Image source: (Insurance, 2010)

EXTENDED INFORMATION ECONOMICS MODEL

for the life & pension insurance branch

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PREFACE

This document presents the research project of the Extended Information Economics model and prescriptive method. This research was conducted between April 2011 and March 2012 and was done as Master Thesis project as student of the master programme “Economics & ICT”. Part of the study “Informatics & Economics” at the Erasmus School of Economics, faculty of the Erasmus University Rotterdam.

I would like to thank everyone of Logica that were involved in this project some way or another, and especially my company mentor Edwin van Dis, manager Ronald Evers and the supervisors Hilke de Wit (project leader of Working Tomorrow Rotterdam) and Robin Mastenbroek (Architect of Working Tomorrow Rotterdam). I also want to thank the representatives of the companies that have been interviewed. Last but not least I want to thank my university supervisor, Rob Mersel and the co reader Robert van Wessel, owner of ApixIS information consultancy for their good support during the writing of my master thesis.

William Tanis
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SUMMARY

This document presents the results of a master's thesis project for the programme "Economics & ICT", part of the study "Informatics & Economics" at the Erasmus School of Economics, Erasmus University Rotterdam. This project was combined with an internship at Logica.

The value of Information Technology (IT) for business has been an important topic in literature for decades. The economics of IT and the real value continues to be a mystery for most companies. Information Economics (IE) is a framework for finding the best fit at a certain point in time, to allocate organisation scarce resources (people, money, equipment). An issue for investing money in IT is that people generally do not know what is required, until they have built something and others comment on what they see. That makes the quantification of costs, risks and uncertainty of solutions a challenging hurdle to overcome. Enterprise Architecture (EA) in combination with the General System Theory (GST) can ease this last hurdle. This research project looks at designing an extension for the Information Economics framework with the topics of EA and GST, specific for migration projects.

Logica wants to get better insights for justification of their client's business migration projects. The focus of the research is on the life and pension branch. Relevance of a model that can give more insight in justifying the investments is high for these companies, because the insurance market is difficult due to legislation on transparency and more competition. Furthermore it gives a discovery of the links between the three topics for the academic literature base on IT project value estimates. The goal of this research, is to have a consistent model (system) to provide justification and continuous insight (reappraisal) of the (predictable) results of a business migration program to the stakeholders in the case of a Dutch life and pension insurance company. The following three objectives are derived from the goal: construction of a model, a prescriptive method to use the model in a specific business migration program and an empirical research of the results.

For the model and method design a literature study was done to investigate the possibilities and limitations for combining IE and EA. The GST provided a fundament for the model in collecting information from outside and inside the enterprise. For IE the improvement was possible on the matter of coping with subjectivity and getting a better insight in the IT landscape for value detection. EA was missing important human and organisational aspects in the design. The focus of the model and method design was on extending IE and EA with GST where used to extend IE.

The start of design showed the following limitations: there was no literature available on the combination of Enterprise Architecture and Information Economics. Another important limitation to consider was the subjective data involved, it was not possible to completely ban subjective data. Last limitation was the choice for a single sector and unavailability of EIE test data.

The EIE model was designed based on four blocks: functional and constructional perspectives (GST), EA framework, EA results and the IE framework. Each element provides input for the next and therefore the prescriptive method is set up to give companies a pathway to follow for applying these elements. The method consist of four phases: external discovery and internal discovery, enterprise architecture analysis and the information economics calculations. Furthermore the evaluation and governance are important aspects to ensure the tools for the EIE method for instance will be in control.

The EIE model and prescriptive method were designed. The templates for using the different elements are presented in the appendices. The next step was verification by an expert group to improve the prescriptive method before testing in practice. Five experts commented during interviews and these points were taken into consideration. Overall the comments show that the method was experienced as detailed in relation to methods used in practice. After the last feedback round, the model and method were testing in practice by using a multiple case study research. Two project proposals were used to show that the model and method can be applied to practice.

The empirical study showed the following limitations:

- The proposals were not (yet) worked out to documented migration projects, therefore the detail level was lower and that made it difficult to test all the different steps of the method.
- The details of the activities were not available. Without it was difficult to pinpoint values in detail.
- Furthermore in the time available it proved to be difficult to fully test the design. Years could be needed to grasp the full potential of an extension on IE.

Not every company can use the EIE model and method, because more information is demanded from the company and it is not available. Important is to start with existing material and look to which detail level is preferred and how to get there to use the EIE model effectively. Even with a low detail level the EIE method steps could be tested to provide a result for decision making and a first input for design. The model and method show a general way for all people involved to know what systems are designed or involved, because analysing without really knowing what to analyse does not make sense. The discovery and analysis phase showed an easy way to get a first general understanding of the project in its environment. Using the model for the first time can be difficult due to low detail levels, but the tables, Value Network Analysis and Enterprise Architecture models can be reproduced for future projects.

For future recommendations involve more companies, people in various roles, better tooling, more standards and fully test the EIE model during the project life this gives ways to test the governance.

1 INTRODUCTION

The importance of Information Technology (IT) for the economic development has been substantial the last 20 years (CBS, 2009). Empirical studies of the economic growth show different impacts of IT (OECD, 2004; van Ark & Inklaar, 2006). IT investments bring forth growth and renewability of capital goods inventory. Statistics show that IT has a contribution to the growth of the GDP between 0,35 and 0,9 percent point a year over the period 1995-2003 (OECD, 2004). After a global decline in 2009 of 4,9% in Information Technology (IT) spending, the recession led many CEOs to believe IT was one of the main cost pools that could safely be reduced without impacting a firm's overall performance (Gartner, 2010a). The underlying problem is that the economics of IT and the real value delivered continuous to be a mystery for firms (KPMG, 2008).

Information Economics (IE) is a framework of business investment strategies for the implementation, change and use of information systems (Parker, Benson, & Trainor, 1988). It is a framework for finding the best fit at a certain point in time, to allocate organisation scarce resources (people, money, equipment). The field of Information Economics takes several economic factors into account: (in) tangible benefits and costs, added value for stakeholders, risk and uncertainty. Still many investments in information technology are not delivering the demanded results (Keil & Mann, 1997; Mahring & Keil, 2008). Many reasons are identified why investments do not meet their expectations. Two primary reasons are:

- The organisational and human reaction to investments.
- The continuous shift in expectations of the information system.

People generally do not know what is required, until they have built something and others comment on what they see (Wierenga, 2009) That makes the quantification of costs, risks and uncertainty of solutions a challenging hurdle to overcome. Enterprise Architecture (EA) in combination with the General System Theory (Bertalanffy, 1950) can ease this last hurdle. Enterprise Architecture is about understanding all of the different elements that go to make up the enterprise and how those elements interrelate (Schekkerman, 2009, p. 7). The enterprise is a collection of organisations (systems) that have a common set of goals/principles and/or single bottom line (Schekkerman, 2009, p. 7). The system theory consists of a specific view on elements and their relation. The definition of a system is therefore important:

A system is a set of interacting or interdependent entities, real or abstract, forming an integrated whole. There are natural and man-made (designed) systems. Manmade systems normally have a certain purpose. They are designed to work as a coherent entity. Natural systems may not have an apparent purpose (Dietz, 2008, p. 7).

The three topics are combined in this research to create extensions for the Information Economics framework, called the Extended Information Economics (EIE) model and prescriptive method. The combination of EA and the General System Theory will also decrease the gap between the business and the IT aspects of information systems. There are some terms used in this report which could confuse the reader. Although this research is set up to be unambiguous and clear it could happen that the reader is confused, therefore these definitions of terms is provided. “The term IT is concerned with improvements in a variety of human and organizational problem-solving endeavours through the design, development, and use of technologically based systems and processes that enhance the efficiency and effectiveness of information in a variety of strategic, tactical, and operational situations” ("McGraw-Hill Encyclopedia of Science & Technology," 2012). This report focuses on information system projects (business migrations). So the term *IT investment* or *IT project* means that it is about an information system (IS) investment. The term evaluation is also a term which is often used in the research. A formal definition of evaluation: “usually defined as the determination of the worth or value of something, judged according to appropriate criteria, with those criteria explicated and justified” (Dan Remenyi, 1999).

The remainder of this chapter shows an outline of the research project. Section 1.1 describes the project context. Section 1.2 presents the research relevance, both from an academic and business perspective. Then section 1.3 presents the research objectives. Section 1.4 contains the research questions. Section 1.5 gives the general overview of how the research is carried out: the research method. Finally section 1.6 contains the outline of the remainder of this document.

1.1 Project context

This research project was conducted in the context of the Erasmus University of Rotterdam (EUR) and Logica Netherlands B.V. in Rotterdam.

First, the research project has been done for the EUR course “Master Thesis Informatics & Economics”, which is an obligatory course before graduation. The grade for the thesis will be determined by a supervisor and co-supervisor of the Erasmus University Rotterdam. The supervisor and co-supervisor give guidance during the research, communication on the progress will be on a regular basis. The supervisor for this research project was Dr. Ir. Rob Mersel, a staff member of the Erasmus School of Economics at the Erasmus University. The co-supervisor for this project was Dr. Ir. Robert van Wessel an external expert in the field of Information Management and associated with the Rotterdam School of Management at the Erasmus University.

Second, the research project has been done for Logica, a business and technology service company, located in 40 countries. Currently employing 41,000 people. It provides business consulting, systems integration and outsourcing to clients around the world, including many of Europe's largest businesses. The research is part of the Value Proposition development program for the Dutch Financial Services market. The results will be used in the Business Migration Value Proposition, which

provides products and services to enable clients to perform (business critical) migration projects. This research will focus specifically on companies operating in the life and pension insurance market.

1.2 Research relevance

This section is divided in two subsections. The first part is the academic relevance of the research and the second part is the business relevance of the research to Logica and its clients.

1.2.1 Academic relevance

In the literature there are a lot of examples of IT projects which escalate in time and costs or fail (Keil & Mann, 1997; Mahring & Keil, 2008). Even with four decades of experience of using and investing in information systems the failures rates keep sticking around 70 percent (Ward & Daniel, 2006). The combination between Enterprise Architecture and Information Economics is mentioned as a useful extension to the existing academic literature for IT projects (Wierenga, 2009). Also the opportunity for gaining the full potential of Enterprise Architecture, by looking at it from a System Theory perspective is mentioned in literature (Kloeckner & Birkmeier, 2009).

1.2.2 Business relevance

For the extended model and method interests are involved from Logica and their clients. For Logica the extended model and the outcomes of the research can give the Value Proposition Business Migration new insights in future client migration projects. Logica wants better insight in the investment justification during the migration, by taking all the various factors ((in) tangible benefits and costs, added value for stakeholders, risk and uncertainty) into account. A better grasp of risk and uncertainty brings new business value from an academic perspective. Therefore the model needs to be understandable and easy to imbed in a business migration program. The clients in the life and pension insurance branch are chosen for the research, because one of the choices insurers have, is to rationalize their products and the corresponding information systems. Forced by government regulations (as result of “woekerpolissen“), transparency has become a key requirement. Also the competition of products like “Bank saving products” which have more transparent costs, are an issue for the insurers. They are losing customers to the competition of other markets and so have particular interest in cost reduction and more transparency. This also gives the research an extra dimension of contribution to the society, by achieving a more transparent market.

Life and pension insurance is a long-tail business: decades can elapse between the time when a policy is sold and the claim is made. Managing a portfolio of these policies, each with its own approximately 30-year time horizon, can present an operational and IT headache. As more and more policies expire, the overhead and servicing costs for the systems that manage legacy products are spread across a dwindling number of active accounts, driving per-policy administration costs higher. Since insurers are required to book capital reserves against future expenses, those costs and their anticipated increase over time can weigh heavily on the balance sheet. The valuation of the current

policies, the quantification of risk and uncertainty, the temporal aspects in the investment cycle and the many stakeholders make the business justification complex.

So every insurance client needs increased business value of IT projects due to these changes in the environment. The model can give the insurers better insight in the enterprise assets that are needed for the core and support processes of the business. The combination of a new model combining Enterprise Architecture and Information Economics practices is an opportunity with enormous potential (Wierenga, 2009). Enterprise Architecture can help enterprises avoid the weaknesses in scorecard methods like IE. “But it works the other way around as well: Scorecard approaches prevent Enterprise Architecture from going astray. Enterprise Architecture can only strive as a discipline if it has a way of scoring projects which reflects the value that the architecture adds” (Schekkerman, 2009; Wierenga, 2009, p. 3). The Enterprise Architecture Approach of the IFEAD foundation is supported as best practice element for the method. The scoping on this matter was justified based on the proven approach in practice, the availability of experts in these projects, and the documentation base available in the organisation. Corresponding with the high resource availability in comparison with other EA approaches at Logica, and taking the time span into account this best practices gives the highest business relevance (Minoli, 2008; Schekkerman, 2009, 2011a, 2011c).

For this research the focus is on the product migration. The product is the life insurance or pension product. The important entities in both cases are the contracts (individual or collective). These agreements and corresponding data about the contact, calculation rules, pay outs, etc. have to be migrated. Through the commercial pressure and the difficulties with the administration systems the simple straightforward structure changed in a spaghetti web of products, interfaces, systems, etc. The mergers and take-overs in the insurance market also led to a staking of IT systems from different sources. There are a lot of different products with various characteristics and dependencies. Therefore a product rationalisation is needed next to a simplification of the insurance landscape.

1.3 Research objective

The goal of this research, is to have a consistent model (system) to provide justification and continuous insight (reappraisal) in the (predictable) results of a business migration program to the stakeholders in the case of a Dutch life and pension insurance company. The objectives are formulated according to the available time period of twelve months. It is possible to perform a profound empirical research study within the time period. The following three objectives abbreviate on the goal and form the content of the master thesis.

This goal is quantified by three objectives:

1. The construction of a conceptual model;
2. A prescriptive method to use the model in a specific business migration program;
3. An empirical research of the results.

In the next subsections the objectives are described in more detail.

1.3.1 Consistent model

The research will construct a quantitative model supporting an extended version of the Information Economics method. The model uses elements of Information Economics and Enterprise Architecture. The two topics have strong elements on justifying investment projects like migrating life insurance products. The objective is to combine these elements in an extended model. The consistent model (system) will be used to support an enterprise in their investment decision. To reach this objective a theoretical foundation is given to make the model consistent.

1.3.2 Prescriptive method

The extended model aims at providing more insight in the (economic) pros and cons for each stakeholder in relation to the criteria and requirements for a specific product migration.
A prescriptive method is needed to use the model in a business migration program. Figure 1 shows the program with its elements. The method focuses on using the model concepts for the product migration element in the complete program.

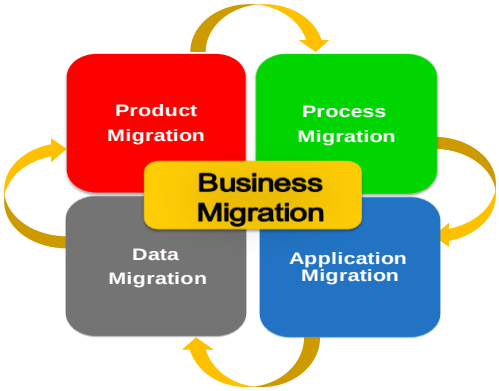

Figure 1.1: Business Migration program (Logica, 2011).

1.3.3 Empirical research

To prove the extended model is applicable and valuable, empirical research is necessary. A business environment that has to cope with the challenges of balancing value, cost, risk and uncertainty is the Dutch life and pension insurance sector. The migration projects of these companies are therefore chosen for empirical study. The focus will be on the clients of Logica in this sector. The bid proposals (a bid to perform a migration project) of Logica for the life and pension insurance sector will be used to validate the model by conducting interviews and desk research. Verification of the model and method will be done by interviewing an expert panel.

1.4 Research questions

The main question is formulated in order to get more insight in the problem:

"How can the elements of the Information Economics framework and Enterprise Architecture be combined in a model for justification and reappraisal of product migrations at life and pension insurance companies in The Netherlands?"

To find the answer on the main question, the research will be divided in several smaller parts. For every section, a specific research question is formulated:

1. *How can Information Economics (IE) elements be combined with Enterprise Architecture (EA) into a single model for justifying product migrations?*

The first research question explores the combination of the topics of IE and EA in literature, as discussed in the academic relevance section 2.2.1.

2. *What is the contribution of the theoretical foundation (general system theory) to improve consistency in the extended IE model for justification?*

The second research question explores the literature on the need for a theoretical and academic foundation for using EA in the context of this research (Dietz, 2008; Kloeckner & Birkmeier, 2009). In the next questions the extended IE model for justification applied to a life or pension insurance product migration is referred to as “the model”.

3. *How can a prescriptive method be defined to capture the current state of an insurance company into the model?*

This question looks for the combining the insights gathered from the first two questions in a prescriptive method to prepare the model for usage in the insurance companies for the migration of their products.

4. *How can the model and method be used for justification and reappraisal during life and pension insurance product migrations?*

The previous question gives a model and method for justifying migrations of the products to a new life or pension insurance environment. This question is the next step in the sequence and looks at bringing the model and method one step further to continuous justification of certain investments.

5. *What is the impact to the migration decision process within insurance companies when applying the model and method?*

The last question examines the results of the model, method and the empirical study at the insurance companies and presents future steps for research on the topic.

1.5 Research method

The research method used in this research is based on the book ‘Business Research Methods, second European edition’ (Blumberg, Cooper, & Schindler, 2008). The goal is to ensure that the research is reproducible with respect to the methods used for the study. The sample of people interviewed or cooperating in the research will not be reproducible. This sample will be based on the people who are available for interviews within the available time period. For the further design of the research and the classification see section 2.1. The research will deliver a literature study and a quantitative model (financial calculations and ordinal valuation), that will be validated by an empirical study. The decision for a quantitative research is based on the empirical nature of the research problem (Gilb & Cockburn, 2008).

The literature study is confined to the topics of Enterprise Architecture, the General System Theory and Information Economics. The research is bound by first defining what the three different topics comprehend. This is meant to inform the reader on the subject. It is to be expected that the majority of the readers are not familiar with all the terms. By starting with a description of the topics, all readers have the same starting point. This first descriptive part will only handle the essential elements, because the research is prescriptive on these topics. Therefore the focus will be more on combining the essential elements of these topics in the literature and not on a full coverage.

The second aspect of the research is the extended model that is developed during the research. The initial version of the model is developed on a high abstract level, to ensure it is generic and not branch specific from the start. The information gathered from the life and pension insurance branch is then used to reach a desirable abstract level valuable for the clients. The focusing and scoping to a lower abstract level makes validation possible in a case study.

The last aspect is the empirical study. This aspect will include a multiple case study research. The data collection includes a document study and interviews involving client projects and experts. The purpose of the documentation and interviews is to validate and verify the extended model. First the validation will be performed by interviewing the involved people from Logica for the client migration proposals and analysing the project documentation on the criteria and requirements they have for the investment (migration) and afterwards validating the method and model by presenting the results. The interviews for verification are with experts on the topics of Enterprise Architecture and Information Economics. They will be asked to comment and advice on the model. It is important that the concepts and insights from literature are used in a consistent fashion. The topical scope of the study tends towards a multiple case study analysis, because the research will take criteria and data from bid proposal projects of Logica for two client companies for validation. This method is chosen, because the topics combined have not been researched before. Therefore detailed case studies and expert interviews are preferred. Due to the time available for research, the number of interviews is limited.

1.6 Outline of the document

The remainder of the document starts with chapter two and presents the research design and framework describing the process of the research that is conducted. Chapter three explores the literature on IT investment, Information Economics, Enterprise Architecture and the General System Theory. Chapter four uses the literature and input from best practices and contains details on the design of the Extended Information Economics model. Chapter five addresses the setup and process of the empirical study conducted, empirical data gathered and analysis of the empirical results. Chapter six is devoted to the conclusions of the research, a discussion on limitations of the model, indications for improvement and directions for further research. Chapter seven contains a list of figures and tables contained in this document and chapter eight provides a list of references used in literature and practice.

2 RESEARCH FRAMEWORK

The framework of the research is the blueprint for fulfilling the objectives and answering questions (Blumberg et al., 2008, p. 195). The interviews and the results of the empirical study will be anonymised to protect the involved companies. The diagram of the framework gives the visual representation of the process by which the research is conducted (Wingerden, 2008). It includes the literature study, empirical study, results and the relationships between those. The research framework for this research is presented below:

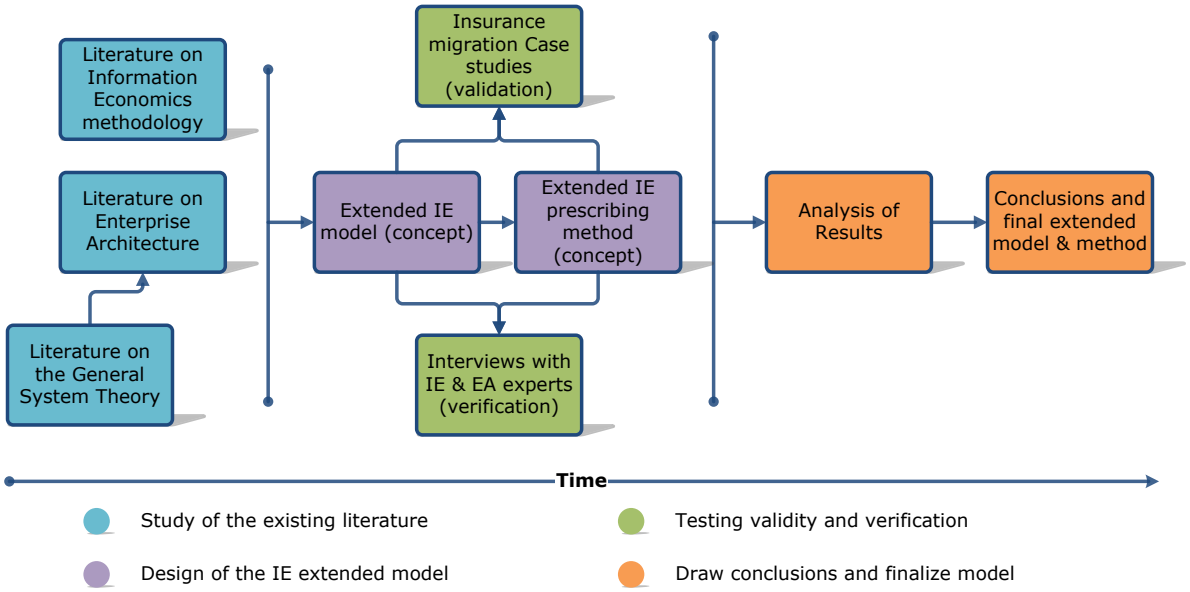

Figure 2.1: Research framework

The model has a prescriptive nature (expressed in the prescriptive method). This study aims for valid representation of the theory and the results of the model in practice. (Blumberg et al., 2008). The following sections in this chapter address the justification of our decision on the four different parts of the research (figure 2.1).

2.1 Preconditions

This section addresses the preconditions for the model and method during the research, these conditions were stated:

- The model and method should involve the topics of Enterprise Architecture and Information Economics to improve the current traditional approach of IT project justification.
- For the model and method design a modelling tool is needed to perform empirical research. This software package is chosen as precondition considering the available support and software licenses at Logica. Logica has had instated standards chosen for EA. The product is Abacus from the software vendor Avolution.

- For the case study research, the life and Pension insurance branch was stated as precondition. Furthermore the amount of two was decided and the choice for two bid projects top 25 insurers to have comparable cases.

2.2 Limitations

The first major limitation of the research is that the complete validation of a justification and appraisal model could not be possible in a time span of 12 months. Therefore only available elements in the case study data are tested for the other parts the previous empirical studies and expert reviews will ensure validity and verification of the business relevance. Considering this, the result of the research gives a new approach but detecting if the complete method approach is relevant for the practice needs, an extensive future research project. Only the combination in the project of EA and IE will be validated to conclude the extension of IE has business relevance. The incorporation of the model into current project approaches and business cases will need further tailoring based on the recommendations and results in this research. As noted at the beginning of the chapter, there will be parts of the empirical study results of testing that will be anonymised. The interviews are kept confidential.

2.3 Study of the existing literature

For the literature study, the research will build further on the literature review given in the thesis proposal. The literature study makes primary use of secondary literature. The research topic of IT investments and Information Economics is approximately 25 years old and therefore a lot of research is already done on the subject, so finding information is not a problem. The topic of Enterprise Architecture is a recent one, but it has proven to be a popular subject for the scientific literature. The General System Theory is a foundation which will bring the topics into perspective. Finding literature on the combination will bring in the biggest challenge for the research. The study of the existing literature is performed to provide a theoretical framework for the research objective.

Existing literature on the following topics will be studied:

- The Information Technology Investment evaluation methodologies which are recognized in the academic literature (Information Economics).
- IT value, IT governance, knowledge management, and benefit management topics that are related to the IT investment topic.
- The Enterprise Architecture methodologies which are recognized in the academic literature and by the company (EA).
- The General System Theory information.
- The combination of EA and IE topics which is available in literature.
- The combination of EA and General System Theory which is available in literature.
- Information from the business on the problems and issues in business migration justification for the life and pension insurance branch.

For finding literature the following sources were used:

- Books and articles recommend by experts at Logica, supervisors at the EUR, and experts in the field of Information Economics.
- Articles recommend during the Information Economics course from the Erasmus University.
- Academic literature (books) available at the University Library of the Erasmus University.
- Literature and data from the information sources available at Logica.
- Articles found using Google and Google Scholar.
- Digital sources using Search of the University Library at the EUR.

Chapter three describes the results of the literature study. The literature is used for the context and design of the model.

2.4 Design of the Extended IE model

The model will be developed based on the existing literature of Information Economics, Enterprise Architecture and General System Theory and input from the life and pension insurance clients. The model is furthermore based on the experience in practice, available at Logica. The various sources of data and information are combined to develop the extended model and a prescribing methodology for migration projects. The model presents the elements and concepts in correlation. The method steps deliver products, in the form of documents for discovery and Architecture in a software package for modelling architectures and business models. Experts in the fields are approached during the research for advice. This will ensure that the model is verified by proven experts on the subjects of Enterprise Architecture and Information Economics.

Chapter four presents the results of the model and method design. The best practice and further information retrieved from practice are described here. The further details are presented in the appendices C to F.

2.5 Testing validity and verification

An empirical study is performed, consisting of case study research and expert reviews to validate and verify the relevance of the model to the business. The empirical study consists of two parts: first interviews that are used for verification of the model, for theoretical foundations and gathering life and pension insurance branch insights. Secondly the case study research (Hancock & Algozzine, 2006; Yin, 2011) is performed to validate the model with two bid proposals for life and pension insurance companies. The choice for a case study research was based on the main research question and sub-questions 4 and 5. The research needed a first discovery of relevant literature. Based on the literature a model and method have been designed. This model and method are reviewed by experts in the field related to the research topic. The case studies are used to test the model and method in practice. The multiple-case studies have two main aims to investigate:

- Two cases from the insurance branch were selected to test if the model would be usable in practice. Logica was in need of a new approach for IT investments to aid the clients in the insurance branch. The choice for the financial branch was done to keep a narrow scope. The model is tested on two bid proposals for two insurance companies, because the goal is not to generalize the results for other industries but to show the model can be applied in a business context.
- The choice for two cases was made to examine if there are differences in the relevance of the model to practice or in other words the replication logic. By taking two comparable companies external influences on the empirical study are minimized.

2.5.1 Verification of model and method

Expert reviews of the model were done, depending on participation of experts. Three experts from Logica plus two experts from other companies were interviewed to verify the model. The interviews were conducted in a semi-structured way. These reviews give the verification of the model, based on literature and best practices. The experts in Information Economics, Business Migrations, and Enterprise Architecture are asked to participate to ensure the model is sound in the usage of different elements into one single model and prescriptive method. The interviews were semi-structured to get a discussion on the certain elements in literature and in practice. The approach was chosen to get the most feedback in a short period of time. Learning the experts' viewpoints regarding their specific situations was relevant to the broader research problem (Blumberg et al., 2008). The model design document was used as guideline for the review (appendix B).

Some risks are involved with conducting these kinds of interviews:

1. The interviewer is also the designer of the model and method, which was known by the interviewee, the interviewee may not pose invalidities of the model as explicitly as he or she would otherwise.
2. Since the topic is extensive and the experts have different fields of expertise, the interviewee may not have enough insight into all the aspects of the model and method.
3. The external experts are in other companies and have other priorities than the sponsoring company (Logica).
4. The interviewer is also the designer of the instrument and therefore he may assume the interviewee may like the model, while this is not the case.

These risks were reduced with the following measures:

- Next to external experts, people from Logica are involved because, they have considerable gain from the model and the soundness in practice content. Therefore the motivations for maximizing the quality of the model would be high. (Risk 1).
- The Information Economics experts were also interviewed for knowledge gathering. These experts have in-depth knowledge of the related theory and extended experience in the field. When architecture experts need more information on an IE topic, further explanation will be provided accordingly (risk 2).
- Contacts within Logica were approached to bring in the right incentives for the experts to participate (risk 3).
- The interviews were recorded and documented and reported internally to approve the relevance (risk 4).

The testing of the model and method is done after the verification was processed. The final version is partially tested with the information from the two case study projects. Not all the different elements are tested based on the previous empirical research and the available time span. The next subsection will present the propositions for validation of the case studies

2.5.2 Case Study Propositions

The model is a conceptual model of how to see the different topics in relation to each other. The method is designed to make this vision applicable for companies in practice. The method is extensive and therefore the following propositions are described for the scoping of the case studies:

- Testing if there are certain difficulties compared with the normal business case approaches (traditional financial methods).
- Comparison between the result according the normal evaluation method and the test of the EIE method and compare the two different case studies on results.
- Creating a value network approach for the external relations. During the empirical research the assumption is made that a high-level value network with companies and relations is enough for the first discovery of a specific industry. For each company the differences can be applied in the value network.
- The complete enterprise architecture analysis is not performed in the case study. A framework “checklist” would be relevant if a project is examined for the first time. Now the focus is on projects for which the bid process has been completed. The focus is on using the data and applies the model and method and detects the difference between the outcome of the method the company used and the outcome the EIE model gives. The essence in this case is that the methods are performed on the same data that is already used in the first place.
- For the financial categories of costs and benefits there will also be no new data, than the data which was used when calculating the results on the traditional way.

2.5.3 Unit of analysis

Next component of the case study design is related to the fundamental problem of defining what the "case" is. Sections 2.1 and 2.2 give a first outline for scoping the cases. For each case study the following conditions were taken into consideration before selection:

- Life and pension insurance company in the Netherlands.
- Needs to be a considerable firm in the Netherlands, based on market share to have certain relevant migration projects of life insurance portfolios (top 25).
- A specific IT migration project for each company is picked based on a migration of life or pension insurance portfolios to a new Information system and the bid proposal step is performed.
- The project considers the migration from a current situation and integrating the portfolios in a new goal system. The complexity of the project has to be conform the available time for the case study analysis (one month).

Specifically the units of analysis are the project plan, architecture and IT landscape documentation, and the business case.

Due to the different context of the cases. Subsection 2.5.4 describes the data gathering for the detailed cases of section 5.4 and 5.5.

2.5.4 Data gathering case studies

The data needed for a sound case study has to be of multiple sources due to the necessary information to gather the relevant findings and converging of lines of inquiry (Yin, 2003). The combination of sources presents a main advantage of this type of research (Blumberg et al., 2008). The different sources can give different evidence for the same fact. Sources of evidence that are used for the case studies are grouped in three categories:

- Documentation: Annual Report, Migration business plan, IT system landscape & architecture, Project plan, Business Case project.
- Archival records: Lists (systems, applications, integrations, activities, processes) and architecture models.
- Interviews: Interview managers or consultants (Logica) on the migration program and bid proposal documentation for further information needed for validation.

The collection of the data consists of the following steps:

- First step is collecting the available data and documentation on a specific migration bid proposal project performed at Logica.
- Second step is to interview the responsible manager of the migration project proposal for an insurance company and gather the information missing in step one for validation.
- The third step is performing the testing with the gathered data and documentation.
- The last step is reporting the results to the manager of the VP Business Migrations and the responsible supervisors of the Erasmus.

These multiple sources are chosen for the tests of construct validity and a better reliability. The method described in chapter 4 presents a chain of evidence on how the multiple sources are used in the case studies. Next to a chain of evidence the method presents a protocol for data gathering to ensure sufficient reliability of data for a case study research. Regarding the issue of external validity, meaning that the conclusions are also valid in the real life context, the following remark is made: By choosing two companies who are comparable in a Life Insurance market that both have had many experience on IT investments and migration projects, a better conclusion could be drawn on the general usability of the model.

Chapter five represents the conducted setup and process of the conducted expert review, data gathering, and the results of the empirical study are given.

2.6 Draw conclusions and finalize model

The results of the literature study and the arisen extended model are tested on two IS migration projects for companies in the insurance market. The empirical study (case studies) is used to validate the theory and best practices which were used to form the extended model. This research will give an insight and recommendations for further research of possibilities for the model of existing topics.

Chapter six concludes and discusses the research project. A list of improvements and recommendations regarding the model and method will be given for further development.

3 EXTENDED INFORMATION ECONOMICS: A THEORETICAL FRAMEWORK

This chapter gives an analysis of the existing literature. The study examines the relevant subjects for the research and development of an extended Information Economics model.

3.1 Introduction

This research has the goal, to develop an extension for the current available scientific literature on investing in Information Technology (IT). IT has proven to be a difficult subject for companies in the last decade. Investing in IT is involving a substantial amount of the financial assets of companies. The expenses on IT differ for each company, but overall the expenses are large and increasing over time. The large multinational companies are sometimes spending 50% of their budget on IT (Berghout & Renkema, 1997). In the Netherlands on average 14 percent of the investments is spent on IT capital (CBS, 2009). This does not include IT spending in production processes and product development (Renkema & Berghout, 2005). The recent empirical studies show that companies have several problems with the evaluation of proposals for Information System investments.

How information technology delivers value, is a topic that is handled various times in literature (Bannister & Remenyi, 1999). The IT adoption within companies was characterized by automation of routines. The IT adoption became more widespread the last decades, the incentive to use IT for cost reduction changed to improve quality of firms operations. (Peppard, Ward, & Daniel, 2007). The information selection is difficult as mentioned in the literature (Keil & Mann, 1997). An important issue nowadays is the determination of benefits in IT investments. In projects the benefits are mostly overstated to overcome the investment appraisal process. Afterwards the project is not evaluated, because the benefits are not met off course. This gives investments in IT a negative image (Peppard et al., 2007).

For investing in IT another design of the enterprise is essential for achieving real impact (Parker et al., 1988). For the design perspective Enterprise Architecture is an essential approach to combine with scoring methods. The process of translating the architectural costs and benefits into scores will create more advised thought on the relationship between architecture and business. The synthesis could identify a way to avoid failing IT projects. In other research the issue of escalation (time and costs) and failing IT projects was also studied (Keil & Mann, 1997; Mahring & Keil, 2008). Study concluded that escalation is frequently occurring and it is driven by a combination of project management and psychological, social and organisational factors. These factors are an important issue in the Enterprise Architecture literature. Human and organisational factors are often not taken into account in enterprises (Kloeckner & Birkmeier, 2009). “But only such a complete picture would essentially support necessary transformation of organisations in a flexible and agile way” (Kloeckner & Birkmeier, 2009, p. 1).

3.1.1 IT investment assessment

The following table shows the shift of assessing investment proposals. In particular for IT investments this is the case, because most projects show that IT is very intertwined with the organisation. This involves a lot of uncertainties and indirect consequences for different parts of the company. The traditional assessment methods do not take these aspects into account and therefore the results are very uncertain. Therefore the call for more effective methods is large. The table shows the shift of approach in these assessments (Hogbin & Thomas, 1994).

Characteristics 'traditional' investment assessment	Characteristics 'modern' investment assessment
Financial character	Multi-dimensional: Financial and non-financial
Identification of cost savings	Identifying strategic changes
Focus on content aspects	Integration of content with process aspects
Local, standalone facilities for single users	Organisational wide infrastructural facilities
Functional oriented	Cross-functional
Dominant role for IT-department	Dialogue between managers, IT-staff and users
Technical hazardous systems	Systems with large organisational and financial risks
Optimization of project portfolio	Avoiding of bad solutions and uncertainties
Focus of project control: costs and turnaround	Focus of project control: managing the benefits

Table 3.1: Changes in IT investment assessment (Renkema & Berghout, 1997).

Information Technology is giving companies a lot of difficulties, due to the important role IT plays for the strategy in the modern dynamic markets. Companies are looking at ways to make the benefits and value more tangible for their IT investments. IT was always seen as a cost. Now investments in IT are made to achieve competitor advantages or preventing competitor disadvantages. Applying IT is becoming a necessity for most companies. Now in the next two sections the difficulties and essence of investing in IT projects are handled.

3.1.2 Why are IT investment decisions important?

Investing in IT does normally have a certain idea about the possible benefits the project will bring to the company. In the early days the investments were more technology driven and full of future promises. Now the need is shifting to alignment with the business. Decision makers are looking for arguments that give the value of investments to the business. The following four reasons are most important for assessing IT investment proposals (Renkema & Berghout, 2005):

- Preventing misallocation of financial resources;
- Decide on the future function of an enterprise;
- Establish a shared investment vision;
- Realize a successful commitment of IT.

3.1.3 Why is investing in IT difficult?

Investing in IT the right way is very difficult. As shown in the success statistics of IT projects in the last decade (Eveleens, Pas, & Verhoef, 2010; Harris, Herron, & Iwanicki, 2008; Mahring & Keil, 2008; Renkema & Berghout, 2005). Many of the failures are the result of basic patterns of organisational behaviour. Why do the investments go wrong in the first place? There are limits in a company due to resource allocation challenges. Limits in terms of time, attention, corporate willpower and money. Choosing the right projects correctly is easier said than done. There are many forces in companies at work which need to be taken into account to turn the right ideas into good practice.

Also the IT decision making process is not clearly evaluated in most companies. Investing successfully in IT has the following problems at heart (Renkema & Berghout, 2005):

- Difficult to estimate, measure and control the value;
- High difficult unpredictable costs;
- Large uncertainty and significant risks;
- Communication problems and conflicts of interest between the stakeholders.

3.2 Value concept

Loveman states that: "First and foremost, what ultimately matters is value - to the firm, individuals, or society" (Bannister & Remenyi, 1999, p. 8). But what is 'value'? In the literature on IT evaluation, the term is taken as self-evident, but an omission of clear conceptualization can lead to serious misconception about metrics of IT (Bannister & Remenyi, 1999). Value can be seen from different perspectives with different meaning. Two definitions from the Oxford dictionary and Merriam Webster:

- The monetary worth of something.
- A fair return or equivalent in goods, services, or money for something exchanged.

These definitions show the simple concept of worth. It is clear that people are unambivalent about value. For the worth of products, goods, services, or money the economist perspective is essential. Michael E. Porter has been an important author on the subject of business value. The traditional answer to the question “How is value created?” has been for a long time: “through the value chain model” (Allee, 2008). There has been a lot of critics on the value chain model of Porter that it only was a repackaging of the traditional value-added techniques (Murphy, 2002). But the way the model identifies and isolates the key components of a firm’s value creation process, has presented a way to break from the traditional cost-benefit analysis (Murphy, 2002; Read, 2009). Focussing on IT the value chain as microeconomic concept is still valid. The next section will go into the value concept of Information Technology.

3.2.1 IT value and benefits

The use of IT is increasing rapidly in companies. The spending on IT projects is reaching extreme levels (Renkema & Berghout, 1997). In the past decade, the economic environment has negatively

influenced spending levels, but even now an increase of 7,6 % in IT spending is predicted for 2011 (Gartner, 2011). Companies are hoping to achieve increasing profit on these investments or in other words benefit from their IT spending. But in a time when investment figures of IT are increasing, reflection is needed to ensure the allocation of resources is justified the right way. The costs of these projects are kept under control, but control of benefits and value of these projects is mostly missed or incorrect (Renkema & Berghout, 2005). Berghout and Renkema define value as the sum of financial and non-financial costs and benefits. This could also mean that the value is negative when the costs outweigh the benefits of the project. Parker et al. (1988) present a different view of IT value based on the Value chain model (Porter, 1985). They define IT value as “The true economic impact of information technology”. Or in other words the value is the ability of IT to enhance the business performance of the enterprise. Benefits and value are two concepts which are mostly intertwined in literature. In this research the definitions of Parker et al. (1988) and Berghout and Renkema (1997) are used. The following table gives an overview of the different economic concepts.

Investment consequences	Positive	Negative	Total
Financial	Yieldings	Costs	Profitability (Profit or Loss)
	Earnings	Expenditures	Return
Non-financial	Positive contribution	Negative contribution	Contribution
Total	Benefits	Sacrifices	Value

Table 3.2: Distinguishing IT benefits and IT value (Renkema & Berghout, 1997).

As shown in the table, value is a larger concept than the benefits alone. The following citation presents a distinction in terminology: “A view can be taken that benefits are what one pays for and value is what one takes risk for” (Parker et al., 1988). Concluding could be said that the value of an investment in a larger sense, gives the total impact on a company (Negative, Positive and risk consequences).

3.2.2 The IT productivity paradox

The IT productivity paradox is an explicit instance of what the value of IT is for a company. Nobel prize winner Solow said 26 years ago: “You see computers everywhere, except in the productivity statistics” (Renkema & Berghout, 1997). Another citation is from Ton Soetekouw NMB CEO from 1992: “They told us that computers would bring us savings, but they did not. They told us the work would become easier, but it did not. Until now the automation branch has not made clear in most cases what the benefits of automation are” (Renkema & Berghout, 1997). This last quote gives a representation of the doubts, whether IT investments create enough return. The productivity discussion has reached a lot of publicity due to the difficult measuring of the specific worth of IT. There is a strong contrast with the rapid changes in price/quality ratio of IT. These changes lead to an increasing amount of investment in IT (Renkema & Berghout, 1997). Therefore it is surprising that the increasing amount of IT investments do not have a beneficiary effect on the productivity statistics.

The IT productivity paradox has different perspectives (Renkema & Berghout, 2005):

- Macroeconomics level: disappointing productivity growth.
- Industry level: disappointing performance in services.
- Organisation level: benefits from usage of IT.

For now it is not clear in research that the increasing investments in IT have a correlation with the declining figures of productivity. There is a lot of criticism on the measures and methods used for the figures of the paradox. At the moment the productivity paradox does not seem to be a great threat to a successful investment strategy. It is certainly possible for individual companies to invest profitable in IT, providing that there is a willingness to invest in a concrete and well-founded investment decision process. When there are no clear investment priorities formulated it is not possible to measure if an IT project is a success or a failure (Renkema & Berghout, 2005). IT has given mankind services, products and lifestyle advances which were not possible 20 or 30 years ago. It is also concluded that even if research discovered individual improvements with IT, in total it is not seen (Pisello & Strassmann, 2003). There are examples mentioned of spectacular results with IT (Dell, eBay, Wall-Mart). General statistics show that higher investment in IT does not correlate with any measure of corporate success. “The performance and IT spending of over 10,000 companies worldwide give little correlation between IT spending and superior performance in return on equity, return on assets, profitability or shareholder value” (Pisello & Strassmann, 2003, p. 9). The beneficiaries of IT investment are gained by the organisations which manage their IT decisions well.

3.3 IT evaluation and justification

A quote that gives the necessity for right investment decision-making is presented by Kaplan: “Conservative accountants who assign zero values to many intangible benefits prefer being precisely wrong to vaguely right.” (D. Remenyi, Money, & Bannister, 2007, p. 85). A project which is not justified with the right methods cannot give the right accuracy of results on how the project was performed. Therefore it is not possible to conclude that the project was really successful. This gives the context for why better methods are needed for justification and evaluating IT investments (Anandarajan & Wen, 1999).

3.3.1 Categories of evaluation methods

A company often has to make investment decisions, these decisions should also be made when to invest in a new information system (IS). But to make this investment decision for information systems is hard to do. The IS investment decision is difficult, due to the fact that the cost and benefits often are intangible and difficult to measure (Powell, 1992). IT has a far larger economic impact than the relative direct small share of the capital stock (Brynjolfsson & Yang, 1999).

Even though it could be difficult, there are a lot of methods available in order to make an investment decision over an information system project. Andresen (2001) shows that there are at least 82

methods available and Renkema and Berghout (1997) state 65 methods in the appendix of their article. Both Andresen and Renkema and Berghout are aware that their list of methods of evaluation of investment proposals is not complete and that almost every day new methods are presented.

The most known and used methods are classified as “financial methods”: These methods only take consequences of an investment into account that can be translated into monetary values. They are based on the business economic investment theory. The methods measure the consequences for the cash flow due to the investments made. Buying a new PC is an example for expenditure and a saving on personnel due to the investment is a form of revenue. Examples of these methods are: Total Cost of Ownership, Return on Investment, Net present value. There is previous literature which could be referred to on these methods (Harris et al., 2008; Renkema & Berghout, 2005). Verhoef has shown in his research that the financial methods can be extended with function points (Verhoef, 2005). Kaplan mentioned the pure financial methods are not sufficient enough anymore for the investment projects (Kaplan & Norton, 2006).

Next to methods which are restricted to financial decision criteria there are three different classifications made for non-financial methods:

- Multi criteria methods: These methods assess the quantitative and qualitative consequences of an IT investment (Renkema & Berghout, 2005). These methods do not only focus on the financial impact, but also other evaluation aspects are used like strategic match. These other aspects are not necessarily easy expressed in monetary terms (Andresen, 2001). The mostly applied methods work according: first the decision criteria are identified. Next the scores are allocated to each criterion for each investment proposal. Furthermore the weight of the criteria needs to be determined. The final score of the investment proposal is calculated by multiplying the scores with the weights of each criteria and finally take the total amount for the investment (Renkema & Berghout, 2005). Two well-known methods are Information Economics and the SIESTA-method (Strategic Investment Evaluation and Selection Tool Amsterdam).
- Ratio methods: This approach uses financial ratios for supporting decision-making of IT investments. For instance the total expenditure of IT investments related to the profit or revenue. The ratios can also be used for non-financial measures. Examples of these methods are: the ‘Return on Management’ method and the method of IT assessment.
- Portfolio methods: portfolios are a well-known method for supporting the decision-making process. In a portfolio the investment proposals are plotted in graphs with the considered decision criteria. The method of Bedell and Investment mapping are examples of portfolio methods for IT investments (Renkema & Berghout, 2005).

Looking at the different methods and specifically at the differences between financial and non-financial methods it shows, that a combination between these methods is most preferable. Therefore for the research a multi-criteria method was chosen.

In the following table several methods of the different classifications are compared (Renkema & Berghout, 2005).

	Financial Approach			Multi-criteria approach		Ratio approach		Portfolio approach		
	Payback period	Internal rate of return	Net present value	Information Economics	SIESTA	Return on management	I/T assessment	Bedell	Investment Portfolio	Investment Mapping
Object of the method										
Breadth	IS project	IS project	IS project	IS project	IS project	Organisational level	IS project and organisational level	IS project and organisational level	IS project	IS project and organisational level
Type	All investments	All investments	All investments	IS investments	IS investments	All investments	IS investments	IS investments	IS investments	IS investment
Evaluation criteria										
Financial	Return	Return	Return	Return	Unknown	New unit of measure (ROM)	Profitability	No preference	Return (NPV)	Return (IRR)
Non-financial	None	None	None	4 business criteria, 1 technological criterion	7 business criteria, 6 technological criteria	Not clear	Different business criteria	Quality and importance	Only business and IT domain	3 benefits and 3 investment orientation
Risks	Deduction from expectations	Deduction from expectations	Deduction from expectations	1 business risk, 3 technological risks	4 business risks, 8 technological risks	None	None	None	Deductions from expectations	Spread of benefits and sacrifices
Support evaluation process										
Prescriptions for use	None	None	None	Discusses examples, mentions disciplines	None	None	None	Evaluation once a year, mentions disciplines	Discusses responsibilities, mentions disciplines	None
Ease of use	Easy	Easy	Easy	Easy and flexible	More difficult	Quite easy, data not for public use	Quite easy, data not for public use	More difficult	Quite easy	Quite easy
Type of outcome	Interval	Interval	Interval	Ordinal	Ordinal	Interval	Several scales	Interval	Ordinal and nominal	Interval

Table 3.3: Methods for IT investment decisions (Renkema & Berghout, 2005)

3.3.2 Continuous reappraisal and evaluation

The various methods handle the “Business Case” (BC) in different ways as shown in the table. The methods are confined to the first evaluation and justification. This is only one part of the life cycle for Information Systems. The mostly used life cycle stages in literature are: Identification, Justification, Realisation, Exploitation, and Evaluation. IE is placed in the Justification and Evaluation stages (Waal & Aker, 2003). The IE framework is mentioned as usable for evaluation after exploitation, but still with criticism on the domains used and if this are the right measures (Waal & Aker, 2003).

There is various research done on the subject of evaluation and monitoring during the life cycle stages of a system and how the current IT evaluation methods can be used (Nijland, 2004; Okujava & Remus, 2006; Dan Remenyi, 1999; Waal & Aker, 2003). This research will not elaborate further on the appliance, because the IE framework is chosen to extend in this area. The reappraisal and evaluation during the IT project and the IS life cycle stages is straightforwardly stated by Remenyi. A combination between IT investment business case as the starting point and the principles of continuous

participative evaluation as a method for controlling and monitoring the progress of the IS project. Participative evaluation is also sometimes seen as formative evaluation. It is the inclusion of the views and opinions of all the different stakeholders in the project and not only keeping sure that the project is on track during the life cycle (Brunner & Guzman, 1989). The formative evaluation (participation) is a re-iterative process. The requirements of the system are then refined in a controlled manor during the project. Formative evaluation will occur at multiple times during a project. This depends of course on the project and environment. The business case will then be adjusted at each formative evaluation point during the project. The adjusted business case then has new objectives and requirements. The figure below shows the re-iterative nature of evaluation.

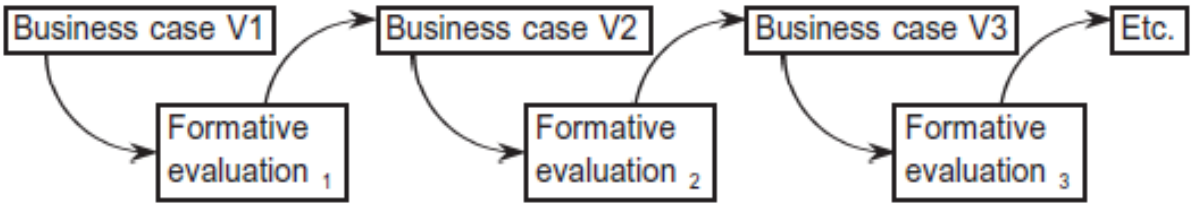

Figure 3.1: Re-iterative process of formative evaluation (Remenyi, 1999)

The comparison in table 3.3 shows the overall completeness of Information Economics in comparison to other evaluation methods. Figure 3.1 shows the reappraisal and evaluation possibilities for the IE framework and other IT evaluation methods. The following section describes the information economics framework.

3.4 Information Economics

The discipline which aims at measuring benefits and costs of IT projects is called “Information Economics” (Waal & Aker, 2003). “Information Economics uses several financial justifications techniques to assess potential information technology application in calculating a return on investment. The defining of values in investments is an important issue and especially the values beyond measurable benefits (intangibles) (Parker et al., 1988). Value conversion is a challenging question for investments. This section describes the Information Economics (IE) framework handled by Parker et al. (1988). Furthermore the research of Oirsouw et al. (1993) is used to see a modern appliance of the IE method. The two studies will be combined in the method and model (chapter 4) to use the best approach in combination with Enterprise Architecture and the General System Theory. Furthermore the possible appliance in practice is another important factor to take into account in the considerations of which path to follow.

Benson and Parker studied strategic planning for information technology. They discovered that the real purpose of strategic planning is to affect corporate decision-making. With strategic planning, better understanding of the corporate business is strived for. A way to assess alternative resource allocation is the heart of the matter. Budgets and limits of organisations make the case for investing in Information technology, based on value to the business. Concluding could be said that it is necessary

to “link information technology investment decisions to commonly understood business decision-making processes and business investment decisions” (Parker et al., 1988). A new set of tools and concepts is needed to deal with the information technology investments. The framework Information Economics is developed for this purpose. The framework is divided into two parts. First it is a collection of calculations and computational tools for quantifying benefits and costs for IT projects. This is comparable with the traditional cost-benefit analysis (CBA). It looks further than the traditional methods and deals with value based on business performance. IE also takes the IT infrastructure into account. The second part of IE is the process of decision-making. Every investment proposal should be justified, but these proposals have different characteristics to its value, cost and risks. Resource allocation is decision-making among alternative investments. Prioritizing among these different investments is a difficult task for managers. The IE method is developed to help companies with an expansion of the existing CBA methods and also providing guidance in the decision-making on these investments.

Nowadays there are several factors important for investing money in IT. There are few companies around that can do without information technology. Even more the IT is important for the success rate of the strategy (Parker et al., 1988). IT is an expensive element and in most times the results of investing money is difficult to see. Cost reduction is the most obvious return of a project. This is particularly the case for migration projects. It is important keep the focus more open, because only focusing on one aspect could have disastrous implications for a company. For instance when only focusing on the reduction of costs and not seeing the implications for the strategy or competitive advantage the company could lose terrain to the competition. Investments in IT could definitely deliver return and value, when performing functions more efficient. Another important aspect is the risk and uncertainty with IT projects. Most projects exceed their time limit and budget. The factors are not well defined when starting the project or are not monitored in a formal way. In the following subsection a justification is given why Information Economics is a way to deal with these different issues.

3.4.1 Justification for Information Economics

Traditionally IT was seen as a necessary corporate overhead. The IT department or business unit was valued from a cost center perspective, because they invested money and the profit was difficult to trace back to the IT investments. Nowadays there is a shift of perspectives. The IT department is more seen as a profit center (Harris et al., 2008). This is at first glance against the constituted rules for a profit center, but it is important to discover what the value is and how it can be measured the right way. For all companies, determining the wisest investment with its limited resources in computing is critical for alignment of business and IT. The IT department is supportive for the business, but classifying it as a cost center does not do justice to this part of the enterprise.

The investments that are made in IT are not only about cost reduction on the IT aspects. The IT manager does not only have to look at bringing back the IT budget. This could reduce the innovative character of the company, or can work counterproductive when selecting software or hardware.

Therefore IT management has to be concerned with profit and cost. Especially for migration projects different business units that are affected by the change are involved and therefore the focus on costs is no longer the only measure (Kaplan & Norton, 2006). Related with this shift is the search for better ways of valuating and measuring investments in IT. A company can get in danger by the inability to see what is happening with the information technology. IT projects do not only change technology, but also the business. This makes it difficult to see the future financial consequences.

Not understanding the environment, to see what is happening and making appropriate adjustments is getting companies killed (Parker et al., 1988). They will be forced out of the market by competition, who understand their information technology and the implications it has on their business. Information Economics is a way to give managers and executives a better understanding on their investment decision making process. When managers only use a traditional investment approach, there is no clarity (to mechanistic for complex investments) if their investment is justified for the future (Hoogervorst, 2007).

Information Economics is not a holy grail to completely justify IT investments (Oirsouw et al., 1993). The following critique on the framework show several risks:

- The scores are subjective and have different meaning for everyone involved. People are used to calculate in money. This makes scores difficult to defend at the higher management levels. In practice it is often difficult to give a weight to a score on a decision criterion (Read, 2009).
- When evaluating a project by scoring it on ROI with the classifications used by (Parker et al., 1988) it is difficult for a project which has a return of 200% in a year according to the classification it would get a 1. This shows that an attractive project can be seen as unattractive (Oirsouw et al., 1993).
- In practice the Information economics framework shows that the method can work fine first. But after a couple of years the different projects are not scored evenly. This could exist when people are manipulating the scorings to get their own projects at the top. In this case the projects are al scoring the maximum (Wiseman, 1992).

However, it gives a starting point to create an understanding on handling the domains of IT and business. IE gives the enterprise a method to get a grip on the way to handle the IT investment strategy. Another aspect is mentioned by Hoogervorst ‘the planning, priority focus of Information Economics fits in the structural IT governance approach’ (Hoogervorst, 2007, p. 142).

3.4.2 Cost Benefit Value aspects

The anticipated benefits from investing in IT should be higher than the costs. There are several problems occurring in the cost-benefit analysis. The first problem is the time aspect. Benefits are usually derived when the costs of the project are already made. Time-value comparison is therefore essential. The second problem is how to make the intangible benefits measurable. Therefore the traditional analysis methods have some fundamental problems. Return On Investment (ROI) and Net

present Value (NPV) methods are still the primary means driving the decision of investing in information technology. Using these methods as the primary measures has the danger of turning the decision making process in a management rating game. The projects which have tangible benefits as main driver are possible in favour over projects with unclear intangible results. If a project can achieve a good rate on ROI it is classified as a good project and this could lead to choosing the save option above a project which in potential brings more benefit, but due to uncertainty and intangibility it is passed by. Cost reduction is in favour due to its discrete and measurable character. David Norton mentions three detriments that Cost-Benefit Analysis en Return On Investment methods suffer from (Parker et al., 1988, p. 64):

1. Traditional cost-benefit and ROI approaches are microeconomic and encourage low risk investments with small returns;
2. They are a result of a manufacturing economy where labour is treated as an expense;
3. The analysis is static and short term.

These detriments mean that potential values of projects with strong potential on value for the business may be excluded by the traditional methods. Value is still a difficult topic. “The underlying issue has to do with what the manager or sponsor is willing to pay for a project? In other words what is so valuable that it is worth investing in and paying the bill for?” (Parker et al., 1988, p. 64). The following starting point is given at this point (Parker et al., 1988, p. 64):

“Value is based on advantage achieving over the competition, reflected in current and future business performance. That which will add to the advantage over the competitors of a firm is the value in which management should be willing to invest.”

The first basic element of an Information Economics framework is separation between the business justification and the technology justification to handle difficult investment problems. The traditional methods are already based on these two domains. The costs incurred in the information technology domain are charged to users in the business domain. The purpose to separate the domains for IE is to have the justification clear to managers of the business and the viability of the IT implication for the IT manager. This is not a particular way to assess a project, but rather to show how value of IT is constituted. Concluding it is important to understand what a company wants to know when starting a project. When investing in IT understanding which savings are possible in the current situation is important, but also which benefits of the current situation will be lost. First of all it is important to know how much costs have to be made to reach the new situation. Next step is to calculate which benefits there are for the new situation, but also which costs are needed to keep the new situation up and running.

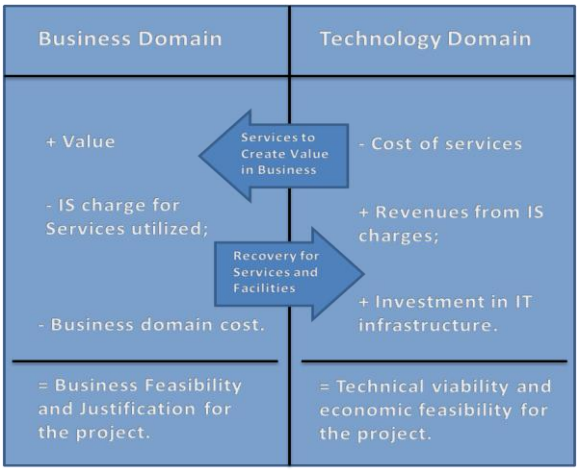

Figure 3.2: Two domain model (Parker et al., 1988)

3.4.3 Business and Technology Domain Values and Risks

There are several values and costs which are not taken into account in a simple ROI calculation. Some are unique to the business domain. In this subsection the values and risks of the business and technology domain are assessed. These assessments will extend the limitations of the normal cost benefit analysis and make the scoring of projects more realistic.

Each side has its own list of value and risk factors. The factors of IE that make the investment and the value factors, in the business domain, are:

- Return on Investment (cost reduction and performance enhancement): A basic strategic decision for organisations to invest in computing is low cost or reduction of costs (Porter, 1980). For the second point the alignment sought and the overall improvement of business performance is focused on in traditional terms.
- Strategic Match: Organisations and the different separate business units have certain strategic goals which they pursue. An important aspect of IT value is supporting achievement of these goals directly of supporting activities to reach certain goals. The value of a strategic match is the contribution to enabling success.
- Competitive Advantage: An important aspect of strategy is the creation of barriers and hurdles against competitive inroads against the firm (Porter, 1985). The value of IT lies in this perspective in the competitive impact that strengthens the bonds with customers and suppliers.
- Management Information Support: Information and specifically the management information is the leading example of hard-to-quantify information systems benefits.
- Competitive Response: This class of value is focused on the elements which are not measured at all by traditional cost-benefit analysis. Value is a function of keeping up with the competition and a major source of pressure for investment justification in information technology (Parker et al., 1988, p. 72).

The risk factor that may lead to a system to be less valuable:

- Organisational risk: this considers the degree to which the business side is prepared for the changes a new or enhanced system may bring about.

In the technology domain we find only one value factor:

- Strategic IS Architecture: Investing in large scale enterprise wide projects need to be aligned with the long-range strategic plans of the organisation. Investing and a clear understanding of the current IT environment is an important value for the enterprise.

The remainder are risk factors:

- Definitional uncertainty: this assesses the degree to which the users' requirements or specifications are known.
- Technical uncertainty: this looks at the readiness of the technical domain itself to undertake the project.
- IS infrastructure risk: this assesses the degree to which extra investment, outside the specific project, may be necessary to accommodate the project.

These factors are first of all weighted to reflect their relative importance to the enterprise, and the proposed system is scored against. Explanation on these topics and how these are integrated in the extended model can be found in chapter 4.

To evaluate an IT project the goals of the organisation are important. These goals are set in the budget plans, information year plans, etc. From the goals the three steps examined here are derived (Oirsouw et al., 1993):

- The changes to the current situation (the object of the intended change);
- The intended future situation (the nature of the intended change);
- Finally why the change was needed (the reason for change).

These three elements can then be hold against each other. The first two steps give the costs of the project and the third step the benefits. The sum of these steps gives a ratio for the project which is essential for the decision process around investments (Oirsouw et al., 1993).

3.4.4 Elements of IE and benefit management

This subsection describes the elements of Information Economics. First the Cost-Benefit Analysis (CBA) will be given as starting point for the cost, benefit and value. The other approaches for value associated with IE and benefit management are described to give a better value of justification.

Traditional Cost-Benefit Analysis (CBA): these types of analysis methods are needed when the costs and benefits relationship is input for the decision making process in a company. A CBA analysis can be seen as the first feasibility study of a certain migration project. The relation between costs, benefits and the strategy determines the priority of the investment to an organisation (Parker et al., 1988).

1) Break down the effort on the basis of the work functions affected by implementation.
2) For each function affected, identify alterations, additions, or eliminations associated with the specific job processes.
3) Determine the cost of performing the job process affected. Cost categories include labour, contract, equipment, facilities, material, and supplies. Cost sources include enterprise and function budgets or projections on the basis of time, volume, and labour rates.
4) Determine the effects on indirect costs caused by the change.
5) Determine the changes to the job processes, because of the new project, information system, or enhancement.
6) Determine the cost of performing the process after modification.
7) Determine where additional costs will occur in the future if no change occurs in the job process.
8) Calculate the difference between performing the process the old way and the new way. The result of the calculation will be expected tangible benefit or an added cost of doing business.

The CBA is used by managers for appraisal, because the hard figures are preferred for the reports. For determining the additional revenues or savings associated with a project is often far from simple. Survey found that the IT investment appraisal was seen as important, the majority of organisations felt the appraisal and justification processes were ineffective (Ward & Daniel, 2006). For the benefits and value aspects in the business case it is difficult with only traditional CBA calculations. There is need for a fresh approach. Benefit management is mentioned as the new way to cope with the failure of benefit delivery (Ward & Daniel, 2006). IT has to be considered a mean or resource to deliver an end and not an end by itself. Organisational performance and business change is the end (Ward & Daniel, 2006). Advantage of IT is all about usage and deployment of the IT assets in an efficient way. To detect how the value is created in the organisation the external and internal value chain are important to discover who the external enterprises are and to see the internal value creation. What inputs there are and what is produced. (Ward & Daniel, 2006). Another way to detect is a value network approach (section 3.6).

As shown by the elements of IE the focus on investing in IT is on value (worth of the project). IT projects value consists of return and contribution. The traditional CBA calculations are ways to detect the intended benefits which are mostly the main aim for the project. Therefore still a lot of companies are only using this part for justifying their projects. The extra IE elements of valuation are set up to evaluate what the additional benefits are and to see the impact on the traditional calculations when the project was envisioned for the first time. From an economic perspective the benefits can be divided in two main streams: turnover increase or cost reduction. Reducing the costs can be achieved in two ways (Oirsouw et al., 1993):

- Through cost avoidance
- Through shifting the costs to other areas

To determine and verify cost reductions, it is necessary to consider how the combination of efficiency, accuracy and speed that creates the benefit can be converted to cost savings. The calculations are based on change in volume or activity and reduction in resources, people and other activity costs multiplied by an appropriate unit cost. The cost avoidance benefits are essentially of three types (Ward & Daniel, 2006):

1) Increases or changes in business activities or volumes that do not have accommodated increase in resources.
2) Certain future costs that will otherwise be incurred to improve efficiency, accuracy or speed merely to sustain the current level of business performance.
3) Uncertain future costs that may result from risks that have a significant probability of causing serious cost problems if changes associated with the investments made.

In the same way as to consider how the efficiency, accuracy and speed attributes of IT can reduce specific costs, the approach of Parker and Benson (1988), identifies increased revenue opportunities from information systems. The authors describe four ways in which value can be created (Parker et al., 1988):

1) Value linking (VL) and Value acceleration (VA): these two techniques are closely tied. Value Linking evaluates the combined effects of improving performance of a certain function and the consequences for a separated function. It represents the ripple effect of change in a function or process. It is not time dependent. Value acceleration is used to evaluate financially any time acceleration of benefits because of linking two departments or functions in cause-effect relationship (Parker et al., 1988). The first technique handles the direct impact on other functions. The second technique handles the impact over time. For instance when a system ensures a time improvement of billing with a day it is a value acceleration effect. Value linking and acceleration models help to trace the impact of a technology change for a certain function or department in financial performance. Five categories of productivity benefits are considered to be ones of value linking and acceleration: operations savings, labour savings, shorter time cycle for completion, better performance and increased revenue.
2) Value restructuring (VR): this technique addresses the values associated with restructuring of a certain job or department function. It measures the value of changes in productivity from an organisational change. It supplements the cost displacement and cost avoidance techniques of traditional CBA (Parker et al., 1988). “Value Restructuring is a way to tie the effect of information technology to results measured through increased productivity” (Parker et al., 1988, p. 122). Value restructuring assesses the economic impact of information technology in labour intensive organisations. This case in particular can be applied to insurance organisations.
3) Innovation valuation (IV): innovation gives the company new functions within the business domain. It changes the way the enterprise conducts its business. Innovation valuation techniques focus on enterprise costs and risks, because innovation applications impact change of business strategy, services, products and the business domain organisation. Innovation valuation techniques are useful assessing new and unprecedented applications of IT. The model is used to investigate the

value of gaining or sustaining competitive edge, the risk and cost of being first, and the risk and cost of failure or success (Parker et al., 1988).

3.4.5 Scorecard

In many companies and particular in the insurance branch the budgets are under heavy constraints. This limits the movement and means that cost reductions are important to achieve. The main question for investments in IT is related to this topic: which benefits does the investment in IT have for the company (Oirsouw et al., 1993)? Looking at the main question it is essential to have a common ground for the IT people involved with the project and management of the business case. An instrument is needed to get IT professional on the same level as management and a scorecard is the option given by IE.

After all the different elements are used and the process of justification is completed a scorecard is the end result of the IE method. The scorecard as present in figure 3.4 is a presentation of the traditional IE method (Parker et al., 1988). Parker et al. use the scorecard to calculate with the different element to present a total score for each individual project and then the projects can be compared. There has been a lot of criticism on this way of comparison (Strassmann, 1990). The scores after summing ROI with risks and benefits can give very dubious results. First off all priority between projects is not a summation. A scorecard is merely a tool for choosing an IT project and not the single criterion on which a manager will make the decision. Also when looking at projects there are different aspects of a project which can be used independent for the decision whether to undertake a project or not. A balance between the critics and the method of Parker et al. is sought and presented in section 4.3.

A scorecard gives a possibility to take a grounded decision on priorities of projects in an IT portfolio. The methods are relative simple and the basic knowledge of architecture and accounting is usually available. A scorecard gives the line managers and financial controllers a tool to monitor how a project is performing on the subjects of value and risks. Critics state that these scores alone do not say enough over a single project. Applying a weighing based on the CSF's can present an opportunity to compare a project score with the current situation without the investment. A precondition has to be that CSF's are already used in the particular company (Oirsouw et al., 1993). In the end the manager makes the decision and not the scorecard.

The Information Economics Scorecard

Evaluator

	ROI +	SM +	CA +	MI +	CR +	OR -	SA +	DU -	TU -	IR -
Business Domain										
Technology Domain										

ROI	Retrun On Investment
Business Domain Factors	
SM	Strategic Match
CA	Competitive Advantage
MI	Management Information Support of Core Activities
CR	Competitive Response
OR	Project or Organizational Risk
Technology Domain Factors	
SA	Strategic IS Archictecture
DU	Definitional Uncertainty
TU	Technical Uncertainty
IR	IS Infrastructure Risk

Table 3.4: IE scorecard (Parker et al., 1988)

3.5 Enterprise Architecture

Information technology is a difficult and important topic for companies as mentioned in the previous chapters. The IT assets are critical for maintaining the business and reaching strategic goals. IT is becoming a commodity, but also the strategic importance is still valid (Minoli, 2008). Enterprises are investing billions of dollars in their IT assets to keep their business up and running. The way the business is trying to cope with optimizing IT assets is properly architecting the IT environment. Alignment of business and IT ensures the enterprise can use IT to achieve the business objectives (Lankhorst, 2009). The most known model for alignment is the model from Henderson and Venkatraman (1990) that is the foundation for others with four perspectives on alignment. The Amsterdam Information management Model of Rik Maes (Abcouwer, Maes, & Truijens, 1997), expands the basic model and adds a Structure row and Information and Communication column. Architecture is explained to provide concepts and tools for the middle column and row (Slot, 2010).

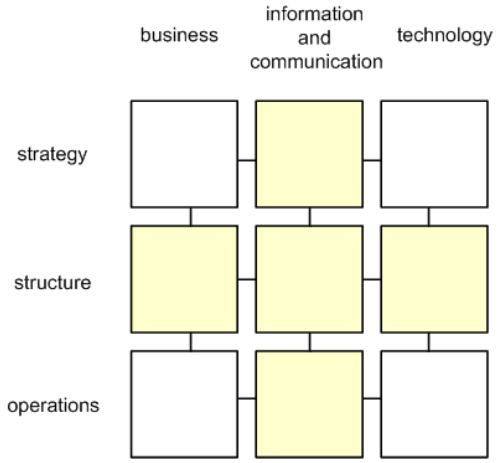

Figure 3.3: Amsterdam Information management Model (Abcouwer et al., 1997)

An integrated approach to business and IT is important to keep the IT technology in line with the business. A way to deal with optimizing the IT assets for a firm to support the business is properly architecting the IT environment. Enterprise Architecture (EA) is seen as a coherent whole of principles, methods and models developed for all relevant assets in an enterprise (Lankhorst, 2009). Specifically EA is important in business transformation projects (Slot, 2010). Companies are in a dynamic environment, because of mergers, acquisitions, innovations, etc. Transforming the business needs an agile way to adapt to the environment. EA stands for a better understanding of the organisation. The organisation needs to be seen as a 'white box', because before you can change you need to know what to change. Nowadays changes in organisations seem easy on forehand but immersive data flows need to be redirected (Lankhorst, 2009). For these changes and the management of complexity architecture is needed. In the next section an introduction of the concepts of architecture is presented.

3.5.1 Defining architecture

Architecture has its roots as notion from building and construction. It was seen as a plethora of principles for designing buildings and squares in the Roman era. It was used to communicate effectively. It consists of design principles so everyone has a common frame of reference. An architecture can be seen as an abstract design which can be filled in at a later stage (Lankhorst, 2009). But, despite the historic view on architecture as a general design principle, there are many definitions existing at the moment (Hoogervorst, 2004). First the well supported definition of the Institute of Electrical and Electronics Engineers (IEEE) (Group, 2000; Maier, Emery, & Hilliard, 2004):

"Architecture is the fundamental organisation of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding its design and evolution."

Dietz has reflected on this and other definitions from well-known authors (2006). The definitions fail to distinguish between concept and the way it is represented. Looking more closely to the definition of IEEE, it consists of two parts. The first part is seen separately from the term architecture and handled in section 3.6, as system ontology engineering. The second part: "the principles guiding its design and evolution" is the notion used for the definition of Dietz that is used in this thesis (Dietz, 2006):

"Theoretically, architecture is the normative restriction of design freedom. Practically, architecture is a consistent and coherent set of design principles"

The definition accommodates the blueprint and the general principles. It could be seen as a structure with a vision (Lankhorst, 2009). As mentioned in the previous sections it is important to see the IT landscape of an enterprise as having two domains. In architecture it is also necessary to see beyond the technology domain. The human systems, organisation and business need to be integrated in a design perspective (Hoogervorst, 2004). In the next subsection the definitions for Enterprise Architecture are described.

3.5.2 Enterprise Architecture definition

Looking at Enterprise Architecture it was first discussed in the 1970s. At present there is still no formal precise definition in practice or theory. There is however a general agreement, that it is about the structure of important things (enterprises), their components, and how they work together. The literature of Hoogervorst and Dietz describe the core perspectives of the enterprise and its design. Considering the architecture definitions and literature on system ontology the following definition is used in this thesis (Hoogervorst & Dietz):

Enterprise Architecture: the collective design principles for the (re)design and (re)engineering of an enterprise such that its operation is compliant with its mission and strategy, and with all other laws and regulations.

Note that there is further elaboration needed. First the enterprise is a collection of organisations that has a common set of goals/principles. An enterprise can be a whole company, business unit, or a single department. The term can be used for intentional and systematic purposeful activities. The design of those activities need to be addressed from the four core perspectives mentioned as business, organisation, information, and technology, each having their associated design principles. These are collectively identified as enterprise architecture and should be defined such that integration, successful change, and agility is arranged and enabled.

According to Minoli enterprise architecture has the following goal to achieve: “The goal of EA is to create a unified IT environment across the company or all the company business units, with tight symbiotic links to the business side (which typically is 90% of the company) and its strategy” (Minoli, 2008, p. 8).

The theoretical result of EA is to make IT cheaper, more strategic, and more responsive (Minoli, 2008, p. 9). In practice this shows to be difficult. Combining EA with topics of portfolio management and Information Economics could lead to better results on these aspects. This will be examined in the empirical study (Chapter 5).

When choosing for EA, a framework is an essential guideline to develop an enterprise architecture. The framework is a logical structure for classifying and organizing complex information and is an essential foundation for establishing an architectural model (Schekkerman, 2004). Today the following frameworks are the best known: The Zachman-Framework (Zachman, 1987), The Open Group Architecture Framework ("Togaf Enterprise Edition 9," 2010), The Federal Enterprise Architecture (Federal, 2007) and the Extended Enterprise Architecture Framework (Minoli, 2008). These frameworks all have a basic layout of domains cited from the book of Minoli (2008, p. 8):

“(1) Business Architecture: documentation that outlines the company’s most important business processes; (2) Information architecture: identifies where important blocks of information, such as a

customer record, are kept and how one typically accesses them; (3) application architecture: a map of the relationships of software applications to one another; and (4) the infrastructure technology architecture: a blueprint for the gamut of hardware, storage systems, and networks. The business architecture is the most critical, but also the most difficult to implement, according to industry practitioners."

In various EA frameworks and also in tailored form at individual companies these domains have different names (Winter & Fischer, 2006). In this research this general separation of four domains will give the starting point for the following sections in this chapter. Figure 3.3 gives a reference view on the various topics of EA. On the left side the environmental aspect are shown. Then the business strategy uses this as input and the assets are available to support the strategy. The EA aspects are there to help with the transition from the existing situation to the end state. Three main definitions are relevant:

- The baseline or As-Is Enterprise Architecture: the set of products that present the existing enterprise, the business practice, and IT landscape.
- Target or To-Be Enterprise Architecture: the set of products that present future states of the enterprise. Captured in the strategic and business plans of the organisation. For a migration project there is an end-state for when the migration is complete, but also the future situation is important after the migration was performed.
- Transformation or sequencing Plan: The document that defines the strategy for changing the enterprise from the current baseline to the future. The transformation, implementation plans are included.

Looking at figure 3.3 various elements are described in the box of Enterprise Architecture. These steps can be mapped back on the three bullets described above. Furthermore several tools and frameworks are mentioned to make EA possible in the organisations. For this research the main idea behind EA is discussed, the various tools are not considered and the governance aspects are not included. These topics are obviously important when EA is applied. For the scope of the Extended IE model, the frameworks are mentioned for background information. The next section gives an introduction to the most known frameworks (Weill & Ross, 2004) (Boh & Yellin, 2007).

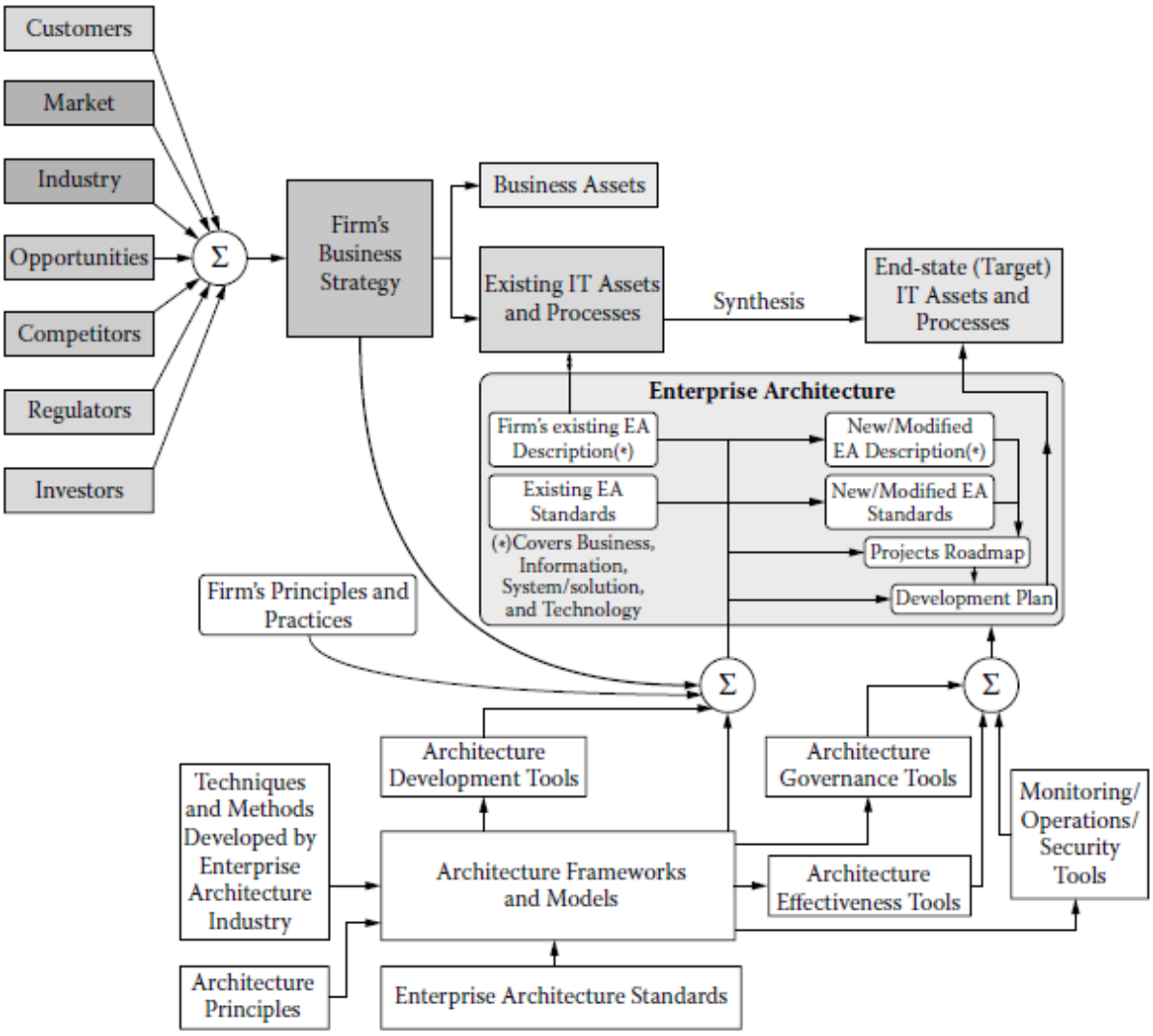

Figure 3.4: Reference view of the Enterprise Architecture topics (Minoli, 2008)

3.5.3 Frameworks

The Enterprise Architecture framework is a structured checklist of issues that must be taken into account for an Enterprise Architecture (EA) (Dietz, 2007). The framework provides a problem space with boundaries in which the individuals can cooperate to solve specific problems. There are various different frameworks that are used successfully throughout the business. A framework can give the organisation guidance on the architecture plans of IT. Frameworks are different from each other on the focus, scope and intent. When a framework is chosen from the existing set it still needs a fair amount of work to suit the organisation. The primary concerns in choosing the framework is the domain of the business and the stakeholders involved. Communication is the biggest issue to deal with in an EA. There are various frameworks described in literature, like TOGAF, Zachman, OMG model driven Architecture (MDA). Further examining of these frameworks is outside the research scope, for more information the literature references can be used (Lankhorst, 2009; Minoli, 2008). As with all the various different frameworks and approaches the way to incorporate is different for every organisation. Most important is the involvement of the stakeholders and communicate about the results and

products of the enterprise architecture approach (van der Raadt, 2011). Important to consider the gap that exists between the business and stakeholder value and the construction aspects of information systems (van der Raadt, Schouten, & Vliet, 2008).

For the various frameworks there are different standards developed for documenting the IT architecture with models and certain rules (Winter & Fischer, 2006) (Minoli, 2008). These standards are examined to ensure the model can be used in general (Group, 2000). The OMG standards organisation has developed various standards for describing and mapping the aspects for EA frameworks:

- Business Motivation Model (BMM): “The Business Motivation Model specification provides a scheme or structure for developing, communicating, and managing business plans in an organized manner”.
- Semantics of Business Vocabulary and Business Rules (SBVR): “This specification defines the semantics of business vocabulary, business facts, and business rules”.
- Business Process Model and Notation (BPMN): “BPMN provides a Business Process Diagram (BPD), which is a Diagram designed for use by the people who design and manage business processes. Thus, BPMN provides a standard visualization mechanism for business processes defined in an execution optimized business process language” (Omg, 2010).

Furthermore modelling approaches as Archimate are searching for a general reference standard in the various industries to create a general consensus.

For IT projects, an Enterprise Architecture Framework gives a set of guidelines and a checklist for the design principles. Each approach is different. Figure 3.5 is from the Federal Enterprise Architecture Framework. This picture gives an overview on the steps for a transformation (migration) in a company. The main idea that can be derived from this figure is formed by first analysing the current situation. Next look at the future situation that is envisioned. Finally a roadmap is needed for going from a to b. This roadmap gives the procedure on IT project strategies and how these have to be performed to reach the future situation.

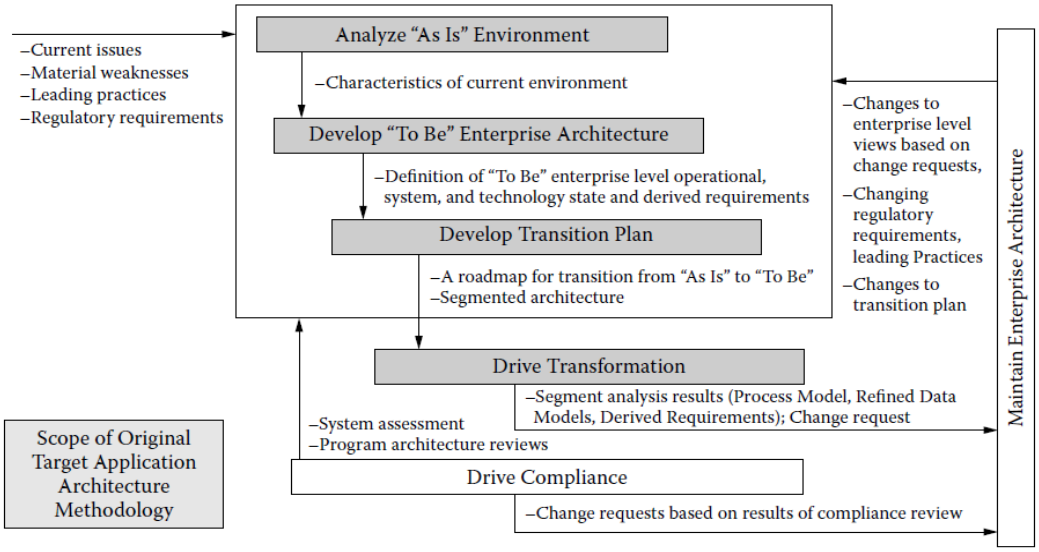

Figure 3.5: Synthesis of the enterprise architecture function as described in the FEAF (Minoli, 2008).

3.5.4 IT Governance

In the literature on Enterprise Architecture and Information Economics, IT governance is a frequently reoccurring topic. On a high level governance is divided in three different topics: corporate governance, IT governance, and enterprise governance (Hoogervorst, 2007). "Corporate governance became a dominant business topic due to the corporate scandals of Enron, WorldCom, and Tyco to name a few" (Weill & Ross, 2004). These scandals undermined the confidence of people in the market. The crisis was a fact and the stock markets fell. The U.S. government intervened and new legislation ensured that management was personally attested for the accuracy of their company accounts (Weill & Ross, 2004). Corporate governance can be seen as the set of internal systems and structures and external law and regulations for control, management that enforce the company to life up to the responsibilities to their shareholders (Hoogervorst, 2007). The enterprise governance was brought to life, because the corporate governance was from an economic financial perspective and for a total enterprise control this was not enough. Enterprise Governance is the organizing competence for the continuous forming of directing authority for the enterprise strategy development and the subsequent design, implementation and operation of the enterprise (Hoogervorst, 2007). IT governance is becoming a topic due to the revolutionary IT developments. IT governance is the organizing competence for the continuous performing of directing authority specific for the IT strategy development and the subsequent design, implementation, and operation of the IT systems.

The most important reasons for IT governance are (Hoogervorst, 2007):

- Benefits of IT investments are unclear or uncertain.
- The connection between IT investments and the business strategy is vague.
- Business flexibility is often hampered by IT systems.
- IT developments are technology driven.
- There are unproductive relations between IT users and IT professionals.

- For IT developments long turnaround is usual.
- IT development and operation are accompanied with high costs.

IT governance is a umbrella term that includes: IT strategy and IT architecture development, IT project portfolio management, and IT program management (Boh & Yellin, 2007). The last two elements are also combined in one topic in literature (Subsection 3.5.5). There are a lot of definitions of IT governance. Important for including IT governance is to exclude the management related activities and the following definition gives the leanest form: “specifying the decision rights and accountability framework to encourage desirable behaviour in use of IT” (Weill & Ross, 2004, p. 8). Together with the earlier insights, it could be said that IT governance needs to address three questions for usage in a company (Weill & Ross, 2004):

1) What decisions must be made to ensure effective management and use of IT?
2) Who should make these decisions?
3) How will these decisions be made and monitored?

The decisions as mentioned in these questions are divided in five key decisions related to IT: IT principles, IT architecture, IT infrastructure, Business application needs, IT investment and prioritization (Weill & Ross, 2004). Al these elements relate to Enterprise Architecture, Information Economics or the various related topics. Therefore IT governance and the questions are important to consider for the model. There are various governance standards around like the International Organisation for Standardisation (ISO) standards, Control Objectives for Information and related Technology (COBIT) and Capability Maturity Model Integration (CMMI) (Lankhorst, 2009).

3.5.5 IT project portfolio management

IT portfolio management (ITPM) is another component in looking at the IT projects in companies. It is the mechanism that ensures balance in a company between the risks, choices and the cost and benefits associated with these choices. The ITPM approach is managing IT as a portfolio similar to a financial portfolio. The mechanism states for continuously evaluation of the different projects in the portfolio and what to do with them. The focus of portfolio management is aimed on the entire portfolio (Program of IT investments in a certain area or for the complete company) of IT projects and not on one single business case (Jeffery & Leliveld, 2004). This mechanism is therefore important to include in this research. The portfolio manager is the one with the overview of the different business cases and in IT portfolio management the right investments mean a healthier portfolio which is focused on the right needs for the company (Suijkerbuijk, 2008). Portfolio management is an approach which looks at the big picture and therefore it has an overview of all the business cases and a way to keep an eye on the balance between the expected risk and return. Portfolio management will bring in an investment perspective by constantly focus on the costs, benefits, risks and prioritization which can give better return on the IS projects (Suijkerbuijk, 2008). The IT portfolio is defined as the activities to keep the projects up to date and facilitates the decision making process for approval, prioritizing and

resource allocation (Hoogervorst, 2007). For large scale projects the portfolio management approach is needed to evaluate a certain project in context with the complete IT function of a company.

3.6 General System Theory

This chapter discusses the General System Theory (GST) in general and the relation with architecture and the relevance for the model design. The choice for GST, was made based on the insights of literature that mentioned the missing of individuals and groups of humans as components in the enterprise architecture approach (Kloeckner & Birkmeier, 2009).GST shows a distinction between the construction and function of elements in an enterprise, which is needed to create a terminology for model creation (Kloeckner & Birkmeier, 2009).

First off the General System Theory is a basic scientific discipline that found its first major application in the scientific world by the hand of Bertalanffy (1950) The general system theory is science that was established more than 60 years ago, however still generates new studies in various research fields. Especially on the topics of humans and enterprises and how these are handled as systems there is a lot of research done (Albani & Dietz, 2008; Dietz, 2006; Kloeckner & Birkmeier, 2009). The model is designed according the research discovered (Ackoff & Emery, 1972; Dietz, 2006). The following sections will elaborate on the enterprise and the system theory, the relation with architecture and value, and the different perspectives involved.

3.6.1 Enterprise as a system

The system theory creates a different way to look at the topics of architecture and IT value that are described in the previous chapters than is used in most modern scientific literature. The founders of the System Theory suggested that a core issue of the modern science is formulating a general theory on organizing or in other words on organized complexity. There are three areas classified: first one is organized simplicity, this is common for machines and mechanism. This area is addressed with analytical methods. On the other hand unorganized complexity is identified, this area can be addressed with statistical methods (for instance making calculations on certain aspects of traffic). A large area is in between these two and is called organized complexity. It is too complex for analytical methods and too organized for statistical methods. According to Weinberg (Hoogervorst, 2010) this is the area to which an enterprise can be seen, and this area is ideally for a systems approach. The main issue of this area is in the large amount of factors that have mutual organist connections. Many authors see the system theory as the only meaningful approach to address this core issue of complexity, and therefore to study and develop enterprises (Bertalanffy, 1950; Bunge, 1979; Rechtin, 2000). Ackoff therefore argues that the failure of strategic initiatives can be blamed on the fact they are structural ´anti-systematic´ of nature. This is also one of the main reasons, why the system approach can give a foundation for the EIE model. First a definition of the term system is necessary (Dietz, 2008):

"System: is a set of interacting or interdependent entities, real or abstract, forming an integrated whole. There are natural and man-made (designed) systems. The entities interact with the environment, to realize a certain function. A random collection of entities without relation is not a system, but an aggregation."

There are different classifications of systems known, for instance a biological, chemical, technical, or social system. If elements of a system are classified according to the same type, the system is homogeneous otherwise it is heterogeneous. An enterprise is a heterogeneous system (humans and machines in one system). Integration and consistency are core concepts in the system theory. The other way around, it is stated that when wanted to give these topics considerable attention a system approach is necessary (Hoogervorst, 2007). System thinking is holistic in comparison to reductionistic (Jackson, 2003). Reductionism is based on the fact that the elements of a system get the exclusive attention. The thought is that if we understand the elements we understand the whole. This view does not deliver a grasp of the whole. As mentioned before a system has a specific function that is derived from the system performing as a whole and cannot be linked to a specific element alone. The behaviour is linked to the interrelation of the parts (Maier & Rechtin, 2000). The holistic view states that the whole gives meaning to the parts. In other words the system theory prescribes to first give meaning to the environment in which the system operates as a whole and then look at the different parts in it, that are exchanging services or products with the environment (Hoogervorst, 2007). Such an approach is concerned with total system performance. Looking back at the definition given on an enterprise and the literature handled here, an enterprise is clearly a system.

3.6.2 General system theory and architecture

To see the relation between system thinking and architecture, the man made systems are of interest. An enterprise has two different subsystems, artefacts (constructed systems with a certain intention and goal for usage) and humans. Two quite different system perspectives exist, that are called teleological system perspective (functional) and the ontological (constructional) one. The teleological perspective of a system is about the function and the behaviour. This perspective is interested in the output of the system (what does it produce?). In management terms this is considered to be the business of the enterprise, also characterized by the products and services that are produced. The ontological perspective is about the construction and the operation. The ontology looks at 'what' the system is (how does it work?). The constructional perspective is also called 'the white-box perspective'. In more management terms this perspective is seen as the organisation of an enterprise, and is characterized by the processes and business functions that result in the products.

The human beings and organisation groups are systems in the enterprise that have to be taken into account, because these are the most flexible (adaption to changes). This is one of the primary objectives of an Enterprise Architecture (agility) as mentioned in section 3.5. Furthermore seeing the enterprise from a white-box perspective and omitting one or more elements carries risk of wrong decision (Kloeckner & Birkmeier, 2009). Humans have the ability to adapt quickly to unexpected

changes. This is not expected from artefacts in general. Beforehand it is impossible to know all the unexpected changes (cannot be foreseen) that can happen. Therefore, including the human factor in a model for justification of investments could increase the level of usable resources (Kloeckner & Birkmeier, 2009). On the other side there are various difficulties in detecting all the elements of human being behaviour. Even in medical physiological studies, it is proven to be very difficult to discover what is going on in the human brain. In this context the construction of the human system is not included, this falls outside the scope. The teleological human aspects are handled in the next sections. The following figure gives the relation between the two system perspectives and the architecture.

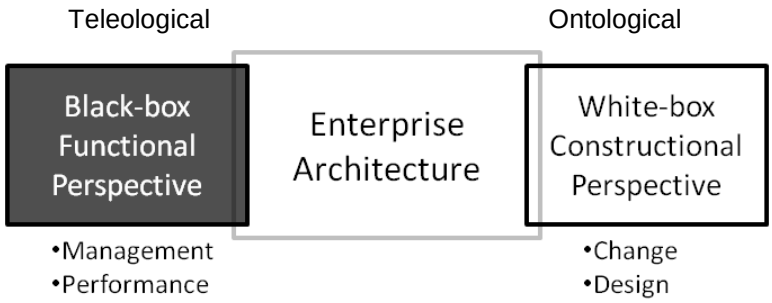

Figure 3.6: the two distinct system perspectives.

As mentioned a system like an enterprise has humans and artefacts. Therefore such a system is called a “socio-technical system”. Realizing artefacts (systems) always involves the two perspectives. These foundations look structural different, but when constructing or changing a system the function has to be in balance. For changing an enterprise the goals, outputs (products and services) that it delivers has to be considered when constructing. The choices have to be justified or reasoned from the functional perspective. Design principles can be linked. For the bridging of the current gap, enterprise architecture is the required concept (Hoogervorst, 2004). An enterprise is not set up as a coincidence, but with a purpose to fulfil. This characteristic leads inevitable to the question how this system can be realised (construction). This leads to a normative guidance. The answer gives guidelines for how the design has to be realised. Architecture has this normative guidance as essential goal. Therefore the link between the two topics seems clear according Hoogervorst:
“From a conceptual perspective an architecture could be seen as a normative boundary for design freedom” (Hoogervorst, 2007). “Therefore architecture is in its essence a prescriptive concept that expresses how systems should be, and not so much the descriptive concept of what a system is.” (Hoogervorst, 2004, 2007). The normative character of architecture is rather obvious, because a descriptive notion is essentially passive (descriptive character afterwards) and cannot give active control in advance. For the enterprise architecture literature and definitions see chapter 3.5. In that chapter the EA topic is described. The frameworks and models in the EA practice have grown large and complex. An outline of ontological layering (like with combining EA and GST) could enhance EA. It is better to have a smaller amount of data that covers the full range of an enterprise, than large amounts of data which cover only a small range of a system phenomenon (Berg-Cross, 2008). For

appliance of these topics in the model chapter 4 will elaborate. The following sections will give more details on the ontological and teleological concepts.

3.6.3 Ontological perspective

The world is the highest abstraction level used in a business or IT context (Bertalanffy, 1950). In the General system theory and the literature on Enterprise Architecture, this concept is classified as the environment of a company. For the concept both topics use the same definition for the enterprise environment in this research:

> **Environment:** A set of elements of the same category.

. The concept “enterprise” is described as a system in its specific environment. For clarifying the concept first a definition of a system:

> **System:** A set of interacting or interdependent entities, real or abstract, forming an integrated whole.

There are natural and man-made (designed) systems. The entities interact with the environment, to realize a certain function.

Ontology is the explicit specification of conceptualization (Noy & Hafner, 1997). Enterprise ontology is a formal and explicit specification of a shared conceptualization among a community of people of an enterprise (Dietz, 2006). The ontology is about the construction, and therefore an enterprise as a system needs the following properties:

The following properties together form the enterprise as a system and figure 4.2 gives a simple representation:

- Composition: the set of elements of some category (red blocks within the purple boundary of the system in the figure).
- Environment: a set of elements of the same category; the composition and the environment are disjoint. A change in any of these elements can produce a change in the state of the system. Therefore an environment of a system consists of variables which can affect its state. Or in other words the elements that have direct lines with elements in the enterprise (in the figure the light blue blocks).
- Structure: a set of influencing relations between elements in composition, and between them and elements in the environment (The lines connecting the blocks).
- Production: the elements in the system produce things (goods and services) which are delivered to the elements in the environment (in the figure the lines from red to the light blue blocks deliver the service or goods).

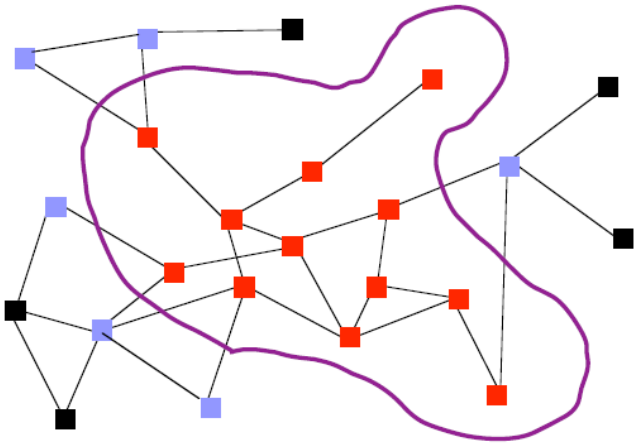

Figure 3.7: High abstract construction of a system (Dietz, 2007)

These properties have the following correlation: Construction = Composition + Environment + Structure. Without these elements it is not a system (Dietz, 2006).

3.6.4 Teleological perspective

This section gives an overview of the teleological perspective of the enterprise. A system of an enterprise can only be a system with a purposeful subsystem. Because organizing a system is an activity that needs purposeful systems to work. This relationship gives identity to the enterprise due to the purposeful elements. Will is an important aspect in this. An aggregation of purposeful entities does not constitute an enterprise unless they have at least a common purpose. The enterprise is divided by characteristics/capabilities: the functional division of labour to reach a common goal defined by its elements (systems). An enterprise consists of at least two purposeful elements which can connect through observation and communication and through which they can respond to each other's behaviour. For the teleological perspective the behaviour and function are discussed.

System behaviour (Ackoff & Emery, 1972)

System Behaviour (systems event): is a system event which is necessary or sufficient for another event in the system or environment. Behaviour is a systems event which starts other events. Reactions, responses and actions are system events whose causes and preceding events are of interest. Behaviour consists of system events whose consequences are of interest. A human system is part of the class of 'purposeful systems'. This sort of system can produce the same outcome in different ways in the same state and can produce different outcomes in the same and different states. The purposeful system has its own purpose and can use artefacts to reach this purpose. This system selects outcomes as well as means and thus displays a certain will. A system which can choose between different outcomes can place different values on different outcomes. These choices of values are of course further interrelated with reaching the outcome in the interest which a system has. The system wants to reach the best value this is the preferred outcome (wisdom).

System function (Ackoff & Emery, 1972)

Function of a system is its production of the outcomes that defines its goals. These are the certain capabilities of what a system can do in a certain situation (the state can change in a situation). The outcome is the product of the system. The system needs to reach this outcome. Therefore a certain efficiency function is relevant. Also a certain adaption can be part of the function of the system. The system can abandon his initial goal and reacts to the changes (ontology) and uses its function to adapt to the new goal. Learning is the concept of increasing the efficiency in pursuing a goal under changing conditions.

- Perception/ Expectation: is correlated with the interest of a system in reaching his goal. Is depending on the type of behavioural system.
- Risks/uncertainty: this is depended on the properties and elements of a system for making a certain choice/decision. There is always a certain probability factor for what the influence is of a certain element or property.

For the purposeful system a purpose depends on the meaning of function and function is not opposed to the structure of that same system. The structure is consisting of certain properties: geometric, kinematic, mechanical, physical or morphological property. These properties are also applied on the boundaries of the larger system of an enterprise and determine the environment. For investigating a certain case for research it is relevant to take a bounded part of space at a certain moment of time: time-slice. Instruments are artefacts that coproduce the outcome of a systems action. The purposeful system (A) uses another system (B) as its instrument to facilitate in its purpose to reach the objective. For instance an insurance employee using a laptop as a technical instrument to type an email for his client. B is a system which acts at a lower level than purposefulness. When a purposeful system needs another purposeful system it can receive assistance because they are at the same level and therefore no instruments.

The next figure presents an overview of the two different perspectives as just described. The first picture presents the teleological (functional) perspective. The enterprise is shown as a black box and only the production, output and input are important. The second figure presents the constructional white box view on the enterprise. The relations, structure, composition are important to show what the elements of the enterprise are.

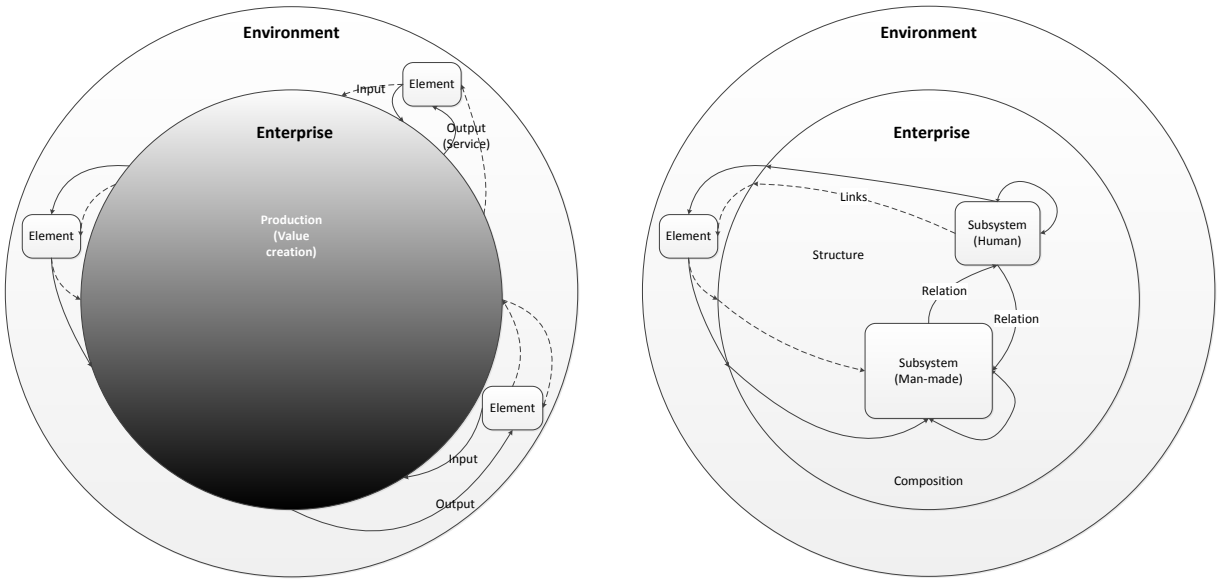

Figure 3.8: System perspectives construction vs. teleological

3.6.5 Value network analysis

The human systems interact with each other and with the artefacts in an enterprise. The exchanges between these systems or between elements in an enterprise are important from a functional and a constructional perspective. It is furthermore related to the knowledge and value question that arises in the IT literature. The key business question is: 'how is the value created?' The enterprise system gets input and delivers products and services as output. What happens in between is the creating value. But as mentioned the enterprise is a socio-technical system, or in other words a living system (Allee, 2008). The enterprise is complex, there are too many variables that cannot be controlled. So cutting up a system in pieces and putting it back together from a mechanistic point of view does not have the best result. Analysing it from a living system perspective looks at the exchanges. An enterprise is a living system which changes over time and during periods. Therefore it is very difficult to classify an enterprise purely into functions and individual processes. The relations between the different elements/sub-systems, is the pattern of the enterprise essential for identifying the characteristics. A white box perspective is essential to generate change (Dietz, 2006). Discover patterns of exchanges between the various elements and systems and particular for the environment and the relation with the enterprise as a system. This gives the value network (figure 3.6): seeing complex systems (humans, enterprises) as webs of relationships, that exchange tangible and intangible values (Allee, 2008; Peppard & Rylander, 2006). Intellectual capital is getting more and more important. "Data and People are inexorably linked as never before. Either one without the other is suboptimal" (Fitz-enz, 2009, p. 16). The data is transformed into knowledge by the people. Knowledge and skills are only of value for the enterprise when applied to business situations. Value adding always starts with the enterprise's goals (Fitz-enz, 2009). Looking more closely, a human being is the only asset (Responsibility) in a company that has the inherent power to generate value (Fitz-enz, 2009). The appliance of the value network approach in the model is described in chapter 4.

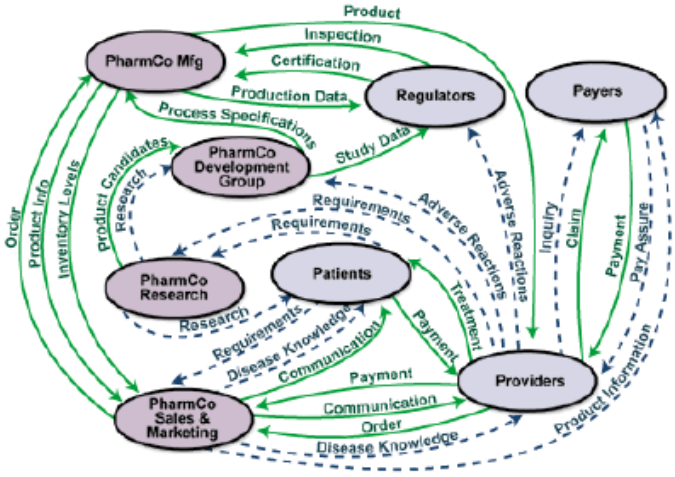

Figure 3.9: Value network (Allee, 2002)

3.7 Conclusion literature study

The main question in companies related to IT/IS: “How does IT deliver value?” is the starting point for the research. Developing an extension for the current approaches, frameworks and theory involved with IT can give people ways to rediscover the investment topic. The alignment with business is becoming the important issue, because the technology is widely available and distinction on new technology is decreasing or is of a short period. Due to the increase in IT spending the critics have also increased, like the issue that IT investment is rarely seen in the productivity numbers (subsection 3.2.2). The information economics (IE) framework is a different way to handle particular IT investments (section 3.4). IE has several positives and negatives (subsection 3.4.1) and examining these points shows that the framework needs extensions to make it usable for enterprises. First off when extending frameworks for investment, decisions control measures are needed. IT governance mechanisms could cope with the control risk (subsection 3.5.4). IT portfolio management is another option. The downside of IT portfolio management is that if an enterprise has a lot of different IS projects the evaluation of the single business cases will not be sufficient this way to ensure constant monitoring or reappraisal (subsection 3.5.5). Therefore this way cannot be considered for the model design. The benefit management research does already show ways to cope with controlling on the subjectivity of value measures. For the IE framework better insight of the enterprise itself is needed, because how can an IS be scored without really knowing how the IT landscape of the company is designed and constructed (section 3.6). This is difficult, because calculation and measurement of a certain Information System is another profession than designing and constructing.

Architecture and Enterprise Architecture still are vague terms and various authors contradict each other (subsection 3.5.2). For a model to extend the Information Economics framework, the terminology and elements have to be clear. Therefore the General System Theory (GST) presented a solution to cope with the contradictions in Architecture and EA. Furthermore GST can ensure that EA considers the people and business aspects (subsection 3.6.2). Seeing companies as systems that produce elements and create value presents a bridge to the value aspects of IE. This is essential to create a

general baseline for a functional and constructional perspective. Therefore seeing enterprises and humans from these perspectives leads to interesting findings for searching a new model for investments in enterprises.

Analysing costs and benefits is particularly focused on connecting the business domain benefits (tangible and intangible) with the technology domain costs (computers, hardware, software, people) as shown from the IE section (3.4). For analysing the costs of a specific project, a clear insight in the current information technology domain and the value and costs of the current environment is needed. With this insight, the change in the information system is measurable. EA and GST present clear insight in the IT domain and environment. The relevant effects of a particular investment can be identified this way. Not only the costs for a developer which is placed on the project to develop, but also the impact of the investment on the current infrastructure and architecture. The General System Theory (GST) and Enterprise Architecture (EA) are a theory and a design approach that have a close linkage. The GST literature is brought in perspective against design and architecture of a system on several occasions (subsection 3.6.2).

Purely focusing on companies, these can be viewed as complex socio-technical systems and therefore the human and organisational context need to be included (Kloeckner & Birkmeier, 2009). When changing an enterprise the traditional black-box thinking (functional view) is not sufficient (Hoogervorst, 2004). To perform a migration of a complete business, insight in the construction and operation of the enterprise is needed (white-box) (subsection 3.6.2). The black-box view is enough for managing a Enterprise Architecture, but for a change (migration) the white-box (construction) view is needed (Dietz, 2008; Hoogervorst, 2004). The GST brings focus on the system's structure and function. The combination of Enterprise Architecture and The System Theory can present a bridge for the gap between stakeholder value and IT construction (subsection 3.5.3). The enterprise as a system creates a different way to look at architecture and IT value. The two perspectives of function and construction from the GST can be found in the frameworks of EA and IE. EA is about the design principles of how the Enterprise is structured (functional and constructional perspective), IE can be viewed as a framework involved with change and management of IT (functional perspective) that is missing the constructional perspective (sections 3.4 and 3.5).

The two frameworks combined on elements of value can combine the two perspectives and GST can structure the model. The general economic concepts of Value chain and Value network give a topic in literature that link the IE framework with the System theory approach (section 3.2 and subsection 3.6.5). The GST improves EA by designing the organisational and human aspects of a company from a system approach, this sets the various elements of enterprise in the same context as systems. In the IE literature a company is described as an open system with people performing processes to manage or operate in projects or daily operations. This classification presents a possibility to combine the different topics. Another link is between EA and IE. Both frameworks need analysing of the activities

that are performed in an enterprise. Detecting the behaviour of the systems (in business terms mentioned as 'the activities').

In IE the initial understanding of the enterprise (the functional perspective) is traditionally analysed by classification of "work functions", in other words the activities (business behaviour). The cost, benefit, and value aspects of the parts in the enterprise are also important for both frameworks. The value benefit and cost description of Berghout is consistent with the description of Parker in the IE method (subsection 3.4.4). These two elements give possibilities for connections in a model and method. The last element for an extended model of IE is the evaluation and reappraisal. As mentioned in literature IE is placed in the stages justification and evaluation and usable for evaluation (subsection 3.3.2). Combining these concepts and prescribing the principles gives meaning to the EA modelling pictures and the IE calculations. These different relations and links set the context for the next chapter. The table shows the topics of literature (chapter 3) and present a starting point for chapter 4.

Literature topic	Limitations for EIE model	Possibilities for EIE model
Information Economics	Missing insight of the IT landscape. Missing the construction perspective.	The traditional CBA and the value methods can be incorporated.
IT governance	An extensive topic can be applied in various ways difficult to incorporate for a method without increasing the time spending.	Control measurement is needed for the internal validation. Governance can cope with the control risk involved (example. segregation of duties issues).
IT Portfolio management	Portfolio management could lead to less detailed business cases of projects. The level can be too low for applying the EIE model.	Gives a possibility of comparing different projects. Due to time limitations not included in the model design.
Architecture & Enterprise Architecture	Missing a unified approach for discovering the enterprise. Vague in terminology. Missing human and organisational context.	Presents a way to restrict design freedom needed for getting the right focus on changes in systems.
General System Theory	Is a theory that gives many interpretations and is difficult to standardize for model design.	Gives a clear outline for a discovery, only if a restricted usage of the theory is prescribed. Presents a solution to cope with contradictions in Architecture and EA.
Value Network Analysis	Missing the overview of a constructional perspective.	Gives a better overview of the external influences than a value chain approach.

Table 3.5: Literature insights for the EIE Model design

4 EXTENDED IE MODEL AND PRESCRIPTIVE METHOD

The Extended Information Economics (EIE) model and prescriptive method are described in this chapter. The model and method are designed according the literature study (chapter 3) and practical experience gained during the internship. The first section will handle the scope for the remainder of the chapter. The second section describes the limitations. The third section is the introduction for the model design. The fourth section shows an overview of the model design. The fifth section a description of the model elements. The sixth section present the overview of the prescriptive method. The seventh section describes the phases and steps, section eight the justification of the element choices. Section nine gives an detailed description of the method steps. The last sections present further in depth information about the tools used for the model and method.

The EIE model is an extension of Information Economics for IT project justification and evaluation. It uses different concepts, models, and frameworks from scientific literature. The method is prescriptive, because it is a pathway to follow (in practice) phase for phase. For this study the focus is on life and pension Insurance product migrations for the validation and verification of the model and method. The model and method are designed to be generic for all branches, because the concepts are abstract and only on detail level changes have to be made. In order to see if it can work in other branches or other projects, further research is needed. This is outside the scope of this research project.

4.1 Scope of the model and method

As with any research project, available time was limited. For this reason the following choices have been made to limit the scope of the model and prescriptive method:

- *Single project/program evaluation, not portfolio:* The model is designed for a single project with possible several migration scenarios. There is no comparison included of different projects in a single organisation and therefore the prioritizing element of IE is left out of the scope for empirical research.
- *Extending IE, not GST and EA: T*he focus of the model is on extending the IE framework and therefore the elements of GST and EA are applied with the focus of improving the IE framework and not to consider how IE can extended EA for instance in analysing the specific value of an EA framework in a company.
- *Focus on product migrations, not complete business migration:* The method focuses on certain elements of the IT/IS investment (Ward & Daniel, 2006). Investment appraisal (IE) and system development (EA and GST) are elements considered in the model. These crucial elements for IT projects in a larger program, like business migrations programs have various management elements that have to be considered in the evaluation process. For large projects, strategic planning, program management, project management, change management, risk management methods are needed to control and manage teams and ensure the projects involved with a large migration are landing within the business in the right way. For this model and method the implementation and incorporation of the EIE model with

specific IT strategy, management and program methods in a company is a considered for further research.

4.2 Limitations of the EIE model and prescriptive method

The goal of the model as presented in the previous section is to provide insight in the IT investment evaluation in combination with the principles and guidelines of design (architecture). However the constructed model has a number of limitations:

- *Use of separate frameworks in one model:* The combination of the different elements in a single model and method for IT investments has not been done before and therefore no reference is available to compare with the end result, but the test in two cases validates the method design. Future remediation could be, to use the method steps and reappraisal in a real life project during justification and evaluation.
- *Data gathering based on subjective data:* the IE framework has this issue and with an extended model this element is more contained by the other elements of the model. Still subjective data cannot be eliminated completely. Also in the design the verification is based on expert opinions and is subjective. Still this is a sound way to improve quality.
- *Strategy as a given:* The method takes organisational goals and strategy as a given, or at least as already determined and agreed upon in the enterprise.
- *Untested dependencies:* The method uses elements of multiple frameworks and therefore the unique alignment of these elements give end scores of single projects that are untested except for the empirical study in this research.
- *The model and method focus on certain elements of the IT/IS investment (Ward & Daniel, 2006):* Investment appraisal (IE) and system development (EA and GST) are elements considered in the model. This means the strategic planning, program management, project management, change management, risk management methods are outside the scope.

4.3 The EIE model: introduction

The initial idea for creating the extended model is described in the literature conclusion (section 3.7). Three topics related to (the research of) IT investments, Information Economics (IE), Enterprise Architecture (EA) and General System Theory (GST), are combined to get the extended model. Based on the available literature and the latest insights in these research areas, the model is constructed. To verify the extended model, this section explains the relationship among the studied aspects relevant for the Extended Model. The following subsections will provide the main aspects of each research topic relevant for the extended model. The last subsection will present an overview of the Extended Model.

The model is intended for IT migration projects. Specifically for migrations of products from a particular information system to another information system. These systems are linked to other systems and interact with people. A large amount of data, connections, people, etc. are involved in the migration of products and services. IE and EA frameworks have been applied in the past for IT migration projects.

EA is used for modelling and redesign of systems to better cope with the goals of the enterprise. IE is a framework to justify and evaluate the financial side of the project with the goals of the enterprise. As described in literature both frameworks have to deal with several issues. Most important a theoretical foundation of concepts is missing to combine the two. A conceptual model presents a way to combine framework elements (EA & IE) with a theory (GST). The term *conceptual model* is used to refer to models which are represented by related concepts which are formed after a conceptualization process (Blumberg et al., 2008). According to the different topics and conclusions from literature, a model has been constructed to put things in a perspective. The goal of the model is to extend the IE framework with better ways to quantify the results of IT migrations.

The Extended IE model is constructed with the General System Theory as a theoretical foundation. This theory presents an enterprise as a system of elements with relations. The theory gives meaning to the EA and IE elements in the model. For the inclusion of GST and EA in a model the conceptualization is the first step. The following section gives an overview of the various concepts combined in a model overview.

4.4 EIE Model: overview

The enterprise and environment are set and considered with the different principles, perspectives, concerns and system types. It is clear that the design has to start with the highest level, the environment. The value network method as a new approach of the value chain is the best possibility as it is related to system thinking. The input and output are needed for an enterprise to see how the value is created in-between. The value network is mentioned as model to view the environment elements in relation to the internal elements (sections 3.2 and 3.6.5). The exchanges approach as mentioned in the Value Network Analysis (VNA) is a clear way to present the relations the enterprise has with the environment. The input and output for the system can be discovered this way, but still the value creation inside the enterprise is an issue. In other words what happens to the input before it is a product or service that is delivered to the environment. The ontological design of the system (construction) is needed to detect how the value is created. For the system design a similar approach can be applied as the VNA, but with focus on the internal relations between the various subsystems in the environment.

The figure (4.1) shows the three subjects of the theory and how they are combined in an EIE model overview. On a high abstraction level the GST is combined with the VNA in the first layer. This sets the stage for the EA and IE frameworks (second and third layer). The EA framework has a link on the functional and constructional perspective of the enterprise. As described in the literature section, an important part of EA is analysing the functional perspective. The EA framework leads to functional and constructional principles that are presented in EA results. The EA results present the input for the calculation in an IE framework. The final result gives the scoring of the project.

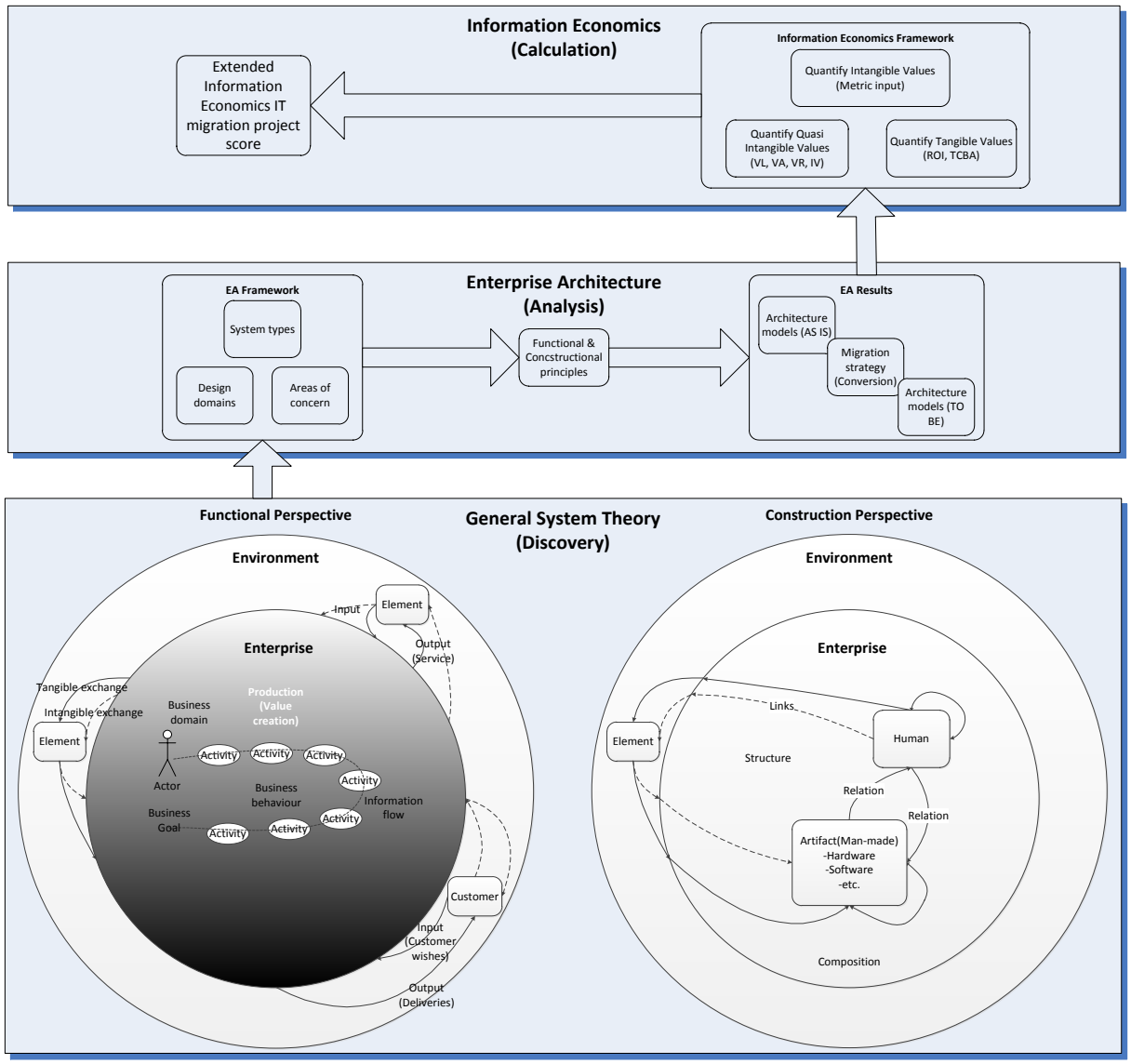

Figure 4.1: The Extended IE Model overview

The following section describes the different elements from figure 4.1.

4.5 EIE model: elements

Figure 4.1 gives the overview of the model with the three subjects of the literature study. The three topics lead to elements that construct an EIE model. The model overview has the following elements that are described in subsections:

- Functional and constructional perspectives
- EA Framework
- EA Results
- IE Framework

The four elements together lead to an end result, that presents a scoring for the project.

4.5.1 Functional and constructional perspectives

The two models (figure 4.1) present the perspectives from the GST (Dietz, 2006). The first model is the functional (or teleological model). It shows in a short description, the function of the enterprise and the behaviour that is needed to create value with input and deliver output. For an insurer this are the policies they deliver to clients. The second model is needed to discover the construction and operation of a system. The relations, elements (human or man-made) and their properties have to be discovered. For an insurer this could consist of insurance agents and their policy administration systems they use.

The board or management sets the goals and strategy for an enterprise. This leads to a certain required function of the IT in their enterprise. These requirements are called the determining requirements (analysis). These demands lead to requirements for the construction of the IT. This shows the interrelation between ontological and functional. Architecture is needed to restrict the design freedom for designers (section 3.5.1). In particular in migration projects of Information Systems it is critical to have a strict set of design principles that embody the requirements for the system. The principles of architecture are divided in two types: functional and constructional principles. The functional principles are important for the functional model. The constructional principles regard the development of the constructional model.

The principles set the requirements for the “To Be” situation. For a system, the specific requirements could differ depending on the circumstances. These principles are consistent with the two perspectives described in the GST:

- The functional perspective is concerned with usage of the enterprise. This perspective involves the function and the behaviour of the enterprise, thus the relationship between input and output.
- The constructional perspective is concerned with the construction and operation of the enterprise, specific how the subsystems in the enterprise collaborate to deliver services to the environment.

How the system relates to the elements and systems in the environment is defined according the Value Network Analysis method (section 3.6.5). The value network approach is also incorporated to map the internal relations in an enterprise. In this way the functional and ontological model of the GST are combined to use in practice. But for the functional perspective it is important to not only discover the output and input of a system but also the business behaviour. For this behaviour aspect the architecture framework is incorporated.

4.5.2 EA Framework

Enterprise Architecture is coherent with the General system theory. EA is practically a coherent set of design principles that embody the requirements for a class of systems. But an important question that comes to mind for a model in which the topics are combined: “How is an architecture created?” Which

things have to be considered to get a list of design principles? The following three elements make up an EA framework:

- The set of systems in the enterprise, including humans and artefacts (Manmade subsystem).
- The two design domains that are inherent to the system types. The two domains that are used in the model are the two perspectives of business (function) and organisation (construction).
- The set of areas of concern: this are the requirements brought in by the stakeholders. Therefore the stakeholder analysis is an essential part of EA (appendix E). The requirements give the purpose for the IT migration project.

Enterprise Architecture is a set of design principles and according to the two perspectives of GST, it can be divided in functional and constructional principles. The next step is to apply the Enterprise Architecture analysis to model the As Is situation, pathway (migration strategy) and To Be situation.

4.5.3 EA results

The design principles lead to the EA result elements. The EA results block consists of three elements:

- The As Is architecture models (current situation): The As Is models combine the insights of the constructional and functional perspectives in clear models to map the relevant elements in the enterprise. The EA framework and design principles give the guidelines to model the current situation of the enterprise.
- The migration strategy (pathway): The migration strategy gives the strategy for migration and the mapping from current to future situation.
- The To Be architecture models (future situation): The To Be models combine the insights of the constructional and functional perspectives in clear models to map the relevant elements in the enterprise. The EA framework and design principles give the guidelines to model the future situation of the enterprise.

The EA results lead to input for the information economics framework. The combination of the discovery on the two perspectives (GST) and the analysis of the EA framework that are stated in principles and EA results.

4.5.4 IE framework

The GST and EA concepts lead to a result after analysis with EA models and tools. The next step is applying the IE framework. Reflecting on the literature (Section 3.4) the IE framework can be divided in three concepts:

- Calculation of the Tangible Values: Cost and Benefit Analysis with the first version of a Return On Investment scoring (traditional financial approach).
- Calculation of the Values methods: The four Return On Investment extensions on the first analysis: Value Linking, Value Acceleration, Value Restructuring and Innovation Value.
- Calculation of the Intangible domain Values: The quantification of the business and organisation domains, according available properties (performance, modularity, etc.) of the IS.

IE has been created as an economic framework that can be applied on the projects that include the system design elements. The background is different, but there is a close linkage. The difference lies in the input for the IE framework and the eventual output. The input for the IE framework comes from the EA analysis results that are created according the EA framework and GST discovery.

The following section describes the prescriptive method that is set up to facilitate with the usage of these scientific topics and the interrelations. Furthermore this can be traced back to the value exchanges of the VNA method used for the discovery. Therefore these concepts are used in the calculations. The benefit method is used for the details that are missed in IE (see appendix F).

4.6 Prescriptive method: overview

For the general overview there are four main phases that can be distinguished from examining the relations between the literature topics in the model design.

First step is to decide upon the synthesis of the environment of the enterprise (Dietz, 2006; Repoport, 1980). This step is discovering the elements of the system which are outside the system boundaries of the enterprise, but which are interacting with elements of the enterprise (organisation under observation). Formulating the boundaries is done by detecting what the degree of freedom is for the organisation to operate in (for instance a governmental entity lays done certain rules). The next step is analysing the organisation within the own system boundaries. This is going into the analysis part of the model. Discover the different parts of the organisation and the relations. The third step is the Enterprise Architecture process of transformation. This is the exploring phase to look at what the possible scenarios are for the migration under the restriction of the environmental rules and the organisational system structure. The final step is the economic aspect of Information Economics. Define the value of the system parts (costs, benefits). Measure the costs of the migration project en discover value of the system, when changing different system parts. Figure 4.2 is a global overview of the steps followed in the prescriptive method.

The figure shows the high level method overview of the model. The overview presents the steps, a reappraisal (evaluation) path and a governance layer. These phases lead to a final score for a migration project. These four phases with the various steps and products are handled in the following sections.

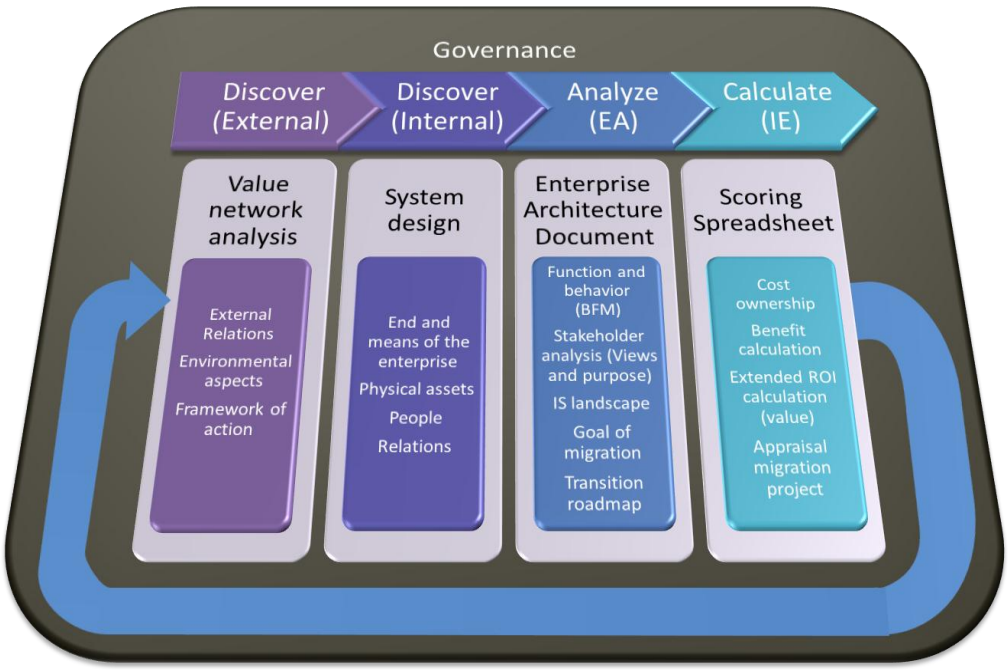

Figure 4.2: Method overview

4.7 Prescriptive method: elements

The different phases and steps of the prescriptive method and usage of the EIE model and the choices that have been made are described with the underlying steps involved. This section gives a justification of the steps and the next section describes the details of the steps.

4.7.1 Phase 1: External discovery

1. Collect the current environmental aspects (issues, legislature, market, opportunities, customer demands, etc.).
2. Discover the proper elements (other enterprises) in the environment (outside the composition) which influence the enterprise (for instance a Governmental body which enforces certain regulations).
3. According environment, pattern, and structure the framework of action for the organisation can be set (value network).

Product phase 1: Value Network Analysis

4.7.2 Phase 2: Internal discovery

1. Detect the ends (goal (CSF), objective, and vision) and means (mission, strategy, tactic, business rule and policy) of the enterprise.
2. Discover the physical subsystems within an enterprise. (Abstraction aggregation)
3. Discover the social (people) subsystems within an enterprise. (Abstraction aggregation)
4. Discover the mutually influencing relations among the subsystems of the enterprise (the teleological system notion.) Detect the current function and behaviour of the enterprise.

Product phase 2: System design document

4.7.3 Phase 3: Enterprise Architecture analysis

1. Analysis of the first two phases for the system types and design domains (the intended use of the design) (As Is).
2. Analyse the purpose of the various stakeholders (purpose off concern is the relation between stakeholders and the enterprise).
3. Analyse if a sufficient picture of the current IT architecture can be given, dependent of the specific situation of an enterprise (As Is).
4. Model the business behaviour and function in a business function model (As Is).
5. Model the IS landscape (functional domain view, ownership of systems view, ownership of data view and the system life cycle view) (views give representation of the quality what a system can have for certain stakeholders) (As Is/ To Be).
6. Identify the ends of the migration project (To Be).
7. Complete the analysis by modelling the expected changes in the business function model and future IS landscape (To Be).
8. Specify the enterprise architecture transformation process (a roadmap for transition from “As Is” to “To Be”).

Products phase 3: Enterprise Architecture document and models

4.7.4 Phase 4: Information Economics calculation

1. Calculate the cost of the current physical assets according the Total Cost of Ownership methods, but also the value of the employees which are not physical assets (ownership including labour costs, pension, lease, leave, etc.).
2. The costs of the project are inventoried according the Information Economics Cost Benefit Analysis. The costs are directly imbedded into the ‘to be’ picture.
3. Identify the benefit profile of the migration project (tangible and intangible) according the value analysis of IE.
4. Calculate the extended ROI number and use the IE domain factors in combination with input from the EA framework. The end result is a score of the migration project (Return On Investment, benefit management, and value methods).

Products phase 4: EA models with incorporated cost calculation and IE scoring spreadsheet

4.7.5 Evaluation (reappraisal)

After the fourth step is completed the migration project gets a score based on the EIE model. This score is for the justification of a migration project. After the project is justified and started the evaluation loop is used to reappraise the migration project after each stage of the migration project. Changes in the enterprise or its environment can be an incentive for evaluation of the score and the phases. Keep continuous insight in the impact of the project by controlling the enterprise (keep track of the changes in the physical and social system with the EA framework tools). The model shows this element by having a loop that can be used continuously during the project. This leads back from the end result to the beginning and the phases can be processed for reappraisal.

The reappraisal can be initiated when an event causes a change in the enterprise. These events can be external or internal of nature. Another option can be to perform the evaluation periodic during the life cycle of certain migration projects. The evaluation loop does not prescribe a complete iteration of the four phases described earlier. The product of this element in the prescriptive method consists of:

- An inception report with the changes in the external and/or internal discovery phases.
- The changes applied in the EA models and documented in a change report for traceability.
- The last step is a new version of the IE calculations with the updated numbers.

The principles for evaluation and reappraisal give a method for controlling and monitoring the progress of the IT migration project.

4.7.6 IT Governance Layer

In the first place the method is created for the Business Migration program of Logica. Therefore the method is used within the governance controls of this program. The quality assurance system in place is called Cortex. The Cortex processes are designed according the international standards of ISO 9001. Cortex is a business management system that is larger than the quality system alone. It integrates quality, commercial, technical and financial control systems.

IT governance has the following elements in the VP Business Migrations (Logica, 2011):

- Accountability to all regulators and the internal organisation.
- Openness and transparency in the context of the Act on Financial Supervision (WFT) and for policy holders.
- Controllability by audits and providing reports.
- Future-proof and the base for the new form of insurers that are needed in the current environment.

Furthermore the project methodologies used are MSP (Managing Successful Programs) and Prince 2. The project/program managers are Prince 2 certified. The maturity level aspects that have to be followed are according Capability Maturity Model Integration (CMMI) level 3. The quality system is supplemented with the specific methods and techniques for realising the results of the financial organisation involved. These different standards ensure the validity of the Business Migration methodology. The EIE model is designed to be reproducible according the level 3 maturity. This states that processes have to be defined and clearly documented. The processes are characterised and described in this thesis. Further documented and justified in the following sections. The templates of the different phases are presented in the appendices to ensure a certain standard of documentation and reproducibility. For the Quality certificates further research is needed to formalize the EIE model according the standard's demands.

The IT governance layer is needed for the internal validity of the model. The EIE model is a justification and appraisal model for IT investments, therefore a governance aspect is needed to

ensure IT extends the enterprise strategy and objectives. The various phases need a governance control to minimize subjective influence on the decision making of the model.

The justification of the IS migration projects in a specific company does not conflict with the methods already available. To eliminate issues, certain rules on the usage of the model and the processing of the (re)appraisal are needed. For instance the calculation phase has to be under responsibility of another person than the one in the discovery phase or design phase.

For control of the project certain points have to be made clear from the start of the project. The following points have to be considered for starting the project and for formalisation of control before the EIE model can be used according the prescriptive method:

- The important strategy goals have to be in relation to the scoring of the project
- The place of the project in the current and future company plans
- The goals of a project
- The size of the project
- The tools and methods that are used in a project have to be clear
- The milestones for revaluation and progress have to be stated for measurement

Certain differences exist between organisations. Documentation has to be followed. For consideration of the first phases, performing the discovery and design of the environment and enterprise can be used for future projects. Making an external and internal value mapping can be revaluated for future migrations and handle if changes have to be involved. Looking at the environment in a time span of two years the most relevant entities in the environment are the same on a high abstraction as on a low abstraction. Sure the companies involved can differ as for the exchanges when, for instance a new legislation is issued by the government.

The model which is used when following the prescribed method described in the next sections, needs the right people to be involved. The culture is the important element to consider when using the EIE model in a company. Extending the IE framework with EA and a GST approach does already consider the organisation from a system perspective and therefore elements like strategy, goals and if possible Critical Success Factors are taken into account in the model itself. The standards that management uses for evaluating projects on IT have to be considered when using EIE in a company.

Which formal demands are instated by the specific company for project proposals, have to be considered when implementing the method. The decision making process needs to be in line with the budgeting process, consider yearly information plans for al projects, of the specific company. The top management needs to evaluate the scorecard and the criteria if these are enough for their situation or that extra criteria are needed.

4.8 Prescriptive method: justification

The first phase examines the external elements that influence the enterprise. The choice for external discovery as first phase is derived from the GST literature (Dietz, 2006; Repoport, 1980). The Value Network Analysis subscribes to this approach and presents the most time efficient analysis of the environment. In the IE framework this element of environment discovery is not clearly defined and therefore leads to room of different interpretation. The view of systems as open systems is described and the importance of the environment and the relation with the enterprise is mentioned (Oirsouw et al., 1993). The environment is stated as important for the scorecard due to the influence environmental aspects can have on the internal ends and means (phase 1 step 1 and phase 2 step 1). Steps 2 and 3 are in according with the IE framework on the point of discovering the factors that influence the contribution to the enterprise of IT investments. The steps can cope with the IE risk of a scorecard that is outdated based on the wrong environmental aspects (Oirsouw et al., 1993). In the IE literature the importance of these relations with relevant parties, is described but specific methods are not mentioned and therefore leaves room for extending in this section. The choice for an external focus first is needed to discover the design freedom for a system design. Furthermore in IE this element has to be clear before insight into the risks and values can be achieved.

The second phase follows directly from phase 1, because the design freedom is described at this point and then the internal organisation needs to be discovered (Dietz, 2006; Repoport, 1980). First of the ends and means are important to discover what justifies the existence of the enterprise. This is compatible with the proposed company analysis in IE (Oirsouw et al., 1993) and EA business architecture approaches ("Togaf Enterprise Edition 9," 2010). The steps 2, 3 and 4 are according the system design approach (Dietz, 2006). The IE framework is lacking this part in the literature and therefore no decisive reference on this extending element can be found. A justification of including the system design approach in the method is given by the alignment issue between business and IT. In literature this alignment is discussed as only possible to realise on a level of design. Specifically this is called the enterprise design (Hoogervorst, 2007). The integration and relation between business and IT, refer to the dependencies of elements within a system. These elements have to be aligned to support the function of the system as a whole (functional perspective). The construction and design is needed to know how the enterprise function is derived (section 3.6). The design of IT systems and the architecture approach are part of the enterprise design; therefore phase 3 is a direct follow up on this phase. In the GST this relation between the phases is related to the two perspectives described in the model design.

The third phase is consistent with the architecture and functional perspective on an enterprise. This step is needed as further elaboration on phase 2 and to really extend IE with the right information on the activities that produce the output of the enterprise. This function of the company is dependent on the principles of EA and the EA framework is a clear way to identify and analyse the enterprise and IT systems in a movement area that is set in phase 1 and 2. The 8 steps of this phase are processed with the best practice approach of EA according Logica and the literature of Dietz (2006) on

architecture and frameworks. This element is a step to present the CBA of the IE framework with a design to base the calculations on. The purpose, behaviour and function elements of a systems are essential for an IE framework to work in the first place (Oirsouw et al., 1993). These preconditions are now incorporated in the model to prevent risks and achieve better alignment. This phase is the link between the system design approach and a company analysis mentioned in the IE literature. The company analysis in IE is not set specific and therefore the eventual scoring cannot be specific. The inclusion of phase 1, 2 and 3 with a design of system and enterprise with the corresponding principles described in an EA framework can provide a better basis for scoring.

The last phase describes four steps that take the information of phases 1, 2 and 3 as input and perform the IE elements according the two studies of Oirsouw and Parker & Benson (Oirsouw et al., 1993). The choice for IE leaded to inclusion of these specific steps directly into the method. The extending with GST and EA give the input for steps 1 and 2. Only the benefit management literature is included in step 3 and 4 to bring some more structure to the benefit profile decisions. For further details on the use of IE in the method and differences with the framework described originally by Parker et al. (1988) see section 4.7 and the appendix F.

The evaluation and reappraisal of the migration projects is according the various literature examined during the research. The formative evaluation can be approach in different ways. Figure 3.1 gives a simple representation on the reappraisal of business cases. The reappraisal of the phases in the prescriptive method follows the re-iterative nature of evaluation, but can be used continuously during the life cycle stages (Dan Remenyi, 1999). The participative evaluation gives the formative nature of reappraisal for the migration project. The templates are further described in the appendices to show how the phases can be reappraised continuously.

The governance layer for the prescriptive method is consistent with the literature and used method within the Logica Business Migration program. IT governance is an essential element, because of the questionable reputation of IT investments. As mentioned in literature IE fits in a structural IT governance approach, but it misses the system design element. Therefore the GST and a governance structure for this EIE model are essential to consider. The governance layer in the model consists of three important questions that have to be assessed before starting and during a project (Grembergen, 2004; Hoogervorst, 2007):

- Structure: Who makes the decisions en what are the responsibilities. So who is responsible for the design, architecture mapping, cost calculation, benefit tracking?
- Process: Are the method steps performed in a right way? Are the preparations in place? The documentation and resources have to be in place.
- Communication: For the decision about the tracing and measuring of results a communication plan is needed to ensure the method is under endorsement of management.

As has to be stated, each company is different. This means different enterprise may handle the three important question in a different way (Grembergen, 2004).

The model and method include the IT strategy, system design, and architecture of IT systems. The specific IT governance layer is presented as the organisational competence for the continuous guiding authority on the various elements of the model.

A Quality Assurance (QA) team supports the projects to control the quality of the conversion process. The governance/compliance and security preconditions are leading. For compliance the fiscal, juridical and actuarial preconditions are important for conversions. These are coming from DNB/AFM, Solvency 2, SOX and the conversion policy of the particular company.

4.9 Detailed description of the method phases

For migration projects, cost avoidance and reduction is often the main goal and operational efficiency a secondary goal. Considering the reduction of IT systems and connections plus the reduction of back offices. Furthermore competitive loss avoidance is indirect an issue for particular Life Insurance enterprises. When a competitor restructures their IT landscape for instance and reaches a cost reduction. The enterprise will have higher fixed costs in comparison, and can indirectly lose market share on the long run. This is the outline set for the case studies (chapter 5). In this section the method is discussed in more detail and the prescribed theory and best practices are considered according. The steps are justified and the consistency is described.

4.9.1 External discovery

1. Collect the current environmental aspects (issues, legislature, market, opportunities, customer demands, etc.).

Enterprises have various systems to consider in their environment. When looking at a business migration project it is crucial to have a certain level of insight on what can influence the project from the outside. From the economic view it can be seen as discovery of the macro model. There are different orderings of system groups on the outside that can interact with the enterprise: competition, trade union, clients or customers, suppliers, IT vendors, outsource contractors, consultancy firms, Auditors, Financial government, Banks, etc. These different companies and firms can also be seen as systems with their own elements. For the model only the complete systems in the environment are important and the influence they have on the enterprise. This step can also be found in EA frameworks. The choice to keep it separate from phase 3 is made, based on the GST literature to have this clear before analysis as a reference source (Allee, 2008).

2. Discover the proper elements (other enterprises) in the environment (outside the composition) which influence the enterprise (for instance a Governmental body which enforces certain regulations).

Detect what is communicated with these elements and detect how they create constraints for the enterprise. This gives an overview of restrictions for the design freedom of the enterprise to operate in. This gives a starting point for the migration project to set the best possible goals for a certain degree of freedom. An inventory list can be made and a classification of the relevant relations and exchanges. The following tables are used to classify the exchanges between parties. Furthermore the table gives a first insight into the activities and the relation with the exchanges.

What we receive	Comes from	Activities	Intangible impact

Table 4.1: Input value network (Allee, 2002)

What we output	Goes to	Value enhancement or value added

Table 4.2: Output value network (Allee, 2002)

3. According the environment, pattern, and structure the framework of action for the enterprise can be set.

The information is gathered and the next step is mapping the exchanges of the entities with the enterprise. For this step a value network can be used. The VNA gives an overview of the different exchanges between the organisation and the environment. Also a first differentiation between tangible and intangible exchanges is made. This is done with the doted (intangible) and solid (tangible) lines. To keep distinctions clear between physical and non-physical. For this method however it is also crucial to include the particular rules which shape the degree of freedom for the organisation to manoeuvre in.

4.9.2 Internal discovery

1. Detect the ends (goal, objective, and vision) and means (mission, strategy, tactic, business rule and policy) of the enterprise.

The goals, mission, and strategy for starting a migration project is depending upon what the degree of freedom is for the organisation in relation to the changes in the environment. The environment set the

space for the enterprise to perform a project in. This step is about the issue of alignment between the enterprise and the environment. Important question is to detect the ends for the organisation? Strategy goals, vision, mission, critical success factors (CSF), etc. have to be clear beforehand, because starting the investigation of migrations without knowing if it fits the ends and means, can lead to misinforming the decision makers.

2. Discover the physical subsystems within an enterprise. (Abstraction level and aggregation)

First step when starting a migration project, an insight of the relevant subsystems and its components has to be discovered. Looking at change or design of an enterprise without clear understanding of the elements seems no prudent approach and is often disastrous (Hoogervorst, 2004).The discovery of these assets depends on the abstraction level which is needed for the project. Only the relevant assets have to be discovered, because otherwise the amount of work for design is disproportionate to the result. First start of on a holistic level. The highest abstraction could be a distinction between artefact and human. The next abstraction could include making a further distinction of artefacts for instance between office supplies, buildings and computers. The level of detail and abstraction depends on the company and their specific accounting measures. For instance getting insight in the amount of computers and telephones is demanded in some companies. Taxonomy can be used to classify different subsystems or components.

3. Discover the social (people) subsystems within an enterprise. (Abstraction level and aggregation)

The social system consists of the intellectual capital which has to be considered. The intellectual capital refers to the difference between tangible assets and the market value. So the intangibles are closely correlated with the intellectual capital (Read, 2009). There are three forms of intellectual capital: human capital, structural capital, relational capital. The focus for this section will be on human capital to detect the knowledge transfers. There is a close relation with the intangible exchanges of the external discovery phase. The system gathers input and then starts producing to deliver output. The people make this happen by transferring knowledge. By detecting the important exchanges with the environment (Input and Output) the activities that are performed in the enterprise can be discovered. The next step is to detect the value driver for the activity and quantify the worth. It can be difficult for instance to discover the capabilities of people, it could depend on years of experience or training. For the knowledge transfer due to migration, it is important to use templates and document the interviews and information used. For instance an FTE designs a system, due to the migration the FTE is fired. By detecting his activities the knowledge transfer needed to keep information in the organisation can then consist of making documentation for the system he designed.

For the social system only the human beings are considered as social individuals. Therefore primates and other high developed species, as well as all artificial intelligent agents are not seen as social

individuals. The human beings are considered as the only purposeful systems as described in literature (Bertalanffy, 1950).

4. Discover the mutually influencing relations among the subsystems of the enterprise. Detect the current function and behaviour of the enterprise (The teleological system notion).

The rules set by the environment are detected; the different components and subsystems are named. Now give a first overview of the processes, activities, functions and services. This can connect the first dots and relations between subsystems and outlines the function and purpose of the enterprise. The discovered elements are gathered in input tables (appendices A,B and D). In the following phase these tables can be used. Furthermore it is the first step of aligning business and IT. The relations for instance between employees is important. What insight can be given and on what abstraction level? Also the exchange of data and information between an information system and an employee has to be taken into account. Detecting the knowledge transfers is very difficult but getting the more detailed level of abstraction can give more concrete insight in the real value of the migration project.

An example of the process to use the discovered information is described here. For instance the client requests a quote for a life insurance product. This is classified as an input. The company reacts with proposing a quote to the client. This is called the output. The next step is to detect what happens between the input and output, by interviewing people involved or by desk research of available process descriptions. Inside the company three activities are performed: check client information, assess client, calculate and offer quote. For each activity the involved people, systems and metrics like time or performance are collected. The data gathered presents the relations and functions of the enterprise in tables to include in models in phase 3.

4.9.3 Enterprise Architecture analysis

1. Analysis of the first two phases for the system types and design domains overview (the intended use of design) (As Is).

This first part of the analysis phase of the model is all about getting an overview of the different relations and roles within the organisational kernel, discovered in the previous phases. This gives a starting point for the EA results, modelling the business function model and IS/IT landscape. This step will set the outline for the design principles both functional and constructional. Another element when looking at the EIE model is the influence of stakeholders; this is examined in the next step.

2. Analyse the purpose of the various stakeholders (purpose is the relation between stakeholders and the system).

Stakeholders have an important role in the investment decision. After the first two steps the elements of the environment and system are clear. The architecture and the further process of valuation of the

elements, is involved with politics in a company. The people who are involved in the project are various so called stakeholders (people that can affect or are affected by corporate activities). Without commitment of stakeholders from various views the project is destined to end up in a disaster. Conducting a stakeholder analysis cannot be excluded from the Extended Information Economics method.

The various stakeholders involved have other backgrounds and incentives for a certain project; this gives various views on a migration project. A user in the organisation that sees his work procedures change has a very different view than an IT professional that designs and is not involved further with the consequences. Next to these groups top management can be considered as the overriding stakeholder, because in the end the budget is made available by them. A clear understanding has to be created for this group to get their support. The stakeholder analysis is important to keep into account. In other words the human factor is important in this phase. Analysing the interest and the understanding of how the stakeholders are viewing the project can ensure more support for the project.

3. Analyse if a sufficient picture of the current IT architecture can be given or if extra information is needed (possible hire experts or conduct interviews with available experts). Dependent upon the specific situation of a certain enterprise (As Is).

When migration project are needed for a particular organisation due to reorganisation, mergers, etcetera. It can happen that of the old legacy system the documentation is not complete or that the experts of the old mainframe systems have already left the company. In these cases there can be various different approaches that are needed to get a clear picture of the IT landscape. Without a clear understanding, the way of scoring these projects is getting very difficult. The following options can be necessary to undertake in these situations. When the experts are not available and the necessary documentation is missing. Hire external experts who know the legacy systems and who can construct documentation on the architecture.

When the experts are available but the documentation is missing, conduct interviews to get the needed information and document it. This can mean that these experts have to be compensated during the migration project to ensure that these employees are not leaving before the knowledge transfer is complete.

4. Model the business behaviour and function in a business function model (As Is).

This step uses the input from step 2 in subsection 4.9.2 of the functions available in the organisation. Visualizing it in a Business Function Model as shown figure 4.3. Without focussing on the words the model gives a clear picture on the different actors (stakeholders) and which functions they have in the organisation. Model is needed to show the functional perspective. It is a model to show what an enterprise does (Negash, 2004), or in other words the function of the business. The model has

designed according the best practice approach of IFEAD (International Foundation of Enterprise Architecture Development) (Schekkerman, 2009). The three main components of the Business Function Model are:

- The stakeholders: the involved stakeholders that are recognised in the first and second phase of the method and that can be described in the stakeholder analysis of step 2 of this phase. These are visual presented in this model to get the functional model according GST.
- The functional area: the logical/functional group as used by the particular company. This component includes the activities performed in that functional area.
- The Lines for connection between functional areas: The major information connection between functional areas and activities to reach goals and denotes information exchange (value).

The model can be applied according different approaches. Even specifying it to activity level shows the business behaviour. The function model is based on a best practice approach from the E2AF framework. Not focusing on the traditionally well-described business processes but on the actions. The business behaviour (BB) is an ordering of tasks and/or activities that accomplish business goals and satisfy business commitments. Manual or automated operations that perform units of work. Business behaviour can be triggered by events in the environment or by internal initiatives or conditions. BB is what produces the outcomes that fulfil the purpose of the business. Actors in the organisation perform the BB. As an end-to-end set of activity, behaviour can evoke various functions (Schekkerman, 2004).

The figures 4.3 and 4.4 are illustrative and only the blocks and lines have to be considered, the text label and details are not important at this point. For more detail see appendix E.

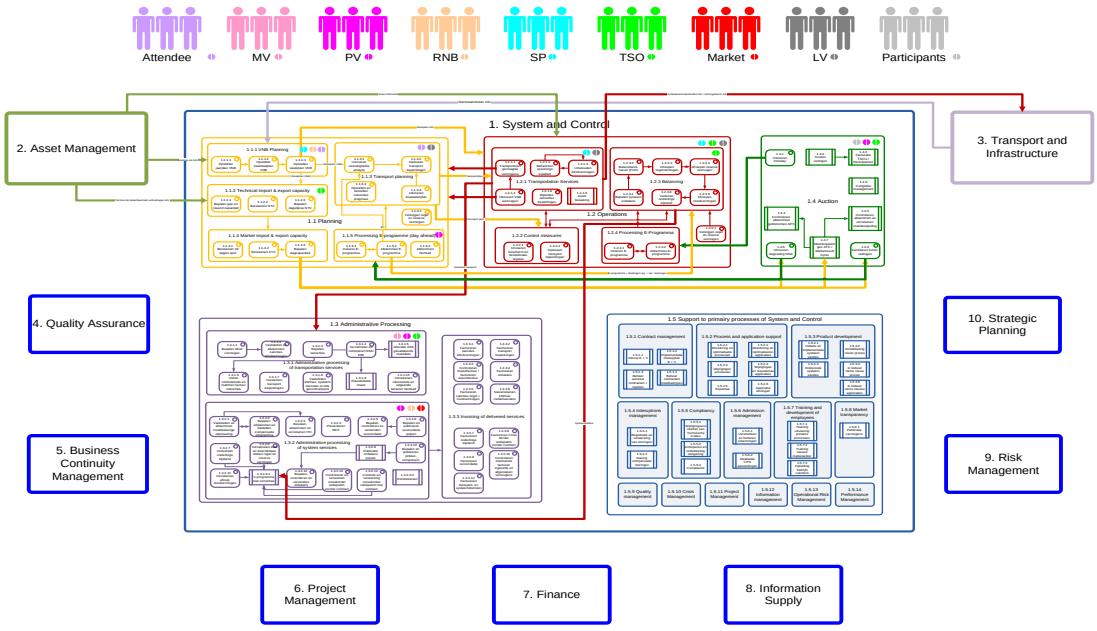

Figure 4.3: Business function model (BFM) (Schekkerman, 2011b)

5. Model the IS landscape (functional domain view, ownership of systems view, ownership of data view and the system life cycle view) (views give representation of the quality what a system can have for certain stakeholders).

Getting different views on who is using which system is needed for alignment with the business when a migration is performed. For instance if an organisation migrates products from a particular application to a new environment, the old application can be shutdown. The particular department can also have a cost reduction for not using the mainframe system that the old application was using. When another department is also using the mainframe system with another application than there is a cost reduction for the first department but not for the enterprise. The example shows the essence of mapping the IT architecture landscape on the functions of the business (figure 4.4).

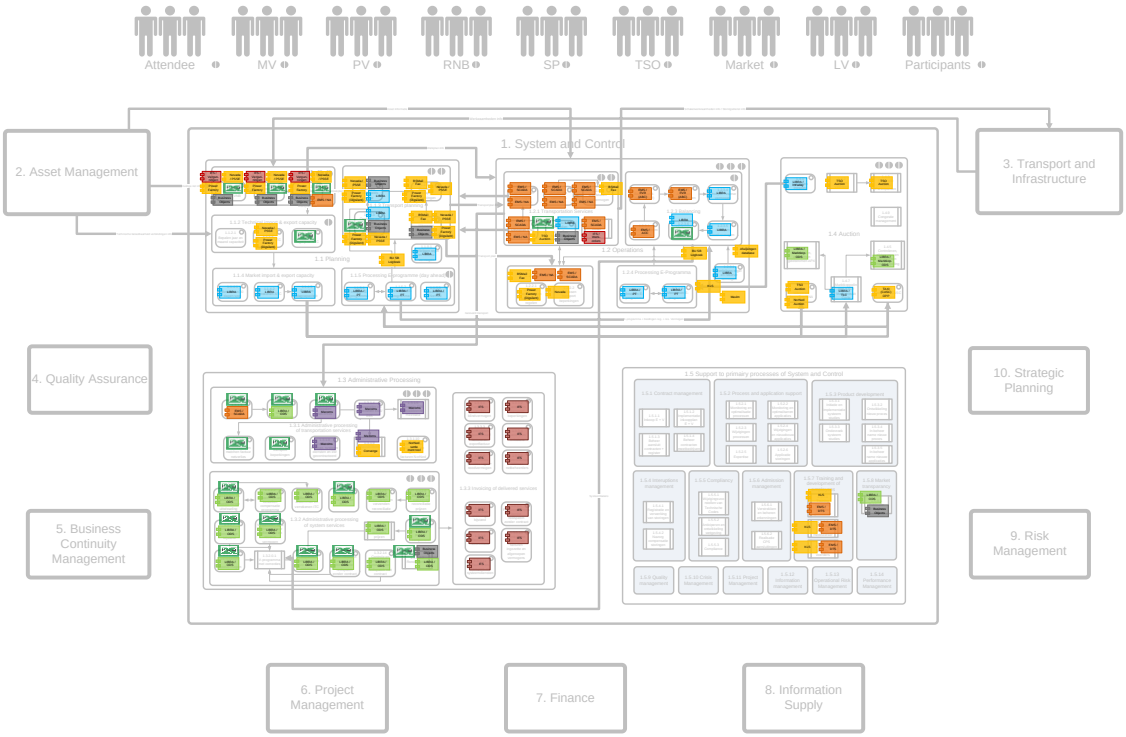

Figure 4.4: Mapping the IT landscape on the BFM (Schekkerman, 2011b)

The choice for the models of the IFEAD is depended on the standards Logica uses in the business migration program. Off course this is not a holy grail and other best practices like the architecture approach of Archimate can be used for the modelling parts (figure 4.5). The essential element that has to be in the models is the linkage between the systems and the business functions (activities). In other words the linkage between the construction and function of an enterprise.

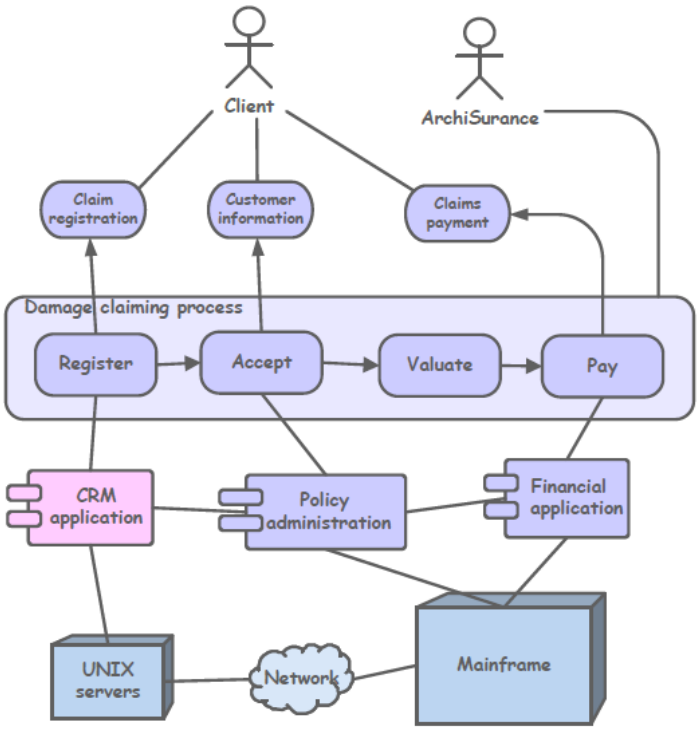

Figure 4.5 the Archimate model for business functions and application mapping (Lankhorst, 2009)

6. Identify the ends of the migration project (To Be).

This section is consistent with what the enterprise wants to reach with the migration project. For instance a cost reduction of 50 %. These specific project ends have to be consistent with the goals and means of the enterprise in general as described in section 4.6.2. Furthermore these ends have to be within the degree of freedom, set by the environmental aspects from section 4.6.1. This section states the goals and objectives for the future. This is a basic part of the normal project plans and business cases. This step will deliver a list of the specific critical success factors for the project that will be used in the last step of scoring the project on the right scale.

7. Complete the analysis by modelling the expected changes in the business function model and future IS landscape (To Be)

Completing the analysis is done by modelling the To Be situation in the same way as the As Is models based on the analysis of the previous steps and the ends of the migration project. The important step in this phase is to analyse the complete set of models with the performance, modularity, reliability and Total Cost of Ownership (TCO) metrics that present input for the Activity Based Costing (ABC) approach in the fourth phase. The details of these four analysis methods are described in the appendix.

8. Specify the enterprise architecture transformation (migration scenarios) process (a roadmap for transition from “As Is” to “To Be”).

For the transformation process an Enterprise Architecture framework supports guidelines and governance controls. In this phase identifying the migration strategy and different scenarios is most important. Is it clear that the proposed migration directly supports the organisation's vision, mission, and strategy? Does it make good business sense? For the transition the Extended Enterprise Architecture Framework (E2AF) is used to formalize this process (Schekkerman, 2009). The particular approach is shown in the following figure. This approach is a guideline to follow, but if the organisation has another migration framework in place this could also be used. For a general overview of the E2AF method see Appendix.

4.9.4 Information Economics calculation

1. Calculate the cost of the current physical assets according a cost ownership method. But also the value of the employees which are not physical assets (ownership including labour costs, pension, lease, leave, etc.).

When different assets are named and classified according the discovery phases, an adapted version of Total Cost of Ownership (TCO) can be used. TCO gives the total lifetime costs of the physical assets. These costs have to be charged by means of the discovery documents and the Business Function mapping. The method used for this specific approach is the combination of allocating costs in measures and applying on activities for the elements (Activity Based Costing (ABC)). The architectural design gives a way to map the total costs approach for different assets on the activities they perform, to discover the cost and value for each activity (Peacock & Tanniru, 2005; Roztocki & Weistroffer, 2004). The data from the discovery phase gives datasheets with information on the TCO, performance, etc. of the people and IT. The numbers are mapped on activities according hours of employee or processing of the system. This presents the combination of TCO and ABC elements.

This part of the model has to be worked out to the relevant abstraction level for the specific project. As stated in the literature study, looking at the business behaviour, is the correct way to analyse the enterprise. In the previous step, the IT assets are mapped on the functions in the organisation therefore it gives a good starting point for these two steps to detect the value of an asset for different activities. There will not be any restriction on how the costs and current value of the assets is constructed. This is done to make it easier to implement the model in the enterprise. If an organisation has to change its costing method it would cause for a lot of extra work and calculation which does not have a positive effect on the acceptance of this model.

When looking at the cash flow of most assets in organisations a lifecycle is passed through. Three mainstreams are relevant: initial costs, operational costs, and liquidation costs. For the human assets these costs follow a different terminology, there are initial costs when people are brought in from other companies (Initial training and loss of productivity from new resource and involved colleagues). The operational costs consist of the salaries for every fulltime-equivalent (FTE). The liquidation cost can

occur when a contract has to be terminated and a salary has to be paid for a few months these are extra costs when the FTE is not working for the organisation anymore.

Knowledge is difficult to quantify. Some elements can only be quantified based on a scoring mechanism. This is a subjective elements which can be processed by involving different actors in the project and based on their experience scoring can be given. When looking at humans as capital they are different from the other physical assets. An enterprise does not have ownership of a human being (employees have a responsibility to the enterprise). The employees work in the firm and have certain knowledge, skills, and attitudes. The people in the organisation are valued according the financial methods. The intangible value creation is depended on the relations with others.

2. The costs of the project are inventoried according the Information Economics Cost Benefit Analysis. The costs are directly imbedded into the ‘to be’ picture.

The migration project costs consist of the resources needed for performing the migration. The resources for migrations consist of project teams, materials and IT. The costs are based on expertise and the enterprise architecture analysis. The product migration costs are dependent on the source and target transactions that are needed. The effort needed for these conversions is calculated using best practice approaches of the specific enterprise and possible external parties.

3. Identify the benefit profile of the migration project (tangible and intangible) according the value analysis of IE.

Applying elements of Information Economics that can be used for migration projects in relation to the valuation of the IT landscape. This is a process that goes through several iterations in alignment with a certain level of abstraction off the elements of the system. When activities, functions and mapping of IT are getting more detailed the IE method and scoring of the project will get more detailed. In the appendix F the financial economic considerations of IT projects is described as a path to follow within the model. In organisations there are various financial norms applied. There is no exclusive standard. In this method step one financial method is chosen considering the best way to deal with investments in the model (Parker et al., 1988)..

4. Calculate the extended ROI number and use the IE domain factors in combination with input from the EA framework. The end result is a scoring of the migration project (ROI, benefit management, and value methods).

In the previous step the value of the migration project is decided upon several iterations depended on the abstraction level of the IT landscape. In this step a particular scenario is chosen and the initial valuation is completed. The migration project is started. During this process or during transformation the IT landscape can change. For instance if an asset is changed and the value changes the current IT landscape valuation changes and rolling out the IE method on this new situation gives the scoring

of the IT project for that point in time. This will give the migration project a new score and therefore continues insight in the justification decision of the project can be provided. The calculation elements are presented in the following figure:

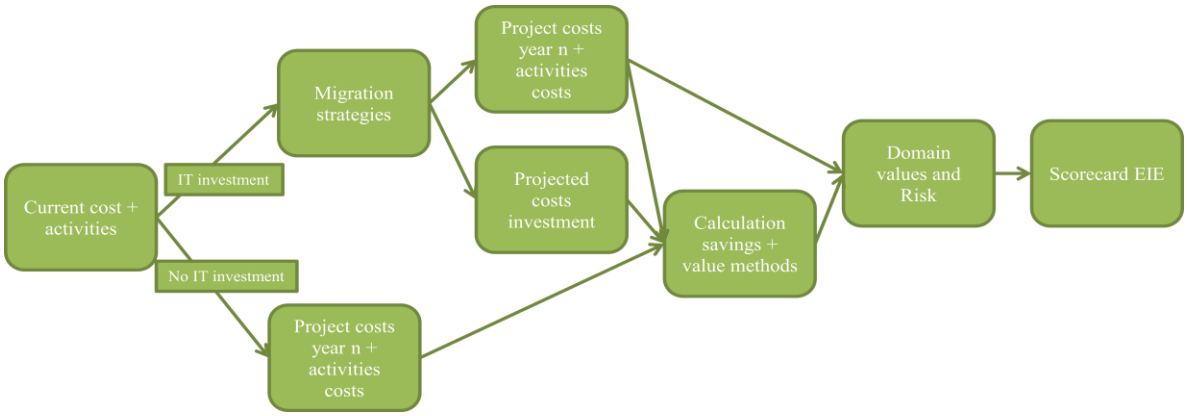

Figure 4.6: Elements of the calculation phase

The figure includes the comparison of the current business with or without investment. The elements are considered according the IE framework, with inclusion of the activity allocation collected from EA as extension. Furthermore the EA project and activity costing is used in the domain value and risk step to improve with architecture insights discovered in step 4.6.3. The risk score included is an overall scoring of the project. The size of the project in relation to the organisation. During discovery the people and systems involved by the migration can be counted and related against the enterprise to score the project on organisation risk.

4.10 EIE model tools

Figure 4.7 shows a representation of the used tooling (Avolution, 2011; Microsoft, 2010). The figure shows the software that is used when applying the method (section 4.3). The tools used for testing the method in practice can be replaced by comparable tooling. Figure 4.7 shows the four phases. For phase 1 and 2 there is documentation, data, interviews, etc. collected and produced as described in previous chapters. A recommendation could be to gather all this data in a repository, because in large projects the data gathered could be enormous. This repository can then be used in the following phases. Phase 3 shows a visual representation of the EA modelling tool Avolution Abacus that is used for the EA elements (Gartner, 2010b). The tool has an option to include costs for IT assets. The next step is to export the information from phase 3 in Abacus to a spreadsheet application like for instance Excel. This is where phase 4 starts and the information from the previous steps is used to calculate results and score the project. This figure shows a simple way to implement the EIE model in a company. Surely other tooling can be used, considering the steps described in section 4.6. The prescriptive method needs modelling and spreadsheet software, to make the method efficient for usage. The modelling tool Abacus presents specific metric calculations that decrease the time for going through the steps in phase 3. Other tooling would need more customization or manual labour for the link between the modelling in phase 3 and the calculations of phase 4.

For the tools a specific set of governance controls are needed. The governance controls are tool specific. For the documentation of the four phases and evaluation the governance controls section 4.7.6 is set up. The controls for Abacus and Excel are standard for the software.

Avolution Abacus: The tool uses constraints to validate and define the data. The constraints are defined in two groups. The first one for the models and the second group for the properties of the elements in the models. The constraints for the models are used to restrict the hierarchy and the topology. Hierarchy is used to restrict parent child relations. The topology to restrict the connections between different elements. The properties can be restricted on data type (integer, Boolean, text, etc.) or on the status of the properties. The status can be required or optional for each element.

Microsoft Excel: in the excel tool the formula auditing can be used to evaluate the data input. The data validation presents a restriction to data inputs. The workbook protection options are needed to set rules and authorizations for auditing and control and usage restrictions. The change tracking function can be used for control to manage the changes in calculations.

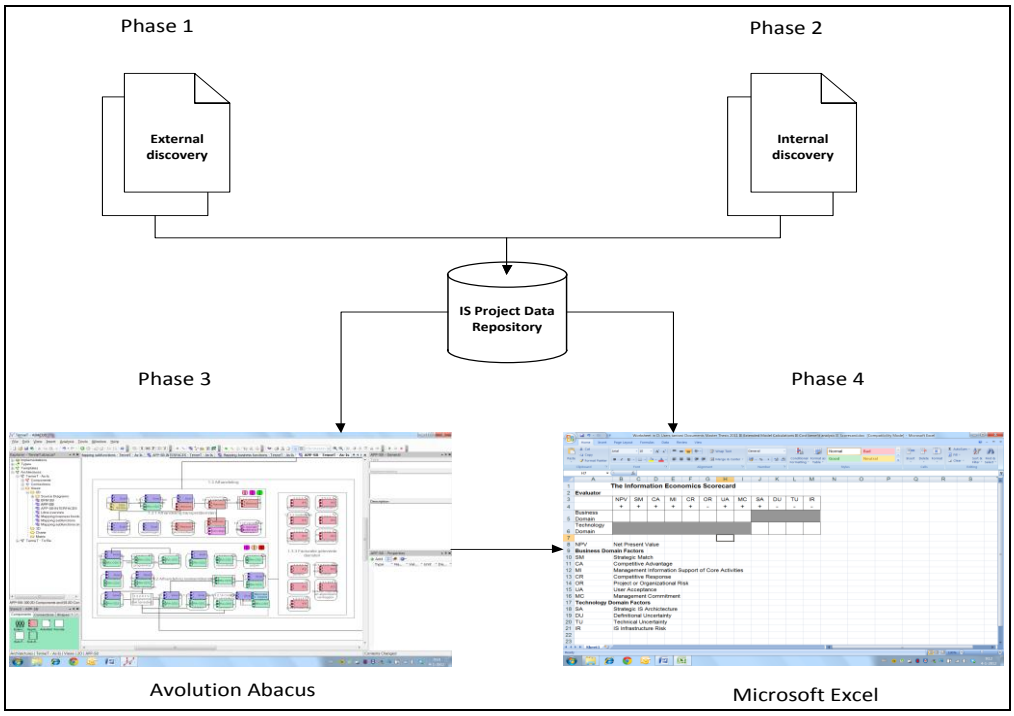

Figure 4.7: Representation of tooling

5 EMPERICAL RESEARCH: EXPERT REVIEWS & CASE STUDIES INSURANCE

This chapter presents the results of the empirical study of this research. The goal of the empirical research is to discover the verification and validity of the designed Extended Information Economics model and method described in chapter 4.

Section 5.1 introduces the empirical study. Then section 5.2 describes the verification of the model and method by experts in the field. Then section 5.3 describes the case study design, including the description of the validation of the model and method with a case study research. Section 5.4 describes the life insurance branch and environment. The section will include a branch specific external discovery. Section 5.5 describes case study of the first IT migration. In the same way 5.6 describes the second case study. Section 5.7 presents the findings and conclusions of the case studies.

5.1 Introduction

As described in section 2.1.3 the setup of the empirical study consists of the verification and validation steps. The verification of the model and method consist of interviews and reviews of experts in the fields of Enterprise Architecture and Information Economics. The verification is performed before the validation. The model and method description in chapter 4 presents the final version after the verification. The validation is done according case studies as a research strategy. Chapter 3 presents the theoretical framework as two projects of two different insurance companies are picked for the empirical study. Companies in the market use different approaches (section 5.3) an extra comparison could enrich the results. By performing multiple-case studies a comparison between both companies can be made. The differences related to the specific situation are analysed and the resemblances contribute to the result of the model and method testing. The choice for two case studies including two comparable IT migration project proposal of Logica for two insurance companies. These cases are comparable in size. The evidence of multiple cases is often considered more compelling, and the overall study is therefore regarded as being more robust (Yin, 2003). So the cases have differences because of the real life situations of different companies, but due to the same projects and market influences the prediction of results is similar for the outcome of the study (a literal replication).

During the first interviews with the managers responsible of the bid proposals for IT migrations it became clear that gathering a complete set of real life data for the EIE model was impossible. The testing is based on the available information and assumptions made by the team of Logica for the proposal. In this way the available documentation and interviews were used to validate the model in comparison with practical approaches.

The reviews with the Experts took place as planned. The experts were handed a document with the details of the prescriptive method. The experts would review the method overview and predefined elements based on their area of expertise. The review was then discussed in an interview, to further elaborate on the insights. The company mentor also contributed in the stage before the expert reviews in brainstorm sessions during the design phase of the model and method.

5.2 Verification of the model and method

The model and method were verified by a team of experts mentioned in table 5.1. The feedback of the experts was in most cases collected during interviews and feedback rounds by email. Next to the feedback of the experts, the reviews of the supervisors of the Erasmus and Logica have contributed to the design of the method and model.

Nr.	Expert name	Expertise	Employed at
1	Enterprise Architecture Expert	EA Frameworks. Benefits of EA.	Logica Consulting
2	Wouter Paul Trienekens	Enterprise Solution Architecture. Dietz Demo.	Logica Consulting
3	Hans Wierenga	Architecture and IT Value	Altran Group (DCE Consultants)
4	Gert-Jan Schnepper	Client Lead Business Consulting	Logica Consulting
5	Business Migration expert	Program Manager Business migrations Insurance	Insurance Organisation

Table 5.1: Experts involved for verification

The literature study leaded to a model design. The elements of the model were incorporated in the prescriptive method. The experts reviewed the method steps in detail and the corresponding background information on the model was provided accordingly. The method was then discussed according the points the experts argued. The most important review statements of the experts are described in the next table. The table shows the expert and its commentary on the EIE method followed by the action taken due to the comment.

Expert No.	Comment	Action
1	I am missing a clear way to translate the valuation and information economics calculation from the architecture models.	The linkage between phase 3 and 4 is changed based on TCO and ABC method elements that give the right starting points for calculation based on the input from the analysis.
1	The stakeholder value is important to incorporate for the architecture steps and	The clear framing of purpose, function and behaviour elements in the enterprise is

	should have a more prominent role.	changed by bringing a separate step for the stakeholder analysis to incorporate the purpose factor.
2	The business function model is highly suitable for Activity Based Costing.	The advice was incorporated in the final version by taking elements from the ABC method to combine with TCO.
2	Architecture is driven by the relevant aspects. Which are those in relationship with the objective of the investigation?	The relevant aspects from the discovery phase are documented in elements for creating the architecture models, according templates shown in the appendices.
3	The prescriptive method is sound. It should enable you to capture the relevant information to make an assessment of the benefits of changes, regardless of whether these benefits arise from value changes in the underlying technology, the information systems or the business functions, without losing sight of the business purposes which are served by the changes.	-
3	Be aware of the detail level. Too much detail for identifying systems and elements in the method, does not improve the time effort. A low detail level presents a low improvement compared to the traditional methods.	Difficult subject, because it is company specific. The level of detail has minimal involve people, systems (application, mainframe, database) and business functions with activities. the templates described in appendix D (Based on the EA approach of Logica) show an outline for gathering these details.
3	There is inconsistency between the title of the last step of phase 2 and the description. The title discusses the components and the text discusses the interactions.	The title was changed and an extra step to analyse the components and interactions was created for the third phase.
4	Risk management is an important aspect to use in the method, make the risk elements as explicit as possible.	Project organisation risk analysis is incorporated in the IE framework. The risk factors are linked with the information from the analysis to improve the explicitness of the risk analysis (section 4.9.4).
4	The focus in the first discovery is important to be external of nature and look at the various factors that influence the enterprise. The physical elements can come after this.	This input was used to distinguish the order of approach the discovery of the enterprise and its environment.

4	Important to discover the soft factors for a migration. 80% is under water, tip of the iceberg.	The value network analysis is used to better cope with the soft factors that could influence the migration.
5	The usage of a first external discovery could be useful as a checklist to have things in perspective with migration of products.	
5	Theory is always hard to plot onto practice but the steps and details are of a comparable level. The method is sound and closely related to what the insurance company of the expert uses in practice. Their method is based on own experience by doing. The EIE method on research.	
5	The costs estimates in practice can be improved, but it all has to be decided in a high tempo so people will fall back on what they know if there is no time enough. This could be an important downfall of a more detailed method. On the other hand it could give a way to outperform the peers.	

Table 5.2 Expert commentary and corrective actions

This input was then collected and incorporated into the method to enrich its usefulness. The changed versions of the method were reviewed by the Logica supervisors to ensure that the initial goals of the research are still met. This process leaded to five iterations and the last version of the method is presented in chapter 4. The last version and the templates associated with the description in chapter 4, was compared to the method used by the 5th experts in practice at a large insurance organisation. The three last comments in table 5.2 sum up that feedback. The last check with expert 5 did not lead to new findings for reviewing. The reviews did not lead to a reflection of the model that was designed solely based on the literature study. The last version as described in chapter 4 is tested in the multiple case study research described in sections 5.4 and 5.5.

5.3 Case study research Life & Pension Insurance

The case studies are performed to validate the EIE model. The prescriptive method is a practical appliance of the model concepts. The comparison between the method and the approach used in practice will give findings on the practical relevance (validation). This includes testing the propositions as stated in section 2.5. This section describes an outline of the case studies and describes the life and pension insurance market to show the current situation. Setting the context for the next sections is important to have a general baseline for the two cases. Section 5.4 presents case A and section 5.5 presents case B.

The Life and pension insurance companies that were chosen are large representatives in market share (In total 53 life insurance companies and 579 pension funds in 2010). The top 7 companies in this market had 74% of the market share. Looking at the market it is volatile and difficult market for the key players. The main trends for the future are investing in new products and reach solutions for the old policies and funds that still have contract terms of 20 to 30 years. These policies and funds are not

at a sufficient level for the current market and are only considered a severe cost. Atos Consulting has presented a scenario planning in 2009 for the life insurance market. Important to notice are the trends of the rise of new products (bank saving), technologies (internet, BPM) and new business models (outsourcing) in the life market that suppress the old way of insuring. Low cost foreign entrants without legacy past and a low cost business model plus banks with the substitute products will take a large part of the market share (creative destruction of old products). Gartner stated that by the year 2015 40 percent of the policy administration systems will be administered by commercial off-the-shelf solutions (Gartner, 2010a). The companies that want to keep it in house as mostly are preferred in Europe need to change. Only the insurers that can transform their business and reach cost reductions can survive. Therefore a better way to justify and evaluate the IT investments is a possibility for insurers to meet the demands of stakeholders to cut more and more costs. Specifically the research focuses on migration projects to deliver improvements and cost reduction (FS, 2011).

The following four options indicate the possible conversions that are involved with the migration projects for life and pension insurance organisations (Logica, 2011):

- Technical conversion: The contracts/policies are in the new system landscape equal on the old system landscape on the matter of premium, costs, liability, communication, etc.
- Semi technical conversion: The contracts/policies are (somewhat) different in the new system landscape, but on the matter of premium, costs, liability and possibilities the client's position will not be worse. Making use of the fixed income funds in combination with the possibilities of the modern insurance products, each benefit is available, without losing the traditional aspects. Client contact will be mainly in the area of announcements.
- Commercial conversion: The contracts/policies in the new system landscape do not offer the same possibilities than the old landscape and/or are different on premium, costs, liability than the old landscape. Clients have to be approached for a new offer.
- Phasing: Products are not used in the new landscape and will be saved as history data. The clients have to be approaches and get an offer of the standard products.

Essential for the conversion, are the descriptions of the current systems and the goal systems in detail. The difference between new and old can be compared afterwards by evaluation to see if the benefits are met. For the case studies the current information of the products and there usage in- and outside the company is needed. IT description is also involved, because as discussed earlier the current models and the future model are derived from the initial discovery.

5.4 Case Life Insurance Migration Company A

The case will involve a test of the EIE method on a Bid proposal for a migration project. The case is anonymised. Logica and a partner designed the proposal. The company of the migration project is a Dutch insurance company and will be referred to as company A. The company wants to migrate policies between four of their systems (total of 8 administrations in the life insurance division).

5.4.1 Scope of products and applications

The two source policy administration systems (referred to as Administration A and B) that manage 600.000 policies. All the policies have to migrated technical or commercial to two targets (referred to as Administration C and D which have around 200.000 policies) or if the policies are closed and transferred to an archive database (phased conversion). Customer and intermediary records that are in the source systems have to be migrated to the relation management system of company A.

- The conversion to administration C will be commercial
- The conversion to administration D will be technical

The choice is dependent on the effort and costs of the conversion. With the commercial conversion in a lot of cases there will be a concurrence with compensation or correction.

5.4.2 Assumptions and limitations

- Logica does not have further information on the source systems, because it is only conversion and the IBM tool InfoSphere DataStage can work with the mainframe systems and the databases. The extraction connections with the administrations will be developed by the IBM experts involved from Logica.
- The conversion project cost estimates is based on the experience of Logica on previous migration projects. These assumptions will be used in this project to compare the method with the approach Logica used.
- The documentation of company A and the interview with the responsible manager from Logica have led to the benefit and value assumptions for the project.
- The project excludes the relation management system and the archive system from the discovery and analysis of the EIE method. There are no further details on these systems available. The conversion costs estimates are included.
- For the commercial migration the products in the new system are leading. The current products in administration C will not be adjusted to the migration.
- In the technical migration to administration D the goal products can be adjusted to lower the support costs (technical).
- The IT governance is not evaluated for the case study, because both the approach of Logica and the EIE method is according the principles described in 4.7.6. The governance specific tool controls are used. The design and test are performed by the researcher of this thesis project. There is no segregation of duty, therefore an unadulterated test of tool controls is not possible.

The next subsection will present phase one of the EIE method to discover the environment of the life insurance companies. The Value Network Analysis presents a general overview of the important relationships that a Life Insurer has with other parties.

5.4.3 Phase 1: Value network life insurance

The value network is specified for the life insurance branch. The insights are based on the experiences and documentations acquired during the internship. First the table presents the input and outputs related to the general elements in the environment. The figure shows the value network. The value network shows the important information streams between the company and the external parties. There are three intangible streams identified between the client and the company. In the other cases the streams are tangible. Exchanges of information are used to show the important elements in the value net of the insurance company. For this case study only the information exchanges between the insurer, the client and intermediary are of importance.

Elements in Environment Insurance	Service Output	Service Input
Client	Advice, Quote, Premium, Claim	Wishes, demands, payment, requests
Intermediary	Provision Payment	Life insurance premium collection
Asset Management	Report	Intermediary management, collecting, disbursement, provision, reporting
Banking	Banking information	Reporting
Tax office	Tax return	Tax Assessment
Medical	Medical advice request	Proof of good health
Medical Inspection body	Medical advice request	Medical advice Life Insurance
AOV	Disability request	Handling Disability Insurance
CIV prosecution		Indexing/ Scanning
DNB	Supervision information	Reporting

Table 5.3: Value network inputs and outputs

There was not enough information to make the VNA more specific, but in line with the overall detail level the effort would not relate to the possible benefit, as presumed based on the expert reviews.

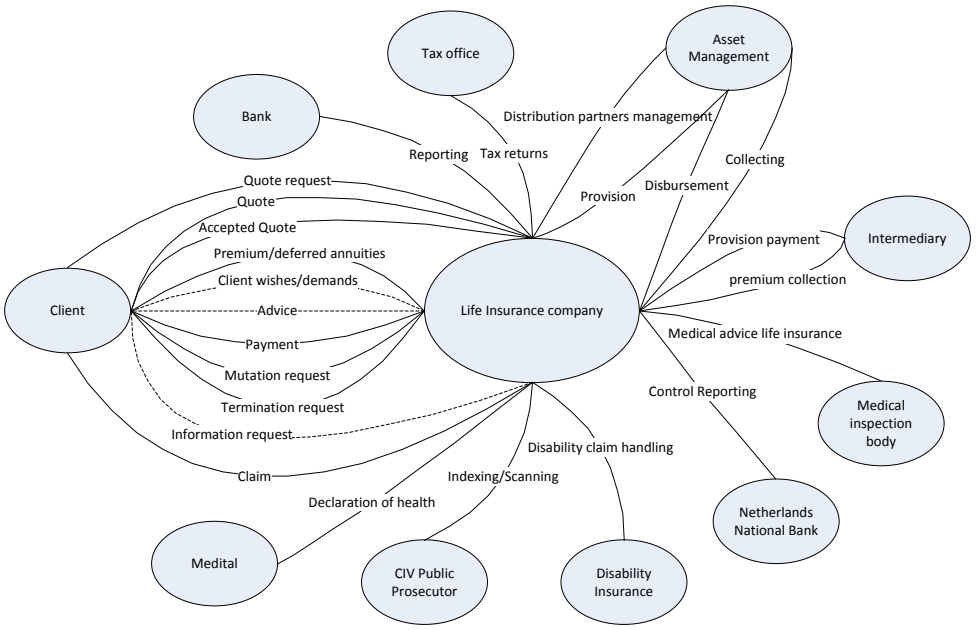

Figure 5.1: Value network analysis general Life Insurance Company

5.4.4 Phase 2: Internal Discovery life insurance

This phase discusses the four administrations that are used in the migration and the elements of construction and function that are important for the project to discover and analyse in the following phase. The result of this phase is input templates for starting phase 3. These input tables are shown in appendix A. First a description of the four administration applications:

- Administration A: traditional registration system for capital insurance. Policy format, registration of claims, control mutations, policy registration online, policy registration batch, reductions and calculations. These different components are part of the administration A.
- Administration B: traditional registration system of policies for prolongation, mutation and closing. Complex application based on old mainframe systems and created in the eighties.
- Administration C: This is the new system of the organisation that will be the administration for the future to sell all the products with. Therefore the policies for conversion have to be conform the insurance product details that are implemented in the goal system.
- Administration D: traditional registration system for capital insurance. The traditional products are insurances with a guaranteed level of payment. Application components: input and changes of contracts, systematic changes based on policy conditions, unroll the payment, reporting, make policy parts, generate information on relation, perform calculations and information exchange with other applications.

The administration applications are supported by mainframe systems and databases for the policies. The following table presents an overview of the corresponding relations and the Source or Target characterisation for the migration project.

Policy administration system	Mainframe platform	Database	Source or Target system
Administration A	IBM z-series	IDMS	Source
Administration B	IBM z-series	Adabas Natural	Source
Administration C	IBM p-series	AIX and Oracle	Target
Administration D	IBM z-series	IMS and DB2	Target

Table 5.4: Technical information policy administrations

Table 5.5 shows the important business functions and activities collected according the external discovery (table 5.3 and figure 5.1 are used). To scope the data gathering only to the relevant elements internally for this particular migration project see section 4.9.2 step 4 for an example to perform this step. The steps are collecting input and output, discover the throughput (activities and business functions), detect the details of the throughput (behaviour). The discovery of details includes the used resources (people and systems) and the time and performance properties of the activity or business function. These activities and functions are part of the overall business function of administering policies.

Business Function	Activities
Prolong	Creating insurance policy, creating addition, activation of premium collection, creating prolongation specifications, Activation of current account bookings
Mutate	Evaluate change, Changing contract, Change coverage, Inform client on change in capital, Confirm change
Informing	Handle questions of intermediary/client, Inform client on expiration or buy out, Advise about capital release, Inform about policy conditions and jurisdiction
Pay out	Handling request for termination contract, Handling payments (period), Processing one time payments

Table 5.5: BFM overview for administration of policies

For the specific activities the detail level on time and effort was not sufficient enough to incorporate in the models for the EA analysis. This means that the important value driver of the business function is used for the IE calculations. With activity details the IE calculations could be applied for each activity on their specific value driver and will present more information for overall project performance and TCO calculation. The following subsection gives the analysis of the As Is situation, pathway and To Be situation.

5.4.5 Phase 3: EA analysis of the case A migration

The discovery phases have as result the input data for this phase. The tables can be found in appendix A. The first figure shows the Business function Model. The relevant business functions are client relations, administering and reporting. The main function is administering the policies for this

project. The four sub-functions: inform, change, prolongation and pay out are included based on the documentation of Company A. Further details are excluded, because the activities are not clearly documented and therefore including these in the model is not preferred. The four stakeholders relevant for the business functions are the intermediary, client, actuarial companies/ DNB, and the internal stakeholders of the insurer (the board). The strategic goals of the company state for cost reduction as the most important goal, followed by more client focused and transparent service.

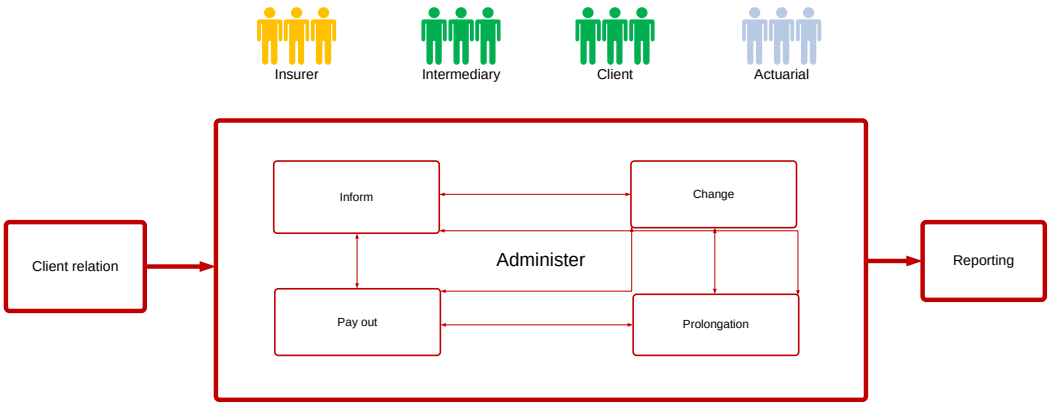

Figure 5.2: As Is Business function Model

Figure 5.3 Shows the mapping of the four administrations on the different sub functions. In this project the four administrations all are used for all the activities in the administration of policies. The customer relation management application is included in the conversion of data. For the TCO calculation no data is available on this application.

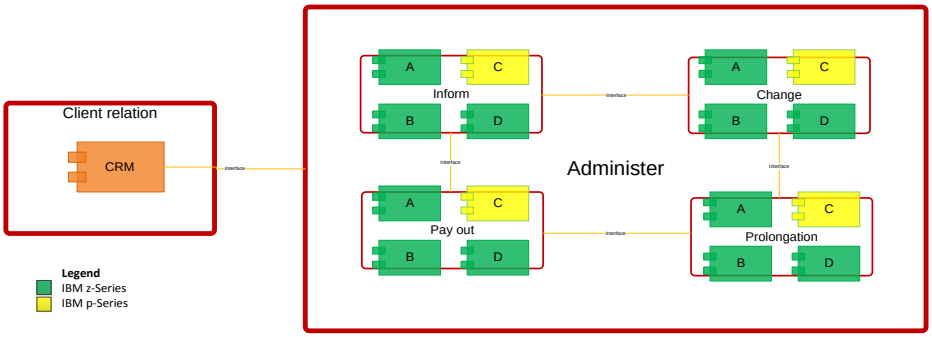

Figure 5.3: As Is Application overview

The As Is situation is shown in simple representations as described following the method in chapter 4. The next step is the migration strategy that is decided by the responsible program manager of company A. The following conversions are part of the migration project (table 5.6). Logica is the external partner that will perform these conversions. In total 6 conversion streams are distinguished.

Conversion	Description
Commercial	Administration A to C and the related relation system for the commercial migrating policies and relation records on the clients and intermediaries Administration B to C and the related relation system for the commercial migrating policies and relation records on the clients and intermediaries
Technical	Administration A to D for the technical migrating policies Administration B to D for the technical migrating policies
Archive	Administration A to archive (on demand) for the closed policies Administration B to archive (on demand) for the closed policies

Table 5.6: Migration paths

Figure 5.4 shows the status changes of the administration systems for the product migrations. The migration has a timeline of 1,5 years with a maximum of 2 years.

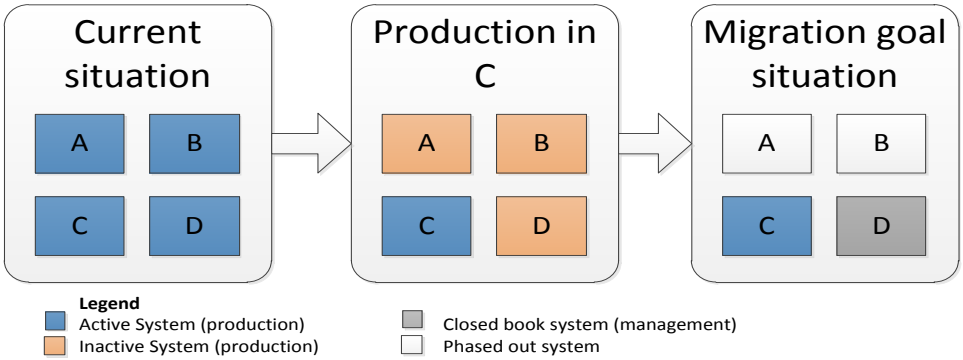

Figure 5.4: Migration pathway (1,5 years)

The As Is situation is modelled according documentation, the pathway for migration is described and for the EIE method and shown in figure 5.4 . The following figure shows the To Be situation. The only difference is the phased out systems A and B. The mainframe systems are not changed because system D still uses the mainframe z series of IBM.

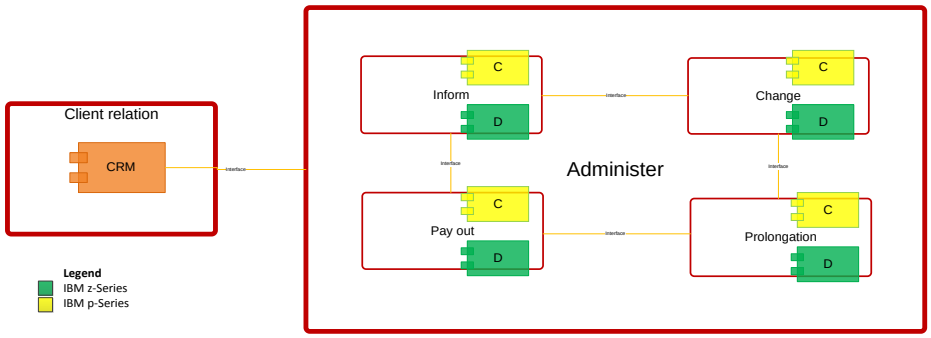

Figure 5.5: To Be Application overview

The EA models with the filled elements and properties gives the starting point for the fourth phase. The applications, systems and people relevant for the life insurance migration were discovered in the first two phases included in the models in this phase. The next phase uses the results of the TCO calculations performed on the properties of the models (figures 5.3 and 5.5).

5.4.6 Phase 4: IE calculation score of migration case A

The last phase uses the input from the models and discovery of the elements, to present the project score for Case A according the EIE method. Figure 4.1 shows the extended model and the EA results element presents the input for the IE calculations:

- The first element of the EA result element is the As Is situation. For the IE calculations the phase starts with the TCO calculations that are performed in the Abacus Tool, based on the information from the phase 2 input sheets. The As IS input sheets give important metrics for availability, performance and TCO (more information can be found in appendix E on the used metrics).
- The second element is the pathway and this is corresponding with project migration costs (table 6 of appendix A). The migration project costs are based on the bid of Logica and the projected costs for the project according the documentation of Company A.
- The third element includes the metrics for the To Be situation. The models present input and the difference between the To Be and As Is situation minus the project costs will present the results for phase 4.

When the migration costs are clear. The difference between the As Is and the To Be situation is important. The case research shows two elements: costs increases due to the project or cost savings due to the value methods. The following tables and descriptions present these criteria for calculating the difference:

Cost savings

System		FTE	%	Sort
Administration A	Technical	12	30%	Maintenance
			70%	Change (replacements etc)
	Functional	3	100%	Change
Administration B	Technical	6	30%	Maintenance
			70%	Change (replacements etc)
	Functional	2	100%	Change

Table 5.7: Employee FTE Reduction on the source administrations

Savings in IT are on a yearly basis by phasing out the administrations. The savings consist of database and mainframe savings:

- Administration A: € 1.500.000
- Administration B: € 500.000

Further details on the mainframes and databases are not included in the documentation.
Savings on acceptant policy handling: Value acceleration is visible for system C. by migrating the products from the administration A and B to the new system administration C. the policies are handled faster which leads to a saving of 80% on acceptants. This saving is calculated based on the performance and by using an ABC approach with policy product as the cost driver. The automation of the information handling copes for 80% reduction of acceptants. Only the people intangible information and mutation activities still exist and cope for the remaining 20%. For the technical conversion there is no saving on acceptants.

On-going cost increases

System		FTE	%	Sort
Administration C	Technical	2	30%	Maintenance
			70%	Change (replacements etc)
	Functional	1	100%	Change
Administration D	Technical	1	30%	Maintenance
			70%	Change (replacements etc)
	Functional	1	100%	Change

Table 5.8: Extra costs for personnel needed for the target administrations

The administration systems A, B, D have an availability of 95%. The administration system C is set on 90% availability, because the system is new and by usage the people work with it less efficient. The archive system has an availability of 100%.

The tables 6-8 in appendix A present the IE calculations that show the result of the EIE method for Case A. These tables are according the templates of appendix F and filled with the data from these four phases.

The result of the EIE method is presented in the following overview:

Project	Return (value)		Contribution (year 5)	Risk index	Complexity reduction	Performance improvement
	Initial investment	*ROI*				
Product migration company A (discount rate 10%)	5.191.881,59	81%	13.423.874	4	40%	27,5%
Product migration company A (No discount rate)	5.191.881,59	92%	20.648.118	4	40%	27,5%

Table 5.9: result of the EIE method Case A

The initial investment is high in relation to the contribution. The ROI score is 81% with a discount margin and 92% without. According the traditional IE framework this is a score of 4 on a scale of 5. The risk index is based on the input from the risk analysis for project organisation risks. The risk analysis is based on the amount of systems (4 out of 8) that are hit by the project and that are part of

the main business function of administering policies (almost 30% of policies affected) and the impact on the business (177k policies have to be converted commercially which is highly uncertain on the outcome). The complexity reduction percentage is the reduction of interfaces from 10 to 6 by phasing out 2 administration systems (figure 1 and 2 of appendix A). The performance improvement is the automation improvement of 80% for administration C as percentage of the total acceptants per policy (appendix A). The commercial conversions represent the biggest part of the saving. This element does also have the highest uncertainty factor, because the business case is based on the expectation that the clients will accept the commercial offers.

According the EIE method, the project would be a success but the risk analysis and the low contribution number could support the choice of Company A to not go through with the project. Company A ended the project to search for other scenarios of cost reduction. The following section presents case B and the last section of this chapter shows the findings of both cases.

5.5 Case Pension Insurance migration Company B

This case describes testing the EIE method on a project to setup a Premium Pension Institution (PPI) by Company B and Service Provider A. This company is an insurance firm in the Netherlands that wants to start a PPI to sell pension products. A PPI, like a pension fund or pension insurer, is a pension administrator where an employer can place the pension scheme agreed upon by the employer and his employees. The risk lies with the individual participant and the PPI only administers. An important characteristic of a PPI is that it is not bound to the Netherlands but it may administer pension schemes of companies within the whole European Union. Another characteristic of a PPI is that it is specifically aimed at the administration of Defined Contribution (DC) pension schemes. The PPI only provides capital building for the participant. The normal insurance products of Company B include Defined Benefit (DB) pensions.

When the pensionable age is reached, a PPI has to transfer the accrued capital to a pension insurer to make the pension payments. The PPI has to be independent from the insurance company and asset management company, therefore company B is setting up a new legal entity to sell pension products. The PPI provides transparent costs risk and structure of their pension capital. The participant decides how he wants the capital pay outs to occur.

5.5.1 Scope of products and applications

Company B wants to enter the PPI market, because they are afraid to lose market share to foreign parties that offer products whit lower and more transparent costs. Furthermore they want to present an own answer to the market demands of delivering PPI services. To do this a new legal entity has to be set up by Company B (outside scope of this case study). The goal of the PPI set up is to create a fast solution for administering, completely separate from the current pension system IT landscape of the organisation. The IT landscape for the PPI will be specifically setup outside Company B by a service

provider that will take management and support roles. This choice was made to keep the current company systems separate from the PPI systems. The management and support costs of IT will be independent of each other. The service provider can minimise the infra, support and software costs.

The best practice method used for this case to validate the EIE method used input from the EIE model design to include system theory aspects. Therefore the start of the method is more comparable than case A (classification of construction and function perspective for use in calculations). The important elements in the case of a PPI are: the participants (clients) and the premium flow (transactions). The participants are divided in active and Inactive. The inactive participants are the accounts of individuals that changed of pension fund and kept the old pension account, but this is made inactive. For the premiums there are certain fiscal restrictions and a strict legal minimum and maximum. Offering and contracting are the main business functions of the PPI entity that is created.

The PPI will have a negative effect on the parties in the insurance market. Company B calls it a survival of the fittest challenge. Companies weakened by the crisis are expected to be competed out of this new market. The Dutch National Bank (DNB) has set requirements for PPI in the market to create transparency of the costs. Due to the current issues with the coverage degrees and pension funds people are looking at other products and one of them is the PPI. Licenses for PPI's are issued, because they do not have this problem.

5.5.2 Assumptions and limitations

- Logica does not have further information on the source systems, because it is a single conversion and a new IT landscape is setup.
- The conversion project cost estimates is based on the experience of Logica on previous migration projects. These assumptions will be used in this project to compare the method with the approach Logica used.
- The documentation of company B and the interview with the responsible consultants from Logica have led to the benefit and value assumptions for the project.
- The conversion of participant data to the new IT landscape of a PPI is according a commercial conversion due to legislations.
- The setup of a PPI is difficult in the Dutch insurance market, because it is new and experience in certain projects is unavailable. Therefore the costs and benefits are estimated by business consultants with vast experience of the insurance market.
- IT governance is not evaluated for the case study, because both the approach of Logica and the EIE method is according the principles described in 4.7.6. The governance specific tool controls are used. The design and test are performed by the researcher of this thesis project. There is no segregation of duty, therefore an unadulterated test of tool controls is not possible.

5.5.3 Phase 1: Value network Pension insurance

The value network is specified for the pension insurance branch. The insights are based on the experiences and documentations acquired during the internship. First the table 5.10 presents the input and outputs related to the general elements in the environment. The figure presents the value network. The value network shows the important information streams between the company and the external parties. There are three intangible streams between the client (employer) and the company. In the other cases the streams are tangible. Exchanges of information are used to show the important elements in the value net of the insurance company. The table and value network present a high level overview of the information exchanges. For this case study only the information exchanges between the PPI, insurer, the client, asset manager and employee benefit manager are of importance.

Elements in Environment Insurance	Service Output	Service Input
Client	Documentation contract, offer, pension overviews, premium notes, Quote	Wishes, Demands, Payment (contributions), Requests (mutations)
Insurer	Premium, value transfer	Risk insurance
Asset Management	Build-up OP (entrepreneur pension), Fee	Contribution, Benefit
Banking	Banking information	Reporting
Tax office, public employment service, chambers of commerce, pension register, municipal personal records	Fee	Information, Mutations records participants
Employee Benefit Manager (EBA)	Pension information	Mutation information
Government (DNB)	Compliance Reporting	PPI Legislation

Table 5.10: Value network inputs and outputs

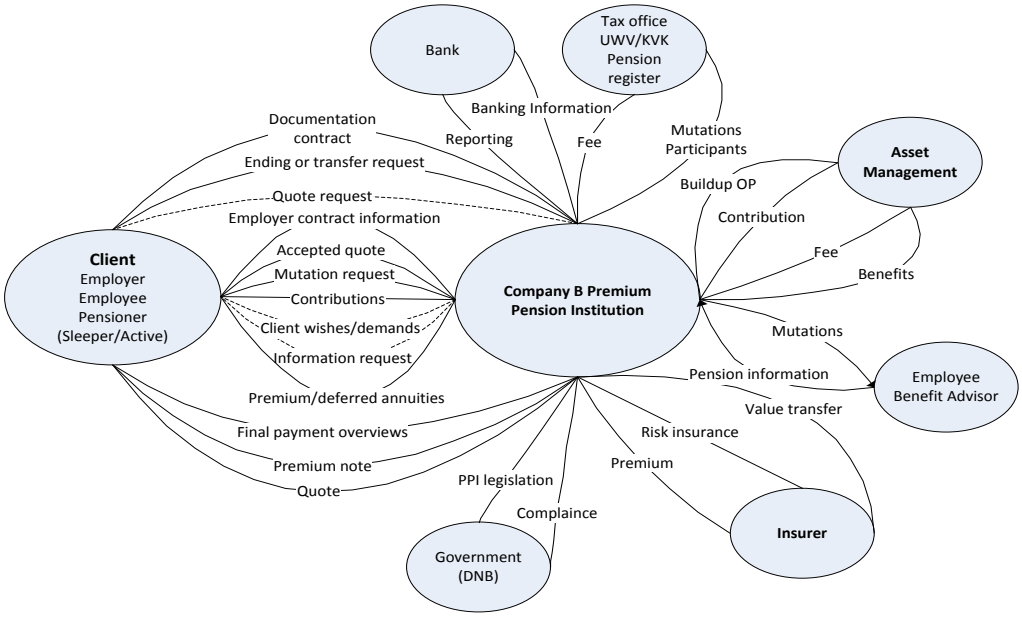

Figure 5.6: Value network analysis general Premium Pension Institution

There was not enough information to make the VNA more specific, but in line with the overall detail level the effort would not relate to the possible benefit. This was also an observation during the expert reviews.

5.5.4 Phase 2: Internal Discovery PPI

For this phase the approach is different as in case A (section 5.4.4). After discovering the project documentation for the environment, the internal discovery was difficult. The creation of a PPI is not reducing the amount of administration systems. It is creating a second IT landscape to administer pension contracts, participant information next to the current IT landscape. A new business is started next to the old. The PPI is outsourced to a new party.

The internal discovery uses the information available (see section 2.5.4 for an overview of data that is used). The discovered information on people and systems is collected in tables that can be imported by a script into the modelling tool to start phase 3 (Appendix E). Appendix D shows lists of possible properties that can be included for different subsystems or elements. The result of this phase is a set of tables with the discovered elements to start phase 3. These input tables are included in Appendix B.

Table 5.11 shows the important business functions and activities collected according the external discovery (table 5.10 and figure 5.6 are used). To scope the data gathering only to the relevant elements internally for this particular migration project (see section 4.9.2 step 4 for an example to perform this step). The steps are collecting input and output, discover the throughput (activities and business functions), detect the details of the throughput (behaviour). The discovery of details includes the used resources (people and systems) and the time and performance properties of the activity or business function. These activities and functions are part of the overall business function of administering pension contracts and build up capital.

Business functions	Activities
Quoting: collective pension for employers and Employee Benefit Advisor	Advise client about settlement and services, Perform feasibility study, formatting quote, Accepting quote
Contracting: employers for collective pension	Administration for new contract employer, administration arrange settlements, fill participant administration
Arrange: contract for employers and employees	Manage contract / employer records, manage participant related records
Collection: of collective pension premiums and costs	Prolongation, collecting premium, create premium notes
Capital building: with premiums	Determine investment, Portfolio management, administration management, analysing portfolio and reporting

Mutate: of contract, participant records and funds	Mutate contract / employer, transfer, ending, check fund changes
Transparent informing: of stakeholders	Inform on final premium payment year, periodically informing, notifications, informing on requests, sales, public relations
Value transfer: for the start of the settlement and reaching pension	Periodically check condition payments, ending payments (settlement), periodically payments (settlement)

Table 5.11: Business Function Model overview for a PPI

For the specific activities the detail level on time and effort was not sufficient enough to incorporate in the models for the EA analysis. The following subsection gives the analysis of the As Is situation, pathway and To Be situation.

5.5.5 Phase 3: EA analysis of the case B migration

The discovery phases have as result the input data for this phase. The tables can be found in Appendix B. The first figure (5.7) shows the Business Function Model. The relevant business functions mentioned in table 5.11 are implemented for the PPI as straight through processing (STP). This stands for a high level of automation of processing in the financial world. A lot of processes are without human interaction.

The main function is administering the policies for this project (figure 5.7). The eight sub-functions are included based on the documentation of Company A. Further details are excluded, because the activities are not clearly documented and due to time constraints of the research no further detail discovery can be performed. The six stakeholders relevant for the business functions are the EBA, client, Insurer, DNB, asset management and the internal stakeholders of the insurer (board). The strategic goals of the company states transparency and speed for the client contact. For the other business functions the focus is on low costs. For the business function capital building the focus lies on the best product with a low risk and high capital increase.

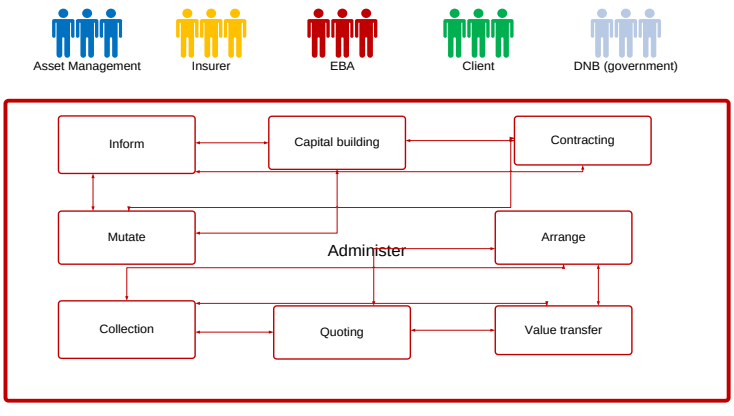

Figure 5.7: As Is Business Function Model

Figure 5.8 shows the mapping of the five current pension administrations on the different sub functions. In this project the five administrations all are used for all the activities in the administration of pension insurances. Four administrations (green in figure 5.8) will be phased out in the next 2-4 years, the migration is in progress at the moment. For the current situation this view is sufficient. For future evaluation changes in the administrations have to be included.

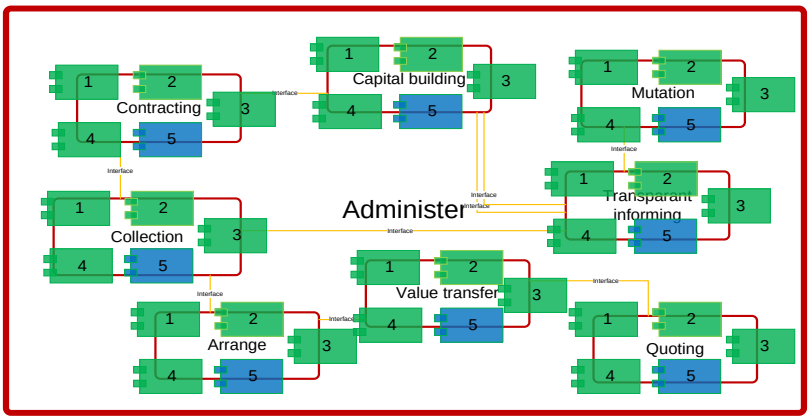

Figure 5.8: As Is Application overview

The As Is situation in figure 5.8 gives a simple representations as described according the method in chapter 4. The next step is the migration strategy. That is decided by the responsible program manager of company B. The migration of the products consists of a migration of pension contract information and employer records to the PPI. The contracts are not migrated, the products are changed in new products for the PPI (commercial conversion). The external partner handles the implementation, conversion of client records and support of the new environment. The following three elements are part of the product migration:

- Commercial migration of the client information.
- Contracts in old environment to archive
- Input of the information in new PPI products

Figure 5.4 shows the status changes of the administration systems for the product migrations. The migration has a timeline of 1,5 years with a maximum of 2 years.

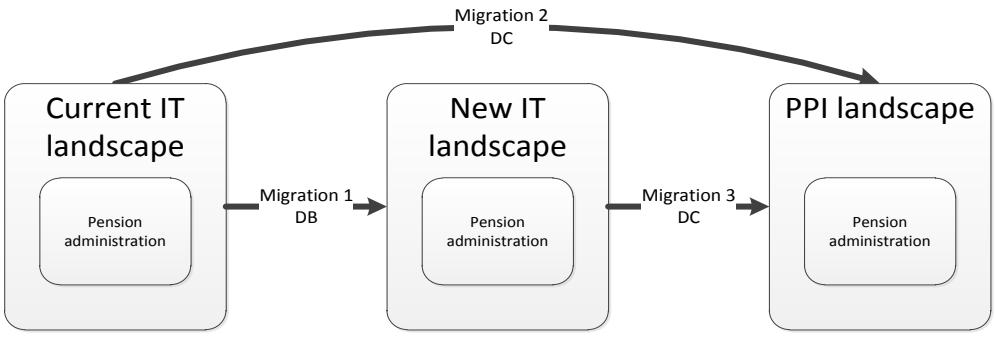

Figure 5.9: Migration pathway (4 years)

Figure 5.9 presents the migration strategy of company B. Migration 2 is the current migration that the focus is on. Migration 2 shows the migration of client information (participants) to the PPI environment. The following figure shows the To Be situation. The To Be situation is the PPI and therefore no old system is included, because it is separate from the current IT systems.

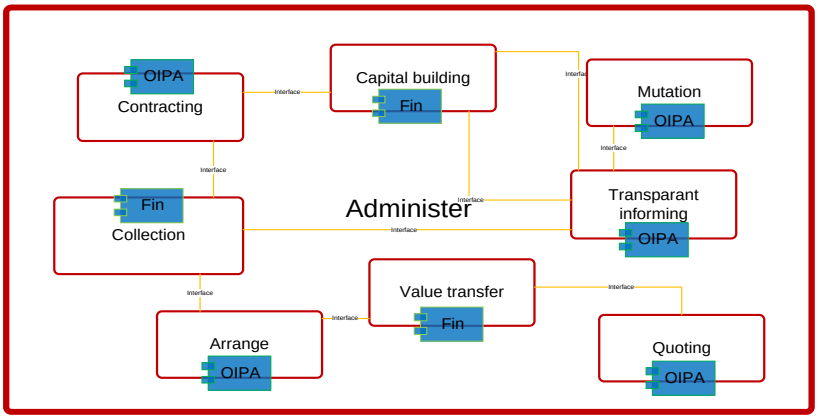

Figure 5.10: To Be Application overview

The EA models with the filled elements and properties gives the starting point for the fourth phase. The applications, systems and people relevant for the migration to a PPI were discovered in the first two phases and included in the models in this phase. The next phase uses the results of the TCO calculations performed on the properties of the models (figures 5.8 and 5.10).

5.5.6 Phase 4: IE calculation score of migration case B

The last phase uses the input from the models and discovery of the elements to present the project score for Case B according the EIE method. Figure 4.1 shows the extended model and the EA results element presents the input for the IE calculations:

- The first element of the EA result element is the As Is situation. For the IE calculations the phase starts with the TCO calculations that are performed in the Abacus Tool based on the As Is input sheets and model. The As IS input sheets give important metrics for availability, performance and TCO (more information can be found in appendix E on the used metrics).
- The second element is the pathway and this is corresponding with project migration costs. The migration project costs are based on the bid of Logica and the projected costs for the project according the documentation of Company A.
- The third element includes the metrics for the To Be situation. The models present input and the difference between the To Be and As Is situation minus the project costs will present the results for phase 4.

When the migration costs are clear. The difference between the As Is and the To Be situation is important. The case research shows two elements: costs increases or cost savings for a migration project.

The result of the EIE method is presented in an overview as that of table 5.12 (excluded according confidentiality agreement with company B).

Project	Return (value)		Contribution (year 5)	Risk index	Complexity reduction	Performance improvement
	Initial investment	*ROI*				

Table 5.12: result of the EIE method Case B

The case result shows two important observations:

- The case is negative because the company goes from one to two IT landscapes, therefore double support costs, the PPI has to have transparent costs and therefore the profit margins are smaller.
- Another observation off the result is that the PPI will compete with the old company products. It is also called cannibalising the current products by presenting other more transparent products. It is not conversion it is replacing the old products by new products in a new IT landscape. So a different form of commercial conversion.

The following points present the expected business migration results concluded from the evaluation with the EIE model and method:

- The migration is difficult, because it is an aberrant product. The PPI is a difficult step for company B, because the prices have to be lowered under their current
- 80% improvement by using STP processing in terms activities performed by acceptants and IT support. The saving is reached on long term by using STP reduction of 70 to 80% in administer staff.
- Transparent sales and fast processing cost improvement for employers and the EBA.
- Higher development costs for each pension product in the old environment. High IT pressure on the total company budget.
- Labour costs are not lower for IT support for the PPI setup.
- The PPI will compete with own environment.
- 4 or 5 systems are still in the current environment.
- 40 or 50% of current costs of the current environment are made in pension administration, the costs for support will increase with 10% for the PPI.

5.6 Findings empirical study

The goal of this section is to objectively explain the data and not draw interpretations or conclusions (Blumberg, 2008). The empirical study consists of three sections. The verification by experts, case study one and case study two for validation. The verification by experts is presented in table 5.2. By examining the comments the mayor findings are:

- The method is reviewed as sound by two experts and is verified to use.

- The comments for improvement have been used in the design.
- The first discovery phase is mentioned by experts as useful, but the time factor is a possible downfall for usage in practice.
- The method needs more detailed information than the best practice methods used in practice to cope with IS migration projects.

The reviews of the experts have changed the method. The end result is tested by comparison to a method used by expert 5 at an insurance company. This last step was a final check for verification and the result was that the method did not need further reviews for testing in practice (section 5.2).

The two case studies are project proposals that are presented to handle business migration projects for clients in the insurance branch. The information used for the case study research is provided by Logica and the involved companies that are anonymised. The first case is a straightforward migration project in description. The EIE method could be applied for testing, on the migration case. For the conversion project costs the numbers where based on experience of similar migration projects. Without further details these assumptions could not be evaluated in a reliable way and are excluded.

Compared to the method used in the first case the EIE method shows a different start of approach to analyse the costs. The EIE method starts with discovery and uses EA models to build up the business case. The method used for the proposal in the case, uses the documentation and experience to present the business case for migration. The proposal of Logica was created based on the information of Company A that was also used for this case study. In the method used by the project team of Logica and company A, the benefits are not included. It was only the quotation. Company A did not proceed with the migration project. The information and assumptions on the benefit side were available but not included. By using the phases and steps of the EIE method these elements are considered even as it is on a high abstraction level. The case was based on assumptions for the benefit side of the migration. The migration project is calculated based on expert opinions, the amount of resources and time needed for conversion based on documentation. This does not include real life testing or observation of the products and systems. The overall finding is that the different steps can be performed according the description of the method steps, even with a small amount of detailed information. Now the detail level is on a business function level and not a activity level.

In the second case the method first used is more comparable with the EIE method. The method used in case B was based on the research and development of the EIE method. The documentation and spreadsheet used, included a system theory perspective of collecting the construction and function perspectives. This shows a comparison with the input table collections of the EIE method. The difference was that in the best practice approach not a total cost and performance was made based on this gathered information and no EA model was created to visualize the relevant elements of the case. Difference is visible in the EA analysis of the relevant elements of the migration project. The proposal for the PPI setup uses a spreadsheet overview for the functions and activities. For the applications needed for the PPI a model is used, but not a mapping on the business functions and

activities. Case B proved to be difficult to handle with the EIE method according the current steps. The approach now is based on a migration within a company and not a migration and new start-up of a second company. Comparing the As Is situation with the To Be situation for IE calculations cannot be done in the same way as Case A. the PPI is a To Be situation that is will be created next to the To Be Situation of the current IT landscape. The case is done based on strategy and legislation only, the business case results in a negative case for the company. The strategy and environment changes (PPI legislation) of company B are outweighing the possible discoveries done in the EIE method on possible improvements and savings made by the project. In other words the project has to be performed to keep up with competition and therefore a negative business case was the result.

The best practice method use the NPV method and experience of experts on conversion to make a cost assumption to justify the projects. The intangible values of the projects were difficult to classify this way. The collected metrics on performance, modularity, availability aspects of a migration project could be collected to show the impact of the migration on the enterprise and business.

Looking at the EIE method compared to the best practice approaches there is little difference in used documentation on first glance. Each migration needs understanding of the processes, products, systems and people involved for in the project organisation or the affected people and systems in the current situation.

The empirical study shows a difference in valuation. With the EIE model the different subsystems or elements of an organisation are documented and incorporated directly with the architecture models. In practice this is not the case and the business case is created based on documentation and interviews and later on the specific details that are examined when needed.

Major difference in the methods was the use of TCO and ABC combined in the EIE method compared to the traditional financial methods. The TCO input is discovered in the discovery phases and calculated with the models in phase four of the EIE method according the mappings on business functions in the EA models. Then in the business case the difference between As Is TCO and To Be TCO gives the end result. As for the best practice approaches the focus was primarily on the To Be situation and on the possible future cost and benefits and therefore an overview of the migration value in relation to the As Is situation was not available.

The research findings of the case studies present the input for the conclusion in section 6.1. In the following chapter the main insights of literature and the empirical study are concluded and the research question are reflected.

6 DISCUSSION AND CONCLUSIONS

This chapter discusses the key research questions which were stated in chapter 1 and considers the findings and conclusions that can be drawn from the research described in the thesis. Furthermore the recommendations and opportunities for the Extended Information Economics model and method are presented for future research on the matter. The chapter is structured as follows: section 6.1 presents the discussion of the findings from the empirical study in relation to the model and method design (chapter 4 and 5). Section 6.2 draws conclusions by reflecting on the theoretical and practical findings by considering the research questions. Section 6.3 discusses the recommendations for applying the developed method in practice and future study on the EIE model.

6.1 Discussion of the findings

This section discusses the findings (see section 5.6) collected during the research project of creating and testing a model and a prescriptive method for combining elements of Enterprise Architecture and Information Economics. The model and method are created for justification and evaluation of IT migration projects. The model was created from the existing theory and methods. This section provides an overview of the differences between the literature and practice.

In the literature the financial methods were often proposed as only way to handle investments, but from 2004 until now, more often methods with a multi-layer approach are used in order to make the investment decisions. In the insurance branch the financial methods are used as justification. As in the case studies the EIE method was also applied during the justification phase. A difficulty was the availability of detailed data during justification. More detail is available in the analysis phase. Therefore the EIE method spans over the justification and analysis phase. This shows a difference in applying to practice by involving more roles in the company at the start of projects. Direct involvement of architects in the justification phase .

As in case B, sometimes investments which should not be executed according to the investment methods are still executed. These projects are often related to the corporate strategy or to the introduction or change of legislations. In practice if monitoring is applied (which is often not the case) the monitoring focuses on time, money and quality during the project. There is no evaluation of the business value of the IT migration. The EA models provides an effective measure for evaluation.

The model and method are designed based on literature and have been evaluated by experts in the field. The case studies show that it is an approach that is comparable to practice. Still there are enough differences. Important to consider is that the research on this subject is difficult, because the combination of topics in the study was not performed before, which shows an integrity risk. Another risk was the appliance of IE on a single project evaluation and not a portfolio of projects.

In practice the main elements are available like EA frameworks and the financial methods. Not the combination with GST as described in the model and method. Difference is visible in the initial discovery phases. In practice this is done less thoroughly due to restrictions in time and resources. The method and model extensively discuss all the elements that are used in practice and have a more prescriptive approach. More is not always better, but in this case it can lead to more detailed models and with the linkage of EA and calculation methods of IE the two elements are brought together under one roof as it was not the case in practice. The initial phase will be more time consuming as discussed, but the benefits from this will be to have a clear methodology for handling IT migration projects. After a first pilot this method can ensure time efficiencies in the following projects.

On the level of detail a discussion takes place between the EIE method and the best practice methods. The EIE method prescribes more detail on business functions and activities that are changed in the company by the migration. The usage of metrics on the As Is situation compared to the To Be situation in the calculations can ensure for a clearer business case, but as mentioned will take more time and resources. If the characteristics are mentioned for the physical and social system a clear starting point for a follow-up IT migration project can be given.

6.1.1 Limitations of the empirical study results

The process of gathering data for testing the model concepts and prescriptive method in practice proved to be difficult. During the research various possible projects have been examined. Insurance companies where approached, but due to time restrictions of the research a complete test of the EIE model and method on real life data was not possible. The proposal bids for migration projects from Logica where the second possible options for testing the EIE model and method in a practical setting. The cases have certain limitations that have to be considered for the research conclusion (section 5.4.2 and 5.5.2):

- The cases consist of proposals for IS migration projects and therefore the detail level is lower than IS migration projects that are performed in insurance companies.
- Limitation was availability of details of source systems to improve the EIE method results. The information for the EIE method case study was not detailed enough for a complete test of all the detail steps.
- The details of the activities were not available.
- The discovery can only be performed accurate if enough time is available. Higher detail levels demand more time and effort of people involved and the business environment could conflict on this point by demanding faster decision making
- Without activity details it was difficult to pinpoint the intangible values or efficiency improvements of a migration project.

The proposals can only be used for going through the four phases, because the projects are still in the start-up phase or are where not started and therefore evaluation of the benefits could not be tested.

6.1.2 Applying the model and method in practice

Making the case completely quantifiable is only possible with assumptions based on experience, this increases subjectivity and that is not desired. Furthermore a higher detail level will inevitably lead to higher costs. The question that has to be asked in a company for using the EIE model and method is: which level of quantification is needed in relation to the available resources? First start with the preconditions that are needed for starting with the EIE method:

- The current procedures for justifying the projects have to be described to discover if extra information is needed to use the EIE model or method.
- The company needs to have documentation on the processes that are performed and preferable on an activity level. The core activities and process are most important. Start from existing material, preferable from a common source that many participants have knowledge of. This improves recognisability and interpretability.
- Experience with TCO and ABC approaches is needed to tailor the current financial metrics to the EIE model and method.
- The company has to have a architecture plan for their company to provide context for using the EIE model and method effective in relation to complete enterprise view.
- The company needs to have an understanding of which strategy goals have to achieved for the projects to get the right focus for the start of the EIE model and method.
- An information plan is needed to discover the value drivers for the activities.
- The number of aggregation levels in the business process categories is free to choose, as long as a consistent view of the information systems is reached. For large or complex organizations a balance between accuracy and detail and practicality of the model should be made.

Reflecting on these preconditions, not every company can use the EIE model and method effectively. The model and method need more information than traditional methods. This leads to more effort for usage. Therefore the EIE model is difficult to use. Companies need a high maturity level of their IT organisation, but by spending more effort the first time on gathering data on the information, people and systems and then model the enterprise picture. For future projects the phases 1, 2 and 3 can be performed in a straightforward fashion, because the details of the various activities are collected during the first implementation. In the other case if the details are not available as in the case studies, the model and method will present a structured way with template documents and models to create better understanding in the company for the investments. Even if the numbers are not precisely calculated for each activity. By presenting what the impact is on a core process, with a margin of error due to missing information, shows management what happens when investing in the particular project. A lot of activities and processes in the insurance companies are comparable between companies due to the strict legislation therefore a lot of information can come from outside the company. In the case a lot of information and data from Logica and other parties was used to discover elements related to the products.

The following section gives an advice for usage or implementation of the EIE model in a company. The EIE model is another way of the IT investment financial evaluation therefore the following elements have to be considered when using the model: training, starting with a pilot project, monitoring of the EIE results with the first projects, evaluation of the model in a specific case. After a pilot phase the model needs to become a part of the regular planning process in a company. Particularly important in this phase of the implementation is:

- Management commitment for the initial pilot: gather the right sponsors for the initial pilot and communicate the results. No commitment for the pilot means lack of commitment for the results and the implementation of an EIE model.
- Interest in the company for the results of the model in comparison with the old methods: choose carefully the right people. If people get enthusiastic, they will present advertisement for the model.
- Commitment of management for implementation enterprise wide: present the results of the pilot project in a clear and qualitative way to the board to really show that the model is essential to justify the IT projects.

6.2 Reflections on the research questions

This section provides the conclusions which are stated based on the findings and discussion presented in the sections 5.6 and 6.1. These conclusions are taken under the limitations of this research (sections 4.2 and 6.1.1). The conclusions are presented according the research questions. The following figure presents the five research questions in relation to the three main chapters of the research. The questions will be answered according the gathered insights in the literature study, design, and empirical study. The literature which is used for sub question one, two and three leads to the design of the model. The method prescribes the usage of the model. The method is tested against used methods in practice. The five conclusions together lead to the general conclusion for the primary research question and objective.

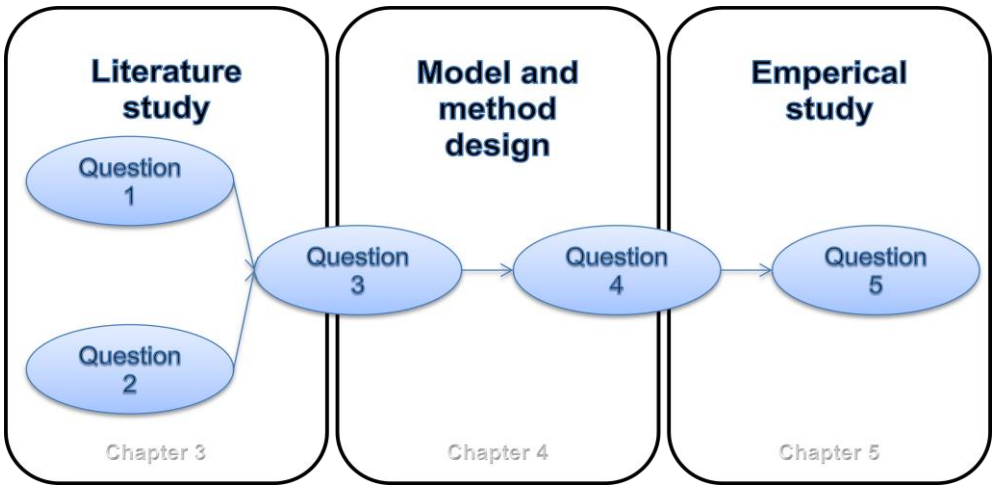

Figure 6.1: Position of the research question in the thesis

How can Information Economics (IE) elements be combined with Enterprise Architecture (EA) into a single model for justifying product migrations?

IE and EA can be combined as discovered from literature. The major difficulty on the matter lies in the definitions of the topics. Furthermore it is important to detect the elements of both topics that have common ground. As discovered both EA and IE start with a detection of the relevant elements in the organisation. The IE framework needs improvement as shown by the criticism in literature. The scores are subjective and are not based purely on measurable elements. Therefore the best way to extend the calculation with quantity metrics. The IE framework is focused on connecting the business domain with the technology domain. These domains are classified according scores in the traditional IE framework. EA gives a framework to measure the changes in the technology domain. By mapping the components (construction) in an organisation on the functions and activities (function) the input for the IE framework is enriched. Combining the input of EA with the Total Cost of Ownership data and metrics of system function and performance enables the combination of the two frameworks.

What is the contribution of the theoretical foundation (general system theory) to improve consistency in the extended IE model for justification?

A theoretical foundation is needed to create a consistent approach for creating a model and method. GST is a difficult topic, because various different views can be given on the theory of GST. For this research a specific context is chosen for the GST applied on enterprises. The theory gives a foundation to gather the needed data and information on the elements of an enterprise and its environment. The discovery phases from the method and model set a context for the analysis phase. The difference with practical examples and literature on EA and IE is the use of a separate discovery phase. As described the EA approach presents from a constructional perspective a restriction of design freedom and therefore is prescriptive of nature. The more common approach for EA is the functional perspective related to the aspects of functions and services. This is the most used approach for IT projects. The foundation of the GST is examined to ensure both the constructional and functional perspective are used in the EA framework for modelling the business and IT alignment. For instance how could an IT project be performed to change the organisation without knowing the current organisation? The GST presents a scientific theory to approach this important issue as shown in the literature and presented in the model and method design. Still it is needed to be unambiguous on what the terminology is and how the GST is used in a model and method. The prescriptive method is designed this way to ensure there is no room on the interpretation of GST in the EIE model design.

How can a prescriptive method be defined to capture the current state of an insurance company into the model?

The model and method have been created according insight gathered from the available experts in the financial services department of Logica. Furthermore the literature study presents a generic approach for appliance on IT investments. The experts verified the model and method on relevant

steps and if it is possible to apply in practice. The prescriptive method with the discovery phases presents a way to gather the relevant components of an organisation to capture the current stage, both functional and constructional. An important flaw that had to be corrected for combining EA and IE in a method, was the omission of a clear foundation to start with analysing an IS migration project. The underlying question of this issue is the research question stated here. Capturing the current state is designing a foundation for analysis and valuation (calculations). The usage of the designed EIE model needs prescriptive guidelines for gathering the right data. As stated by various authors in the literature section, a system can only be analysed when it is clear what has to be analysed. In other words what is the system and how is it constructed? The value network analysis proved to be a first detailed discovery of the state of an insurance company to incorporate in a method. It describes an insurance company in its environment. The second concept is to discover the activities that are performed in companies and the people or systems that perform these activities. The combination of the external and internal discovery presents the essential extension for capturing the state of a company and to use the EIE model in that company.

How can the model and method be used for justification and reappraisal during life and pension insurance product migrations?

The model and method can be applied for different types of products, because the design was generic. In practice the model and method were only tested for one branch. The collective and individual policy products (pension or life) where tested and these projects where comparable. The products are different, but the companies are not. The model and method are useful in an insurance setting. A major issue for testing the EIE model and method for justification and reappraisal, was the availability of information and data. The model and method can only be applied accurately during product migrations when the level of detail on the systems, people and activities is sufficient enough. The two cases show the data used for justification and reappraisal in practice and this proved to be a too thin level of detail to fully benefit from a discovery and analysis approach as provided by the EIE method. Even with a low level of detail the EIE method steps could be followed and a result for decision making was provided. The downfall of using the EIE model and method on a bid proposal project is the difficulty to prove the benefit of this new approach for migration projects. By missing details on the system performance and details on the activities performed, the amount of uncertainty in the costs and benefit calculations is higher than preferred. This means a bigger margin for contingency costs. Still a better insight is created than only using traditional financial methods. The collection of information has proven to be a difficult subject in literature and in practice at the start of a project it seemed even harder to cope with this issue. The level of uncertainty did not prevent a result on the usefulness of the proposals according the EIE model and method. It only shows higher margins of uncertainty. When each activity performed is clear and the input and output properties are clear the values can be detected more precise for each activity and therefore the impact of the migration project can be detected by relations between the elements. The first discoveries and mapping of applications and functions presents a way to get a clear picture of which elements are relevant for the project

(input, output, production of a system). The combination with tooling to directly calculate changes provides an efficient way to evaluate changing conditions or comparing various scenarios.

What is the impact to the migration decision process within insurance companies when applying the model and method?

The impact of the EIE model and method is dependent on the type of project and the specific company. As shown in the empirical study the method and model provide a detailed approach from the start with two phases of discovering the enterprise. The big issue is the fast pace in practice. As mentioned by experts and people interviewed during the internship. The EIE model and method provide a more detailed approach at lower pace. This could be a downside, on the other hand using tooling for all the migrations or further investment projects could prove time efficient, because the discovery and analysis phases can be speed up with input from previous projects. The impact of the model on practice is a clear build-up of the cost or benefits made with an investment. Bringing the EA models next to the business case can enrich decision making. For instance a manager sees the model of the enterprise and an overview of the cost associated with the blocks in the model. The impact of IT on the business costs and benefits is visualised. Therefore if the model and method are used for bid proposals with a low detail level the combination of architecture blocks and TCO metrics present a transparent approach for aligning business and IT. In the empirical study in case A the method could be applied on single migrations and a clear understanding of source and target. Case B shows the inability of the EIE method to cope with the element of outsourcing against an in-house migration. The subjectivity in a migration to a new environment is too high to really collect relevant measures for the EIE method, therefore the impact in this case is smaller compared to traditional financial methods.

Main research question: How can the elements of the Information Economics framework and Enterprise Architecture be combined in a model for justification and reappraisal of product migrations at life and pension insurance companies in The Netherlands?"

Looking back at the objectives it is important to notice that all three have been met. The design of model and method is based on literature and verified by five experts. The case study research proved to be difficult in the time that was made available and in the financial markets in this current time. Nonetheless an insight was given in what the implications are of using a certain model and method. Furthermore the potential and the ease of using models with properties in calculations can provide a basis for the future. So reflecting on the main research question and goal of the research. The elements were combined and a justification was provided, but more detail on the function and behaviour of a system (enterprise) is needed to really show all the difference with current best practice methods. The potential of the EIE model lies in combining system properties in a TCO calculation and mapping it on business function or activities (ABC) to really show the impact of IT in models and in the numbers. This may provide a powerful tool for companies that want more transparent economics of IT.

6.3 Recommendations and future research

This section presents a number of recommendations (improvements or opportunities) for future study of the Extended Information Economics model and prescriptive method.

6.3.1 Recommendations for improvement

Looking at the model it is in accordance with the discovered literature. The method has proven to be comparable to the best practice approaches used in practice. The best practice approaches in practice showed a lower detail level than the EIE model. Therefore a recommendation could be to improve the data gathering process for investment needed for the method, because the traditional justification process is not arranged to handle a detailed model for quantification of migration projects.

Another recommendation for the model is to improve the method based on standards used in the business. Standards like the TOGAF Content Metamodel attributes or the Acord insurance value chain, XML and XBRL standards to analyse their metrics on system components, product properties and process/activity descriptions for usage in the EIE model.

The third recommendation is to formalise interview standards for collecting data during the discovery phases. Standardisation will prevent room of interpretation for the prescriptive method. The Prince 2 or MSP template documentations could be tailored to implement certain interview documentation standards.

The fourth recommendation is based on section 4.2. The model and method focus on certain elements of IT/IS investments. Specific the migration projects and then a focus on product migration. An recommendation could be to include change management, strategic planning and program portfolio to get a companywide approach for migrations and possible other investment projects.

6.3.2 Future research opportunities

Next to the recommendations of improvement there are several opportunities for future research. These options are related to changes in the empirical research to deliver more results on the impact of the model or method.

The first opportunity for research is to include more companies and get access to all the relevant company records. The research should be performed over a longer period of time and various interviews should be performed to get a better detail level of the activities relevant to the project under investigation. In the current study there were only two companies involved in sharing their project results and methods for comparison. To come up with conclusions which could be more generalized the sample should be bigger.

A second opportunity for investigation could be to implement and test the model and method in an enterprise. This includes a company specific set up of the governance and evaluation elements that

are needed to apply the method in a real life situation. By implementing the method and model the information needed for the phases is collected beforehand. The next step is to perform the method based on the phases and step based on the information gathered during implementation. This gives the research more depth by examining the time aspect of performing a justification and/or evaluation of the prescriptive method.

A third opportunity is to interview project owners, portfolio managers, CEO's for example on the model design. Discover the human feeling and support for a certain model in practice, because as shown in literature the GST has always had criticism and by establishing the justification and evaluation on a certain theory elements as management support or other human cultural influences are important to take into account when changing people's work.

A fourth opportunity for further research could be to design a tool around the model and method. The modelling tool could be improved with the spreadsheet possibilities. By making the architecture models dynamic with more information on costs, properties, support staff, etc. The most preferred situation would be a single tool for modelling with all the needed information incorporated to directly output spreadsheet reports without using separate spreadsheet software.

The fifth opportunity for follow-up study is checking the governance and evaluation maturity of the EIE model and method in relation to the ISO 9001 standard and the CMMI level. Further investigation on the details and discovering the needs to get the model and method standardised could be an opportunity to further improve the usability of the EIE model and method.

The sixth opportunity for future research is to test the governance for the tools used in the method. In the case study research the governance internal controls of the tools Excel and Abacus have to be tested in a real life environment by various people to evaluate the segregation of duties and user authentication controls are effective or that further improvements are necessary.

7 LIST OF FIGURES AND TABLES

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8 REFERENCES

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APPENDICES

A. Details Phases Case A

B. Details Phases Case B

C. Template Phase 1

D. Template Phase 2

E. Template Phase 3

F. Template phase 4