale ICT-Services Provider. In I. Seruca, J. Filipe, S. Hammoudi & J. Cordeiro (Eds). ICEIS 2004 - Proceedings of the Sixth International Conference on Enterprise Information Systems. Porto: INSTICC, 123-130.
- Hirvonen A., Pulkkinen M., Ahonen J. & Halttunen V. 2003. The Gap between Strategies and Implementation - Methodic Support for EA Projects as a Bridge. In K. H. Soliman (Ed.) E-Business and Organizations in the 21st Century. Proceedings of the 2003 International Business Information Management Conference. Cairo: IBIMA, 260-267.
- Hirvonen, A., Ahonen, J. & Pulkkinen, M. 2004. The Effect of Some Risk Factors and Client Effort on Project Success. [Accessed 18.8.2004] <http://www.hh.se/iris27/workinggroups.htm>. Abstract published in the Proceedings of IRIS27, Falkenberg, Sweden.
- Hirvonen, A. & Pulkkinen, M. 2004. A Practical Approach to EA Planning and Development: the EA Management Grid. In W. Abramowicz (Ed.) BIS 2004 - Proceedings of 7th International Conference on Business Information Systems. Poznan: Department of Management Information Systems, The Poznan University of Economics, 284-302.
- Hirvonen, A. & Pulkkinen, M. 2003. Evaluation of Enterprise IT Architecture Solutions - How can an ICT consultant tell what is best for you? In E. Berghout & D. Remenyi (Eds.) Proceedings of the 10th European Conference on Information Technology Evaluation, ECITE 2003. Madrid: Management Centre International Limited, 327-337.
- Hirvonen, A. 2004. Application Portfolio Models in Practice - Tools for ICT Planning, management and business value evaluation. In D. Remenyi (Ed.) The Proceedings of 11th European Conference on Information

Technology Evaluation, ECITE 2004. Ireland: Academic Conferences Limited, 183-192.

Hirvonen, A. & Pulkkinen, M. 2005. User Participation in Consulting Projects: Client and Provider Role Variations. Submitted to ECIS 2005 conference.

In the first paper we gain an understanding of the different services and projects provided by a full-scale ICT services provider. In the second paper, the requirements for EA consulting are analysed. Project risk and success factors and the differences between ICT end-user organisation and ICT services provider are discussed in the third paper. Based on these findings, the framework for EA consulting methodology is developed in the fourth paper. The fifth paper proposes an EA evaluation framework including both the ICT end-user and ICT consulting perspectives. The sixth paper analyses one of the EA planning and management tools: the application portfolios. Finally, the seventh paper analyses user and consultant participation in consulting cases and proposes role profiles for the client and the consultant in different kinds of consulting projects.

2.1 The Profiles of Projects Supplied by a Full-scale ICT-Services Provider

ICT services providers have traditionally focused on system development projects. Changes in the portfolio of services reflect the changing role of ICT and the changing use of information systems. New business development oriented consulting services have emerged. Traditional system development, even if it would be well managed and mature, is no longer enough. To be competitive, services providers must have a much deeper understanding of the client's business and possess new consulting competencies.

Different kinds of methodologies, frameworks and process models have been established to support system development. Emerging standardization (e.g. Unified Modelling Language) is one indicator of maturity in the area. For EA development, many development methodologies are available, but their focus seems to be in the ICT end-user EA management, not in EA consulting.

The existing methodologies and approaches seemed not to reflect the current consulting business environment. To understand EA development projects and services of a full-scale ICT services provider, the entire portfolio of services and project types needed to be analysed. This was the preliminary information to identify relations and interfaces between different project types, and constituted the starting point for the methodological improvement.

As a research technique a written questionnaire was used to collect project related data. This approach was selected because we expected to get wider perspective with a large number cases, thus enabling statistical analysis. The questionnaire focused on well-known issues from the respondent perspective.

Questions were negotiated with company specialists and academic people to identify needed relevant information. The questionnaire was sent to the project managers and to an EA consultant in the participating business areas of TietoEnator and the results were analysed statistically with an R statistical analysis tool (R-Project 2004).

One interesting finding was the size of the projects. The mean and median project sizes were quite small. This reflects the changing nature of the ICT services. Consulting has become an important service. The consulting cases presented in this study were relatively small. Our statistical analysis indicates that system development has changed as the general system development process (Sommerville 1998, Pressman 2000) is sliced to separate analysis and development projects. This was supported later also by our interviews with the company specialists. Separate analysis/requirements engineering projects are requested and the iterative approach to systems development is thus challenged. All tasks in requirements engineering projects focus on requirements related analysis tasks. Another provider, based on the analysis project results, may provide the implementation projects.

Based on the analysis, five different project profiles were identified:

- Strategic consulting
- Process consulting
- Architecture consulting
- Requirements engineering (the analysis-phase in the system development)
- System implementation.

These project types form a high-level process continuum (Figure 1.5) where project types are related and have interfaces. Transition and utilisation of project results between the project types reduces development times, improves quality and mitigates risks. Academic or commercial methodology support for the transitions seems to be weak or lacking. Smooth information transfer between projects in different areas would decrease the time and resources needed for the initial phases of the projects, for example when defining the development scope and target, and for analysis activities.

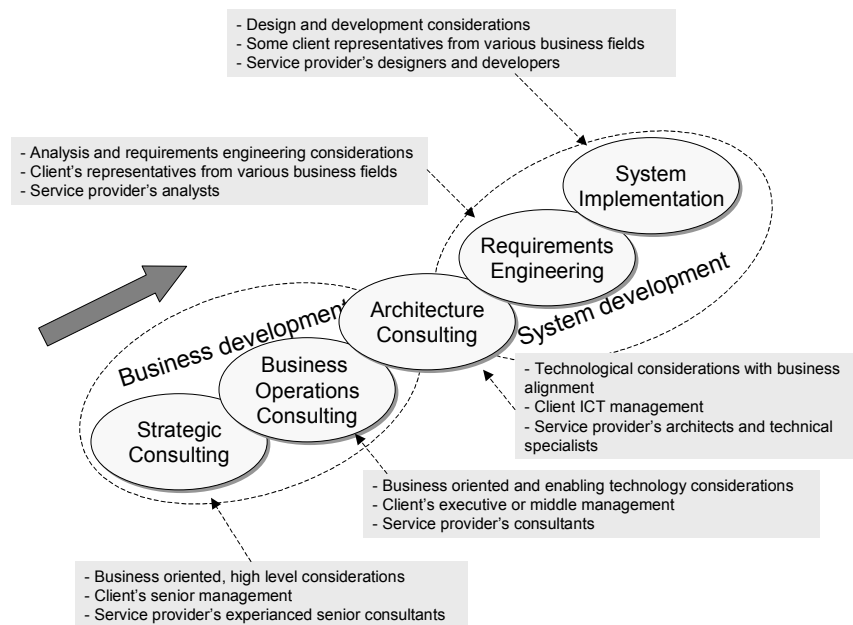


FIGURE 1.5 A high-level process continuum

2.2 The Gap between Strategies and Implementation - Methodic Support for EA Projects as a Bridge

The starting point for the EA methodology development was the analysis of methodology requirements. During this phase in TietoEnator's subproject in LARKKI-project, the target was to analyse what kind of methodological support would be needed in projects dealing with EA planning and consulting. The work started with a pre-study and a literature survey. Several methodological approaches are available in the literature, and the next step was to analyse their suitability for the actual consulting projects.

In parallel with the literature study, the target organisation and the EA consulting cases conducted in TietoEnator were examined. Data was collected in semi-structured interviews with senior architects in three different business areas of the company: Telecom & Media, Public & Healthcare and Production & Logistic. Flexibility in the data collection technique was needed, since the area is not well established. This proved to be justifiable, since with the collected data, the structures previously created by the interviewers were modified. Not only the researchers, but also the specialists in the company, were involved in the learning process, creating a shared understanding of the field. The interviews were recorded on tape and the interview reports produced were reviewed and

discussed with the company specialists. Thus the interpretation could be characterised as negotiated text (Fontana and Frey 2000). In addition to the interviews, the methodologies, processes and tools used in the company were examined. The results indicated that EA planning methodologies were known to TietoEnator. The study found that the current academic or commercial EA planning methodologies are not directly applicable to consulting needs, and, as mentioned earlier, do not support the meta-level process from management consulting projects to architecture consulting, and, finally, to system development. The available methodologies had been tried out by the consultants, who confirmed the results of the literature study: the strengths of the existing EA methodologies lie in the area of the end-user organisation's EA management, and their adaptability for actual consulting projects is rather poor.

The uniformity of the results in the studied EA consulting cases was striking, although no common EA consulting methodology was in use. Also, some tasks common for all EA consulting cases were found. Project starting activities, such as current state analysis and project ending activities such as development planning were a part of all EA planning cases, indicating that some competence had already accumulated, and that practice proven approaches were used in the area.

We found that each area in the meta-process level continuum, from management consulting to system development, has different kinds of methodological requirements. In business development related consulting tasks, communication is an essential part of the work. Understandability of the descriptions is a key requirement. Simple and easy to understand descriptions on a rather high abstraction level are needed. At the other end (systems design and development), formality, exactness and high precision of descriptions is required.

Various other requirements were identified. The clients of EA projects have different levels of organisational maturity. The methodology should be easy to learn and should address people with different backgrounds. Users of the methodology would not be limited to EA architects and consultants, but would also include non-IT professionals in the client organisations. Domain specific support for different business domains should be enabled. Flexibility of the methodology is also very important in consulting assignments. An ICT services provider needs a modular methodology for projects varying in size and scope, focusing on different levels and areas of both ICT and the target organisation. This means that there is a need also for an adaptive toolkit approach. Support for creativity and knowledge sharing should be part of the methodology. EA methodology should interface to system development and process/strategic consulting. Also, support for evaluation, testing and assessment should be incorporated. It should be noted that such approach could be useful also for ICT end-user organisations when they are developing their EA incrementally in small steps.

To summarise, current EA planning methodologies do not support all of these requirements very well, but are rather better suited for the continuous EA

management process for ICT end-user organisations. This is why it was decided to continue with an EA consulting methodology development effort.

2.3 The Effect of Some Risk Factors and Client Effort on Project Success

One area of methodological improvement is risk management. Competitive and successful projects are a prerequisite to be competitive in ICT service business. Factors affecting project success should be understood and risks affecting project success should get due attention in the methodology development.

The research technique and collected data were the same as in the first paper discussed in Section 2.1. In addition some important background information was collected in the interviews. Differencing from the previous studies in the area of project success factors, the client's and the services provider's perceptions of project success were looked at separately. The project size, the relative effort invested by the client, lack of business domain knowledge, project management and administration, lack of technical knowledge, substance-related decision making and responsibility in implementing the results into use were selected as risk factors for the analysis. These factors were based on the literature, but the list was revised by the specialists in the target company.

The original assumptions about the most important project risks proposed by the specialists and by the literature only partially matched with the achieved results. The project success factors for the clients and the services provider turned out to be different. On the client side, results meeting the business needs, produced on time and within a budget, are considered the central success factors. To the service provider, client satisfaction and profit produced are the most important project success factors.

The client does not see all the risks referred to by the literature on project success. For example, project size and technology related risks did not affect project success from the client's perspective. The services provider is able to hide these risks, which is one sign of the service provider's process maturity, but also an indication of success in its strategy - targeting to strategic long-term partnerships and added value to the clients.

The source of domain knowledge and client satisfaction were related. The predictive variable with highest accuracy from the client's perspective seemed in this study to be the relative effort of the client in the project and the source of business domain knowledge. In most cases, typical success factors proposed in the literature, such as project management or technical knowledge, had, in the studied data, no relation to the client's perception of project success. The data yielded the result that the greater the relative effort of the client was, and the closer the source of business domain knowledge was to the client, the more

likely it was that the project was deemed successful from the client's perspective.

In the service provider side, large projects seem challenging: many things can go wrong and the service provider's success factors are harder to meet. Client efforts in the project seemed in this study to have some relation to project success, also from the service provider's perspective. If the client works hard, which can also be interpreted as a commitment by the client's management, the domain knowledge is better injected to the project. It is also more likely that the service provider in this case will put more effort in the project than would be the case with a passive client. Technology is commonly regarded as a risk factor. Our results indicate that this need not be the case. It is likely, that the services provider recognizes technology related risks early, and mitigates the risk with personnel training and careful project planning.

Differences in success and risks factors support also the general assumption of the difference between the ICT end-user organisation and the ICT services provider's EA management. Both should be managed, but EA management and development processes should have their own focus areas at the services provider's and at the client's side. Actualized project risks seem to reflect the changing business environment. A strategic business relationship offers trust and mutual benefits for the services provider and the client.

2.4 A Practical Approach to EA Planning and Development: the EA Management Grid

The interfaces of the project types provided by ICT service providers, project risk and success factors and EA consulting methodology requirements were the findings of the previous papers. From these starting points, a methodological approach was developed. The study presents a common EA planning framework. The framework is used for the actual methodology, which includes also detailed descriptions of the deliverables, the tasks and the process.

Literature was studied to identify basic concepts of the approach. We took Rood's (1994) meta-model of the enterprise as a starting point and compared the enterprise components in it with widely accepted enterprise architecture dimensions: Business/process architecture, Information/data architecture, System/application architecture and Technology architecture. As mentioned before, simplicity was one target of the consulting methodology and was aimed at to make the use of the methodology easier and to enable communication with the clients. The set of dimensions is limited when compared for example to Zachman's (2003) framework (O'Rourke *et al.* 2003), but is supported by many approaches (e.g. Perks and Beveridge 2003). Our study indicates that practical EA cases support these dimensions. Correspondence of selected dimensions to Rood's (1994) generic model is discussed in the paper.

In addition to the literature study, EA consulting case descriptions were requested from the company specialists. The descriptions were discussed and analysed in the workshop. The interview reports were reviewed and discussed with the interviewees. Thus the results can be interpreted as a negotiated text (Fontana and Frey 2000).

Both literature and practical consulting cases indicate the need for a layered approach. In the literature there are layered models, but the layers are defined in a different way compared to the approach presented here. The chosen dimensions of our approach are seen as layers in some models (e.g. NIST 1989). Sometimes the dimensions proposed by us are mixed with decision-making levels (e.g. Zachman 2003). We selected layers based on decision-making. At the highest level (Enterprise level) the top management of the client is involved and questions are related to the whole enterprise scope. The middle management makes business operational decisions based on top management input at the domain level; and finally, at the systems level, decisions are materialized in systems related areas.

The proposed methodological approach is the EA management Grid. The EA management grid is a combination of the four architectural dimensions and the three levels of decision making that reflect also different levels of abstraction. Both are well argued in the literature, but have not been combined so far. The 4x3 matrix is a tool to manage and plan different areas of EA consulting work, including requirements, preliminaries for the tasks, deliverables of different project types, tasks in different project types and planning constraints. It is a backbone for the modular EA planning and development methodology. The main principles of the usage are presented in the paper.

The Grid includes all four dimensions, including technology architecture, at the enterprise level. This is different from other hierarchical EA models that place technology at the bottom level only. We think that top management will be involved with the high level decision making related to technology investments and strategic principles in technology usage.

The results of the study were evaluated against real client cases. Information of the cases was collected by requesting project descriptions and documentation from the consultants from different business areas of the company. The collected and analysed data was discussed and commented by the consultants.

The model was tested in pilot consulting projects which supported the suggested approach. The cases seem to fit well to the model. The Grid was found to clarify the hierarchical view of EA, to support a modular approach needed in consulting cases, and to meet the requirement to cover the gap between management consulting and systems development. In addition to the evidence brought in with the study discussed in this thesis, we could add that the suitability was also proven in the second development cycle of the EA methodology that started after piloting the results. The Grid was adopted

without changes as a starting point for the second version of the EA consulting methodology development.

2.5 Evaluation of enterprise IT architecture solutions – How can an ICT consultant tell what is the best for you?

ICT end-user organisations' EA development and ICT service-providers have differences, but both have common starting points and objectives: the same domain and an interest to contribute to the business success of the target organisation. The consultant often faces the task to evaluate different aspects in EA development and management. A validation and evaluation methodology that serves both parties is needed to ensure quality and to reach previously mentioned objectives. Our literature study indicated that concrete evaluation and testing guidelines for EA are vague. They don't guide the usage of existing evaluation tools, which are included in up-to-date software development methodologies and are quite well established for a single systems' architecture evaluation. However, EA as a context for evaluation is novel.

As a research technique, senior architects from different business areas were requested to provide project descriptions. Nine cases, which were agreed to be typical EA consulting cases, were analysed. The collected data was the same as in the paper presented in the previous section, now analysed from the evaluation perspective. These analysed results were discussed with the consultants to validate the findings.

In the studied cases the most frequently demanded services were in the technology architecture area. The clients seem to appreciate the experience, which, in many cases, is available from the consultants who have seen similar cases in the past. Even though the number of the cases was rather small, a very large variety was found. There were long and large projects, short and small ones, cases where the relative numbers of the client personnel in the project clearly outnumbered the provider's staff in the team, and cases where most of the project staff were consultants. Project starting and ending activities were common in all cases. Project level quality target setting and evaluation seems to be a common procedure, and the quality management of single EA development results was mostly based on reviews. These cases supported our previous findings: A client organisation manages its entire EA for business optimization, whereas a consultant gets limited cases varying in size and scope. Evaluation approaches identified from the projects and literature were combined to support both the ICT end-user organisation and the ICT service provider. Both parties are contributing in a consulting project and both should also participate in the testing and evaluation. From that perspective it is not the consultant alone who can tell what the best solutions for the ICT end-user organisation are. The clients have a great responsibility in the EA development

as they manage their entire EA and develop it with the consultants in a joint process.

These were the starting points in our V-model for EA testing and validation, based on the original V-model for testing (Wallace and Fujii 1989). The lowest level of the model, single planning results validation, presents the most precise level of detail and the shortest time between result production and testing. At the upper levels, the level of detail decreases and the timeframe between results production and testing grows. Pre- and post planning activities focus on business goals and development plans in various areas, development initiation and ending focuses on project level quality assurance and maturity analysis. By continuous improvement we refer to the client's own continued EA improvement process.

A contribution of the study was to provide a context for IT evaluation that had been seen lacking (Remenyi 2000). Architecture is the "big picture", which is more than just the sum of its parts. It provides and enables business benefits and gives, from the business perspective, a more solid ground for evaluation than a single architecture component evaluation would give. Quality targets and testability should be a part of the EA project from the beginning and should influence the whole project. Testing and testability should be paid attention to as early as possible (Wallace and Fujii 1989). The V-model for EA testing and validation marks the evaluation points in the EA management cycle, and guides which evaluation methods could be used and when evaluation should be planned, ensuring effective resource allocation.

2.6 Application Portfolios in Practice – Tools for ICT planning, management and business value evaluation

One of the identified requirements for the EA consulting methodology was a toolkit approach and a set of tools. Application portfolio models are proposed as a tool for enterprise level strategic ICT management, to maximise benefits from information systems investments. Application portfolios support ICT asset management by optimizing the portfolio and the use of items in it. However, our experiences in EA consulting suggest that application portfolio models are not always the most suitable tools to start with in an organization's EA planning and management.

We conducted a case study to validate this assumption. Three cases that were targeting investment planning for systems architecture and development in two different domains were selected. Data was collected again with semi-structured interviews with consultants and a client representative, and this information was supplemented with the consultants' experiences from other similar cases. The interviews were recorded and, transcribed, and the interviewee reviewed the transcribed interview reports. All the interviewees agreed that application portfolios could at least give new perspectives to the

planning and evaluation effort. For this kind of use, application portfolios could be useful for most organisations.

The organisation's domain, its strategic flexibility and organisational maturity affect the usability of the application portfolio models. Often public organisations have a lower strategic flexibility, and their goals are externally set. For these and for other reasons, adequate results can be achieved in planning even with simpler tools.

The literature presents maturity models for various areas. They all present the development of an entity from an initial level towards an idealistic state. Each level in these models has some entry criteria. In this study, organisational maturity was found to affect application portfolio models' usability. If the organisation's maturity is low, for example when an application's business context, supported processes or owners are unknown, application portfolio models are not the first tools to use. Instead, simple system maps and obsolete/conflicting systems lists can be used to clarify basic issues. The strategic positioning of applications that is requested for portfolio models is nearly impossible if the system's business context is unknown. For evaluation purposes, these simple planning tools seem to be inadequate.

A framework of organisational maturity for the selection of a planning tool for information systems investment planning was developed and presented to guide the selection of consulting and planning tools for different kinds of organisations. The model consists of four levels:

- 1) Nearly chaotic initial level
- 2) Awareness level, where some management attention is paid to ICT issues
- 3) Managed level, where systems are known and managed in a simple way
- 4) Optimal level, where application portfolio is continuously optimized

Only organisations that have reached the third level (managed), can fully benefit from the application portfolio models in their information systems investment planning. The weakness of the model resides in the limited number of studied cases.

The study provided an understanding of organisational maturity in general. The ICT end-user manages its entire EA. If the organisation's organisational maturity is low, well-managed EA cannot be defined and developed quickly in one effort. Instead, the development should be partitioned to manageable projects, which should be carried out in business priority order. For this kind of approach, modular and adaptive EA planning methodologies are needed. The methodological requirements are almost the same as in EA consultancy use discussed in this study.

2.7 User Participation in Consulting Projects: Client and Provider Role Variations

This whole thesis has been dealing with consulting services and one main theme has been the dynamism between the ICT service providers and the ICT end-users. In this article we studied consultants' participation and role variations in consulting cases. Even if the context of the development area and requirements were well understood, which can be achieved for example with the EA management Grid (Hirvonen and Pulkkinen 2004) or with planned evaluations (Hirvonen and Pulkkinen 2003), the project can be unsuccessful if the roles of the project participants are not clear and expectations are not understood.

As a starting point we analysed the literature on participation. A lot of work has been done on participation models, but mostly the focus has been on traditional system development projects or IT projects of undefined type. Some consulting related models (Spewak 1992, Block 2000) were also found. The study supported those models only partially, but they gave good insights for the exploration of the area. A general IS planning and implementation framework (Kwon and Zmud 1987) was suggested to clarify the relations of different types of participation.

Our results indicate that consulting cases vary. Their size, scope and content are typically planned case by case. This variability can also be seen in the participation models. In this article, three data sets were analysed. Two of them were collected in the previously presented studies. The third one was collected in two phases. First, semi-structured interview techniques (Yin 1994) were used and the interview reports were discussed allowing us to interpret them as a negotiated text (Fontana and Frey 2000). After the first interview the data was analysed and the results were used as a starting point for the second interviews, where the case documentation was also available to get a more balanced picture (Hodder 2000). The results of the second interviews were documented and reviewed by the company specialists.

As a conclusion, simple information facilitation without any deeper participation in the client's development process can be successful or, on the other hand, the consultants role can be highly operative, and the consultants are closely involved in the decision-making and project management. This goes partially against Block's (2000) 50/50 model, where both the client and the consultant are supposed to participate in decision making and development equally.

The ICT end-user's organisational maturity, as mentioned previously, seems to affect the participation roles. If the client is at a lower maturity level, the need for operative consulting seems to be greater because of the lower competence to conduct or manage the development.

Because there is no single optimal participation model for all consulting cases, the model of consultant participation variations in consulting cases was

created and presented. The model forms a hierarchical model of consulting involvement starting from technology information facilitation at the low involvement end and ending with business operative consulting, where the consultant's close involvement in the decision making process is necessary. The tool will help both the ICT end-users and the ICT service providers to set expectations, understand competence requirements and plan and negotiate about the project as a part of an entire organisation's EA context.

2.8 About the joint articles

The author of this thesis wrote the sixth article, "Application Portfolios in Practice - Tools for ICT planning, management and business value evaluation". Other members of the LARKKI-project group contributed to the writing process in the rest of the articles. The author was the main writer managing the writing process in all the articles presented in this thesis and also managing the action research process.

Our approach to writing was iterative. We quickly produced new versions and each writer in the research group modified the text in their turn. The first and third articles, "The Profiles of Projects Supplied by a Full-scale ICT-Services Provider" and "The Effect of Some Risk Factors and Client Effort on Project Success", were written jointly by me, Jarmo J. Ahonen and Mirja Pulkkinen. The research was planned together. The author designed the questionnaire content and conducted the data collection. Jarmo J. Ahonen conducted the statistical analysis. The author analysed the statistical results with other writers and wrote concluding parts.

The second article "The Gap between Strategies and Implementation - Methodic Support for EA Projects as a Bridge" was written with Mirja Pulkkinen, Jarmo J. Ahonen and Veikko Halttunen. The research was planned together. Mirja Pulkkinen collected the data; analysis of the data was done together.

The fourth, fifth and seventh articles "A Practical Approach to EA Planning and Development: the EA Management Grid", "Evaluation of enterprise IT architecture solutions - How can an ICT consultant tell what is best for you?" and "User Participation in Consulting Projects: Client and Provider Role Profiles" were written together with Mirja Pulkkinen and the author. Data collection was planned together. The data analysis was done and the EA management Grid was developed jointly. The V-model for EA testing and validation in the sixth article and the consultant's participation model in the seventh article was developed by the author.

3 LIMITATIONS OF THIS STUDY

The research project was carried out in only one ICT services provider organisation. Other organisations in other geographical areas, like in the USA or in Asia, may have different kinds of needs in their business environments. The target organisation of the action research study described here is, nevertheless, the largest ICT services provider in Scandinavia. TietoEnator Corporation has organized its business areas according to its client domains. Three different domains of the total six participated in the studies. International perspective was included in two ways: First, consulting cases delivered to the international customers including corporate wide planning tasks were selected to the study. Second, the early versions of the methodology were presented and commented by international forums in TietoEnator and the produced EA development methodology was deployed company wide.

The limited time frame of the research project was another constraint. Most of the results of this study were produced during two years. During that period, literature was studied, requirements were collected, and the first methodology versions were developed and piloted. Pilot results were collected and a new version of the methodology was developed. In addition to that, different kinds of project related data were collected from a three years period in the history, to have a broader scope of evidence.

4 CONCLUSIONS

The role of ICT in organisations has changed dramatically. It has become a mandatory element in organisational and competitiveness improvement and has entered partner and client interfaces. EA management is a managerial tool to guide and develop the whole organisation and the technologies and solutions supporting its activities, enabling novel business opportunities and improvement of operations. This has generated new and changed requirements for methodologies and competencies. One of the required areas is EA consulting and development.

The research questions of this study were:

1. How are Enterprise Architecture (EA) consulting, management and planning conducted at TietoEnator and what are the requirements for methodological support for this activity?
2. How do currently available methodologies support the activity?
3. What kind of methodological support and approach is needed by an ICT services provider in EA consulting and how to implement it?

The answer to the first question is that EA consulting should be studied within the context of its relations to other services of an ICT provider. The study results indicate that the providers' service portfolios have evolved. In addition to traditional system development, a modern full-scale ICT services provider offers strategic, process and architecture consulting.

Traditional system development services have also changed. Analysis phases are separated from other system development areas to separate projects. The reason for this is the open competition that today is required also from the public sector organisations. The separation of system development project phases to individual projects is, from the risk management perspective, also in the interest of the ICT services providers.

The ICT service providers' services form a high-level meta-process where the results of the previous phases can flow to the next ones. If this is enabled by the methodologies, information can be smoothly exchanged and project-starting phases will require less effort reducing time and cost. This sets requirements for EA planning methodology and challenges iterative approaches in the current systems development methodologies.

An important driver behind the change of the ICT providers' service portfolio is the general ICT business change. The services providers are interested in long-term partnerships and increased client satisfaction. These goals can be reached when the client expectations are met. Actions to improve the client satisfaction include development of practices and competencies, which will prevent risks or hide them from the client, and offering consulting services, which will create added value to the client.

The end-user organization and the services provider perspectives to ICT and EA development are different. Differences between the end-user and the services provider are apparent in their perceptions of project risks and project success factors. Some of the risks proposed in the literature are not visible to the client, and the perception of the project success factors differs between the client and the services provider. One key reason for this is the previously mentioned ICT business change. Differences can be seen also in the other areas. The ICT end-user develops and optimizes its whole ICT whereas the services provider works on limited development projects that vary in size and scope. Our study indicates that the client's and consultant's project participation models vary case by case and are different from traditional systems development projects.

Differences in the end-user organization and the services provider ICT development mean also differences in the requirements for methodologies. The requirements for EA consulting methodology were identified and analysed. Among other things, consulting cases' variability requires an adaptable and modular methodology. In addition to consulting requirements, the same requirements seem to apply also to the ICT end-user organisations which need modular step-by-step development approach.

The answer to the second question is that a lot of work has been done in EA methodology development, but the previously mentioned requirements are met only partially there. ICT end-user requirements are better supported in the methodologies, but support for consultancy needs is rather weak.

Therefore, as an answer to the third question, a framework for EA consulting methodology, the EA Management Grid, was developed. The EA management Grid is a combination of the four architectural dimensions and the three levels of decision making with a corresponding level of abstraction. Both are well justified in the literature, but have not so far been combined in one entity. The matrix is a tool to manage and plan different areas of EA consulting work. It is a backbone for the modular EA planning and development methodology. The methodology was completed with an evaluation and testing model that meets the previously mentioned requirements and consultant participation model in consulting cases to support project planning. Presented research results as well as other materials produced in the research project were

integrated into the methodology, which was then evaluated in real EA development cases.

The main contributions of this study are summarised as follows:

- Investigating consulting as a part of ICT services (a novel area for both IS and SE research).
- Recognition and exploration of the gap between consulting and software development, and eliciting requirements of a methodology that covers the gap.
- Creating an ICT services continuum (meta-process).
- Creating EA decision-making layers to parse the examination of EA for different stakeholder groups that need EA descriptions at different levels of abstraction.
- Creating the EA Grid as a methodology framework to cover the meta-process and bridge the gap.
- Creating the V-model of EA evaluation to fit the EA Grid.
- Creating a model for application portfolio tool selection based on organization type and organizational maturity.
- Creating a participation model for provider and client efforts in consulting projects.

Topics for further study:

1. Our study indicated that an ICT providers' services form a high-level meta-process. Methodological support for this kind of process is weak. We developed a methodological support for EA consulting, which connects business consulting and systems development. However, further methodological research and development on meta-process level including strategy, process, architecture and systems development is needed.
2. The support for consulting needs as well as for EA development in organisations with lower organisational maturity is weak in the current EA methodologies. The EA methodology developed in this study applies to these requirements, but further research and development of adaptive and modular EA methodologies is needed.
3. In current ICT providers' service portfolios, analysis phases are separated from other systems development phases. Current systems development methodologies assume that all phases are included in one project. Therefore, development of iterative systems development methodologies to support separation of analysis and design phases from other parts of the system development projects is needed.
4. The issues studied have an impact on competence needs both in the ICT end-user and in the services provider organisations. An analysis

of new competence and training needs for ICT students and professionals based on changed business environment described in this study is needed.

The next sections include the seven research papers previously discussed.

REFERENCES

- Action Research Resources 2004. [Accessed 28.7.2004]
<http://www.scu.edu.au/schools/gcm/ar/arhome.html>
- Argyris, C., Putman, R. & McLain Smith, D. 1985. *Action Science. Concepts, Methods and Skills for Research and Intervention*. San Francisco: Jossey-Bass Publishers.
- Baskeville, L. R. & Wood-Harper, A. T. 1996. A Critical Perspective on Action Research as a Method for Information Systems Research. *Journal of Information Technology* [1996] 11, 235-246.
- Block, P. 2000. *Flawless Consulting, A Guide to Getting Your Expertise used*, 2nd edition. San Francisco: Jossey-Bass/Preifer.
- Braa, K. & Rolland, K. H. 2000. Horizontal Information Systems: Emergent Trends and Perspectives. In R. Baskerville, J. Stage & J. I. DeGross (Eds.) *Organizational and Social Perspectives on Information Technology*. Boston: Kluwer Academic Publishers, 83-101.
- Cohen, E. 1999. Reconceptualizing Information Systems as a Field of the Transdiscipline Informing Science: From Ugly Duckling to Swan. *Journal of Computing and Information Technology* 7 (3) 1999, 213-219.
- Dickson, G. W. 2003. Drivers of IT Success and Failure - Technology or Management? Guest Lecture at the Department of Computer Science and Information Systems, University of Jyväskylä March 2003. Gary W. Dickson, North Carolina State University 2003.
- Earl, M. J. 1989. *Management Strategies for Information Technology*. New York: Prentice Hall.
- Fontana A. & Frey J. H. 2000. The Interview: From Structured Questions to Negotiated Text. In N. K. Denziu & Y. S. Lincoln (Eds.) *Handbook of Qualitative Research*, 2nd Edition. London: Sage, 645-672.
- Gabel, D. 1995. An Introduction to Action Research. National Association for Research in Science Teaching, San Fransisco. [Accessed 10.2.2004]
<http://physicsed.buffalostate.edu/danowner/actionrsch.html>
- Henderson, J. C. & Venkatraman, N. 1999. Strategic alignment: Leveraging information technology for transforming organisations. *IBM Systems Journal* 38 (2-3), 472-484.
- Hirvonen, A. 2004. Application Portfolio Models in Practice - Tools for ICT Planning, management and business value evaluation. In D. Remenyi (Ed.) *The Proceedings of 11th European Conference on Information*

- Technology Evaluation, ECITE 2004. Ireland: Academic Conferences Limited, 183-192.
- Hirvonen, A., Ahonen, J. & Pulkkinen, M. 2004. The Profiles of Projects Supplied by a Full-scale ICT-Services Provider. In I. Seruca, J. Filipe, S. Hammoudi & J. Cordeiro (Eds). ICEIS 2004 - Proceedings of the Sixth International Conference on Enterprise Information Systems. Porto: INSTICC, 123-130.
- Hirvonen, A. & Pulkkinen, M. 2003. Evaluation of Enterprise IT Architecture Solutions - How can an ICT consultant tell what is best for you? In E. Berghout & D. Remenyi (Eds.) Proceedings of the 10th European Conference on Information Technology Evaluation, ECITE 2003. United Kingdom: Management Centre International Limited, 327-337.
- Hirvonen, A. & Pulkkinen, M. 2004. A Practical Approach to EA Planning and Development: the EA Management Grid. In W. Abramowicz (Ed.) BIS 2004 - Proceedings of 7th International Conference on Business Information Systems. Poznan: Department of Management Information Systems, The Poznan University of Economics, 284-302.
- Hirvonen, A. & Pulkkinen, M. 2005. User Participation in Consulting Projects: Client and Provider Role Variations. Submitted to ECIS 2005 conference.
- Hodder, I. 2000. The Interpretation of Documents and Material Culture. In N. K. Denziu & Y. S. Lincoln (Eds.) Handbook of Qualitative Research, 2nd Edition. London: Sage, 703-716.
- Holmes, D. 2001. eGov e-business Strategies for Government. London: Nicholas Brealey Publishing.
- IEEE 1990. IEEE Standard Computer Dictionary, ISBN 1-55937-079-3, 610.
- Ives, B. & Jarvenpaa, S. 1991. Applications of Global Information Technology: Key Issues for Management. MIS Quarterly 15 (1), 33.
- Johansen, R. 1988. Computer Support for Business Teams. New York: The Free Press, MacMillan, Inc.
- Kwon, T. H. & Zmud, R. W. 1987. Unifying the Fragmented Models of Information Systems Implementation. In R. J. Boland and R. A. Hirschheim (Eds.) Critical Issues in Information Systems Research. New York: Wiley & Sons, 227-251.
- Mathiassen, L. (1998). Reflective Systems Development. Scandinavian Journal of Information Systems 10 (1&2), 67-117.
- Mayer, R. J., Crump, J. W., Fernandes, W. C., Keen, A. & Painter, M. K. 1995. Information Integration for Concurrent Engineering (IICE) Compendium of Methods Report. [Accessed 24.8.2004] <http://www.idef.com/Downloads/pdf/compendium.pdf>.
- NIST 1989. Special Publication, Information Management Directions: The Integration Challenge. NIST, 500-167.
- Olle, T. W. , Hagelstein, J., Macdonald, I. G., Rolland, C., Sol, H. G., Van Assche, F. J. M. & Verrijn-Stuart, A. A. 1988. Information Systems Methodologies. A Framework for Understanding. International Federation for Information Processing (IFIP), New York : Addison-Wesley.

- O'Rourke, C., Fishman, N. & Selkow, W. 2003. Enterprise Architecture – Using the Zachman Framework. Canada: Thomson, Course Technology.
- Perks C. & Beveridge T. 2003. Guide to Enterprise IT Architecture. New York: Springer.
- Pressman, R. S. 2000. Software engineering : a practitioner's approach [adapted by Darrel Ince]. 5th edition, European adaptation. London: McGraw-Hill.
- Remenyi, D. 2000. The Elusive Nature of Delivering Benefits from IT Investment. *Electronic Journal of Information Systems Evaluation (EJISE)*, 3 (1). [Accessed 27.6.2003] <http://www.iteva.rug.nl/ejise/index.html>.
- Robson, W. 1997. Strategic Management & Information Systems. 2nd edition. London: Financial Times, Prentice Hall.
- Rood, M. A. 1994. Enterprise Architecture: Definition, Content and Utility. In *Proceedings of the IEEE Third Workshop on Enabling Technologies. Infrastructure for Collaborative Enterprises*. Morgantown: IEEE Computer Society Press, 106-111.
- R-Project 2004. The Comprehensive R Archive Network. [Accessed 8.12.2004] <http://cran.au.r-project.org/>.
- Seltsikas, P. 2000. Managing Global Information Strategy: Xerox. In S. Ang, H. Krcmar, W. J. Orlikowski, P. Weill & J. I. DeGroos (Eds.) *Proceedings of the Twenty-First International Conference on Information Systems. ICIS 2000*. Atlanta: Association for Information Systems, 791-806.
- Sommerville, I. 1998. Software engineering. 5th edition. Boston: Addison-Wesley.
- Somogyi, E. K. & Galliers, R. D. 1987. Strategic Information Systems Management: Towards Strategic Information Systems. Abacus Press: Cambridge.
- Spewak, S. H. 1992. Enterprise Architecture Planning: Developing a Blueprint for Data, Applications and Technology. New York: John Willey & Sons, Inc.
- TietoEnator 2003. Business Review 2002. Helsinki: BBDO Helsinki Oy/Libris.
- TOGAF 2003: TOGAF – Frequently Asked Questions. [Accessed 18.2.2003] <http://www.opengroup.org/togaf/>.
- Wallace, D. R. & Fujii, R. U. 1989. Software Validation and Verification. *IEEE Software* 6 (3), 10-17.
- Ward, J. & Peppard, J. 2002. Strategic Planning for Information systems, 3rd edition. Chichester: John Willey & Sons Ltd.
- Weill, P. & Broadbent, M. 1998. Leveraging The New Infrastructure: How Market Leaders Capitalize on Information Technology. Boston: Harvard Business School Press.
- Yin, R. 1994. Case study research: Design and methods. 2nd edition. Beverly Hills: Sage Publishing.
- Zachman, J. 2003. Enterprise Architecture: The issue of the Century. [Accessed 30.10.2003] www.zifa.com.

FINNISH SUMMARY

Tietotekniikan rooli organisaatioissa on muuttunut voimakkaasti. Siitä on tullut välttämätön elementti organisaation toiminnan ja kilpailukyvyn kehittämiseksi. Yritysarkkitehtuurien hallinta on organisaation johdon väline hallita ja kehittää organisaation koko tietotekniikkaa tietotekniikan samalla luodessa mahdollisuuksia uudentyyppiselle toiminnalle.

Tutkimuksessa havaittiin, että tietotekniikkapalvelutoimittajan näkökulma tietotekniikan kehittämiseen on erilainen loppukäyttäjän näkökulmaan verrattuna. Palvelutoimittaja saa tehtäväkseen eri kokoisia ja rajaukseltaan erilaisia kehittämistehtäviä. Tietojärjestelmien kehittämisen lisäksi johdon ja arkkitehtuurien konsultointi ovat osa palvelutarjontaa. Kyky tehokkaasti hyödyntää palveluketjun eri vaiheiden tuloksia myöhemmissä projekteissa on selkeä kilpailuvaltti toimittajalle. Palvelut muodostavatkin jatkumon ja ylemmän tason prosessin, jossa nykyinen kilpailutilanne on johtanut muun muassa määrittelyprojektien eriytymiseen samalla aiheuttaen paineita nykyisille iteratiivisille kehittämismenetelmille ja osaamiselle.

Erot palvelutoimittajan ja loppukäyttäjän välillä näkyvät myös projektiriskeissä. Tyypillisiksi merkittäviksi riskeiksi arvioidut teknologinen osaaminen tai projektin koko eivät välttämättä olekaan loppukäyttäjäorganisaatiolle näkyviä riskejä. Sen sijaan loppukäyttäjän osallistumisella on selkeä merkitys projektin onnistumiselle.

Näistä lähtökohdista toimintatutkimuksen luonteinen tutkimusprojekti lähti kehittämään menetelmällistä tukea palvelutoimittajan yritysarkkitehtuurimenetelmän kehittämiseksi aluksi kartoittaen menetelmän vaatimuksia. Näiden perusteella toteutettiin ja käytännössä testattiin menetelmän perusosa, joka ohjaa ja tukee yritysarkkitehtuurien monimuotoisia konsultointiprojekteja. Menetelmäkehityksen ohella kehitettiin myös malli yritysarkkitehtuurin evaluointiin ja laadun varmistamiseen. Malli pohjautui osin jo käytössä oleviin toimintatapoihin huomioiden sekä tietotekniikkapalvelutoimittajan että loppukäyttäjän tarpeet.

Vaikka toteutettu yritysarkkitehtuurien suunnittelumenetelmä soveltuukin parhaiten tietotekniikkapalvelutoimittajan tarpeisiin, osoitti tutkimushankkeeseen liittynyt tietotekniikan strategisen suunnittelun ja johtamisen alueelle tarkoitettujen sovellusportfolioiden tutkimus, että myös loppukäyttäjäorganisaatiot tarvitsevat yksinkertaisia ja joustavia työkaluja tietotekniikkansa kehittämiseen. Joillakin organisaatioilla arkkitehtuurihallinnan kypsyytaso on alhainen puuttuvan tai puutteellisen hallinnan johdosta. Tällaisissa tapauksissa kehittäminen pitää kohdistaa aluksi yksinkertaisiin ja rajattuihin perusasioihin, jolloin kehittämismenetelmien ja työkalujen vaatimukset ovat osin yhtenäisiä palvelutoimittajan vaatimusten kanssa.

Yhteenvetona havainnoista voidaan tiivistäen todeta, että tietotekniikan kehittäminen on vahvasti organisaation toimintaan ja strategiaan kytkeytyvää toimintaa, jossa arkkitehtuurien hallinta jatkuvasti korostuu. Tietotekniikan

loppukäyttäjän koko tietotekniikan kokonaisuutta hallitseva lähestymistapa on erilainen palvelutoimittajan rajattuihin projekteihin verrattuna. Tästä seuraa uusia ja muuttuneita tarpeita niin menetelmien kuin osaamisenkin kehittämiseen. Tässä tutkimuksessa on kartoitettu vaatimukset ja luotu menetelmälliset lähtökohdat tällaista toimintaa tukemaan.