

GRADUATE SCHOOL OF MANAGEMENT
St. Petersburg State University
Master in International Technology and Innovation Management

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
School of Business
Master in International Technology and Innovation Management

Maria Teplykh

**CHOICE OF BUSINESS PROCESS MODELING METHODOLOGY
– CASE NORTHERN DIMENSION RESEARCH CENTRE (NORDI)
IN LAPPEENRANTA UNIVERSITY OF TECHNOLOGY**

1st Supervisor/Examiner: Associate Professor Sofya V. Zhukova
2nd Supervisor/Examiner: Professor Sanna-Katriina Asikainen

Saint-Petersburg - Lappeenranta
2010

ABSTRACT

Author: Teplykh, Maria
Title: Choice of Business Process Modeling Methodology
– case Northern Dimension Research Centre (NORDI)
in Lappeenranta University of Technology
Department: Graduate School of Management (StP. State University)
Business Administration (LUT)
Program: Master of International Technology and Innovation
Management (MITIM)
Year: 2010
Place Saint-Petersburg (Russia) / Lappeenranta (Finland)
Master’s Thesis. Saint-Petersburg State University (GSOM) /
Lappeenranta University of Technology (BA).
141 pages, 21 figures, 7 tables and 9 appendices.
Examiners: Asc. Prof. Sofya V. Zhukova
Prof. Sanna-Katriina Asikainen
Keywords: business process modeling, methodology, Business Process
Management, Business Process Reengineering, business
process models

The main outcome of the master thesis is innovative solution, which can support a choice of business process modeling methodology. Potential users of this tool are people with background in business process modeling and possibilities to collect required information about organization’s business processes.

Master thesis states the importance of business process modeling in implementation of strategic goals of organization. It is made by revealing the place of the concept in Business Process Management (BPM) and its particular case Business Process Reengineering (BPR).

In order to support the theoretical outcomes of the thesis a case study of Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology was conducted. On its example several solutions are shown: how to apply business process modeling methodologies in practice; in which way business process models can be useful for BPM and BPR initiatives; how to apply proposed innovative solution for a choice of business process modeling methodology.

АННОТАЦИЯ

Автор:	Теплых Мария
Название:	Выбор методологии моделирования бизнес процессов (на примере Исследовательского центра Северного измерения (NORDI) Лаппеенрантского Технологического Университета)
Факультет:	Высшая Школа Менеджмента (СПбГУ, Россия) Бизнес Администрирования (Лаппеенрантский Технологический Университет, Финляндия)
Программа:	<i>Международный Менеджмент</i> Технологических Инноваций
Год:	2010
Место:	Санкт-Петербург (Россия) / Лаппеенранта (Финляндия) Магистерская Диссертация. Санкт-Петербургский Государственный Университет / Лаппеенрантский Технологический Университет. 141 страница, 7 таблиц, 21 график и 9 приложений.
Научный руководитель:	к.т.н. Жукова Софья Витальевна, доцент (ВШМ) Sanna-Katriina Asikainen, проф. (LUT)
Ключевые слова:	моделирование бизнес процессов, методология, менеджмент бизнес процессов, реинжиниринг бизнес процессов, модели бизнес процессов

Главный результат магистерской диссертации – это инновационное решение, поддерживающее выбор методологии моделирования бизнес процессов. Его потенциальные пользователи – это люди с подготовкой в области моделирования бизнес процессов. В то же самое время они должны обладать возможностью собрать необходимую информацию о моделируемых процессах организации.

Магистерская диссертация поясняет важность моделирования бизнес процессов для осуществления стратегических целей организации посредством объяснения места этой концепции в области менеджмента бизнес процессов (BPM) и в частности их реинжиниринга (BPR).

Для подкрепления теоретических результатов диссертации было произведено кейс-стади Исследовательского центра Северного измерения (NORDI) Лаппеенрантского Технологического Университета. На этом примере продемонстрировано несколько решений: как применять методологии моделирования бизнес процессов на практике; как модели бизнес процессов могут быть использованы при BPM и BPR; каким образом применять предложенное инновационное решение для выбора методологии моделирования бизнес процессов.

TABLE of CONTENTS

INTRODUCTION.....	6
1. STATE-OF-THE-ART IN BUSINESS PROCESS MODELING	8
1.1. BUSINESS PROCESS MANAGEMENT AND REENGINEERING APPROACH	8
1.2. LITERATURE OVERVIEW ON BUSINESS PROCESS MODELING	10
1.2.1. <i>Strategic Benefits of Business Process Modeling</i>	10
1.2.2. <i>Key Problems of Business Process Modeling</i>	13
1.2.3. <i>Business Process Modeling Methodologies</i>	21
1.3. RESEARCH PROBLEM, OBJECTIVES, DELIMITATIONS.....	23
1.4. RESEARCH METHODOLOGY AND ORGANIZATION OF THE STUDY.....	25
1.5. SUMMARY OF CHAPTER 1	29
2. CHOICE OF BUSINESS PROCESS MODELING METHODOLOGY	31
2.1. GROUNDS FOR INNOVATIVE SOLUTION DEVELOPMENT	31
2.2. APPROPRIATE SET OF BUSINESS PROCESS MODELING METHODOLOGIES TO CHOOSE FROM	34
2.2.1. <i>Approach to Selection of Methodology from Business Perspective</i>	34
2.2.2. <i>Current and Future Methodologies-Leaders</i>	36
2.2.3. <i>Process Mapping Guidelines</i>	40
2.2.4. <i>Process Mapping by Means of Leading Methodologies</i>	43
2.3. SET OF CRITERIA SUPPORTING CHOICE OF BUSINESS PROCESS MODELING METHODOLOGY FOR SPECIFIC BUSINESS CASE	49
2.3.1. <i>Construction of Criteria for a Choice of Methodology</i>	49
2.3.2. <i>Explanation of Criteria Details in Business Language</i>	51
2.3.3. <i>Requirements from University Research Context</i>	54
2.3.4. <i>Comparison of Business Process Modeling Methodologies</i>	55
2.4. HOW TO CHOOSE A BUSINESS PROCESS MODELING METHODOLOGY	59
2.4.1. <i>Recommendations for Proposed Criteria Usage</i>	59
2.4.2. <i>Application of Proposed Criteria for Business Cases</i>	61
2.4.3. <i>Construction of Innovative Solution for a Choice of Methodologies</i>	64
2.5. SUMMARY OF CHAPTER 2	67
3. CASE NORTHERN DIMENSION RESEARCH CENTRE (NORDI) IN LAPPEENRANTA UNIVERSITY OF TECHNOLOGY.....	69
3.1. NORDI'S DESCRIPTION AS AN INNOVATIVE UNIVERSITY RESEARCH CENTRE.....	69
3.2. GROUNDS FOR A CASE CHOICE	73
3.2.1. <i>Reasons for NORDI's Participation in the Master Thesis Project</i>	73

3.2.2.	<i>Suitability of NORDI for the Study</i>	75
3.3.	EMPIRICAL STUDY.....	76
3.3.1.	<i>Case Study Design</i>	76
3.3.2.	<i>Interviews and Interviewees</i>	77
3.3.3.	<i>Business Process Model Creation</i>	80
3.3.4.	<i>Practical Example of Process Mapping</i>	82
3.3.5.	<i>Strategic Applications of Models in Business Process Management and Reengineering</i>	84
3.4.	EXAMPLE OF APPLICATION OF PROPOSED INNOVATIVE SOLUTION FOR THE CHOICE OF BUSINESS PROCESS MODELING METHODOLOGY.....	87
3.5.	SUMMARY OF CHAPTER 3.....	92
	CONCLUSIONS, IMPLICATIONS AND FUTURE DIRECTIONS	93
	REFERENCES	97
	APPENDICES	107
	APPENDIX 1. APPLICATIONS OF BUSINESS PROCESS MODELING IN BUSINESS LIFE.....	107
	APPENDIX 2. STRUCTURED FIELD DOMAIN.....	109
	APPENDIX 3. QUESTIONER #1 FOR INTERVIEWS WITH TOP POSITIONS OF NORDI.....	116
	APPENDIX 4. QUESTIONER #2 FOR INTERVIEWS WITH ADMINISTRATIVE POSITIONS OF NORDI.....	118
	APPENDIX 5. QUESTIONER #3 FOR INTERVIEWS WITH EXPERIENCES RESEARCH PROJECT MANAGERS OF NORDI.....	119
	APPENDIX 6. QUESTIONER #4 FOR INTERVIEWS WITH RESEARCH PROJECT MANAGERS OF NORDI.....	121
	APPENDIX 7. BUSINESS PROCESS MODEL OF NORDI BY MEANS OF “IDEFO+SWIMLANES” METHODOLOGY ..	123
	APPENDIX 8. IMPROVEMENT SUGGESTIONS FOR NORDI.....	139
	APPENDIX 9. TOOLS SUPPORTING BUSINESS PROCESS MODELING METHODOLOGIES.....	141

INTRODUCTION

Master thesis is written on the topic called business process modeling. Its place inside such a managerial discipline as Business Process Management (BPM) is advocated. How business process modeling can be involved in Business Process Reengineering, particular case of BPM is also explained. At the same time the benefits of business process modeling in implementation of strategic goals of organization are revealed.

Nevertheless various problems exist which lead to difficulties in explaining to managers why business process modeling is so useful. These problems are analyzed from managerial point of view in the paper. The core issue of them all is found: concept of business process modeling methodology is not widely understood and thus used in practice; there is no answer in the literature on how to choose an appropriate business process modeling methodology in specific business case.

The main goal of the master thesis is to provide a solution for a choice of business process modeling methodology. During the research process it appeared to be necessary to develop an innovative solution for that. The main research question of the study is how to choose an appropriate business process modeling methodology in a certain business case. In order to give the answer to this question several issues were discussed: what to choose from, by what means to choose and how to make the choice.

One of the background ideas of the research was to translate complicated business process modeling concepts into managerial language. At the same time the master thesis is trying to show the value of business process modeling for management.

In order to support the theoretical outcomes of the thesis, case study for Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology was conducted. On its example several solutions are presented: how to apply business process modeling methodologies in practice; in which way business process models can be useful for BPM and BPR initiatives; how to apply

proposed innovative solution for a choice of business process modeling methodology.

The main outcome of the master thesis is innovative solution, which can support a choice of business process modeling methodology. Potential users of this tool are people with background in business process modeling and possibilities to collect required information about organization's business processes.

1. STATE-OF-THE-ART in BUSINESS PROCESS MODELING

1.1. Business Process Management and Reengineering Approach

Until 1990s managerial theory treated ‘company’ as a set of functional departments. At the same time one department was responsible for implementation of specific organization’s function and all of them collaborated in order to achieve the goals set. During 90s due to enormous efforts of Hammer, Champy, Davenport and other gurus the process approach to organizations’ work appeared. Departments implementing stiff functions stopped being a core issue in organizational management. The accent was shifted from how the work is divided between companies’ functions towards business processes, i.e. how the work is done (Brache 1992; Graham 1995; Hammer and Champy 2006).

Correspondent managerial theory reviews company as a set of business processes aimed on achievement of certain results. These business processes bring value to the organization. They are connected with goals of the company and implement them. Application of this theoretical approach into practice allowed real companies achieve enormous business results: satisfy clients better, reduce costs, increase productivity, raise quality, reduce redundancy, increase clearness of their business, thus allowing management to set and reach more ambitious goals (Hammer 1996; Kohlbacher 2010; Lee and Dale 1998).

Main theory emerged in this managerial domain is business process management (BPM). Interest in this discipline grows during recent years thus various managerial theories connected with it are widely developed (Recker et al. 2009). One of business process management particular cases is well-known business process reengineering (BPR) (Choi and Chan 1997; Hill 2007; Melão and Pidd 2000).

The aim of business process management is to help managers control their businesses, organizations, departments (Eicker, Kochbeck, and Schuler 2008; Lee and Dale 1998; Smart, Maddern, and Maull 2008; Trkman 2009). In studies on business process management researchers have developed theoretical support to managerial decisions and propose innovation solutions, i.e. some tools helping to make these decisions. The field is still young; therefore not all innovation solutions are suggested yet.

Business process reengineering is more concerned with revolutionary restructuring of organization. It starts from an analysis of how the organization currently works. Then some break-through concept is suggested to solve issues found in the current state, new business processes are designed and then launched in the organization. Everything is significantly changed in order to achieve competent advantages in business process implementation, which will be not soon caught up by any followers (Al-Mashari and Zairi 2000; Davenport and Short 1990; Hammer 1996; Hammer and Champy 2006; Revenaugh 1994). Business process reengineering techniques are used in business process management for supporting minor modifications as well (Coskun et al. 2008; Graham 1995).

In the foundation of business process management lays business process modeling. This approach is a core part of this managerial discipline. As a particular case business process modeling is widely used in business process reengineering (Brache 1992, Graham 1995; Lu and Sadiq 2007). Different managerial reviews show its importance to a modern business (Neubauer 2009; Schmietendorf 2008; Wolf and Harmon 2010). Applications of business process modeling are going to be presented in the following paragraph; revealing benefits of this approach and its usefulness for management.

1.2. Literature Overview on Business Process Modeling

1.2.1. Strategic Benefits of Business Process Modeling

Before explaining the benefits of business process modeling it is important to state what this concept means. According to various researchers (Bandara, Gable, and Rosemann 2005; Bridgeland and Zahavi 2008; Graham 1995; Melão and Pidd 2000), business process modeling is a collection of activities aimed on representing processes of a company. Under this discipline this representation is commonly done in the form of such well-known managerial tool as business process models. They encompass all graphical representation of business processes; data, resources, and other related elements. Business process model describes tasks and the ordering of these tasks: what work is performed and when it is performed; it also captures who performs the tasks.

Business process modeling can be used for following purposes: communication, training and learning, persuasion and selling, analysis, managing compliance, as requirements for developing software, executing directly as software, and knowledge management and reuse (Bandara, Gable, and Rosemann 2005; Bridgeland and Zahavi 2008). More information about various applications of business process modeling in business life is presented in Appendix 1. This information might be useful for those who are searching detailed information on other applications of this approach.

This master thesis is more concerned with strategic importance of business process modeling due to research questions formulated later on and case study selected. Thus below connection of business process modeling with company's strategy and its vitality to strategy implementation is discussed.

Business process modeling is the first and most important step of business process management (Brache 1992; Graham 1995; Lu and Sadiq 2007). That is so due to several reasons and the concept of business process management itself.

In business process management business process modeling is used in order to map business processes of the organization. In other words the business processes are graphically represented and transferred onto a paper or into a system (Eicker, Kochbeck, and Schuler 2008; Lee and Dale 1998; Smart, Maddern, and Maull 2008; Trkman 2009). It is difficult for the managers of an organization to discuss business processes before they become visible in form of diagrams. Business process models help managers to communicate and express their ideas in a clear and precise way. It is also easy to teach employees how the processes of the organization work by showing them business process diagrams. Business process models can be analyzed and help to see how the processes can be optimized. Other positive outcomes also arise, which are discussed in Appendix 1 in more details.

One of the central ideas of business process management at the same time is to reveal the strategic goals of an organization, divide them into sub goals, assure that they are SMART, etc. Balanced score cards (BSC) usually serve for that reasons (Chavan 2009; Lawrie and Cobbold 2004; Witcher and Chau 2007). This managerial tool allows its users to display how the goals of organization are implemented in its business processes. Key performance indicators (KPI) are attached to every process in the organization allowing control the business and implementation of the goals (Chavan 2009; del-Rey-Chamorro et al. 2003; Parmenter 2007). This reveals the connection of business processes and their modeling with organization's strategy.

Business process reengineering needs business process modeling for picturing the current state of business processes in organization. After finding out the current state it is much simpler to see what exactly should be changed and what can be postponed. At the same time business process modeling allows to control the changes in organization (Al-Mashari and Zairi 2000; Davenport and Short 1990; Hammer 1996; Hammer and Champy 2006; Revenaugh 1994). With the help of future business process models it is easier to explain the management's intentions to employees and follow the execution of the change plan (Belmiro, Rentes, Gardiner, and Simmons 2000; Bridgeland and Zahavi 2008; Manganelli and Klein

1994). This shows how business process modeling ideas can support the strategic changes in organization. Hammer and Champy (2006) discuss in details achievement in this area of such world leading companies as Ford, Kodak, Union Carbide, Duke Power, IBM, Deere and provide dozens of other examples.

Describing in more details importance of business process modeling for strategy and support of its implementation this thesis states that this benefit is one of the most important for any modern company. These ideas will find their reflection in following discussions in master thesis and case study done.

1.2.2. Key Problems of Business Process Modeling

In order to introduce reader with the selected field domain, the literature overview was done and classification of terms and concepts, standards and notations with their various interpretations used in the field of research was created. This information is provided in the Appendix 2. This information will help reader with previous background on business process modeling to structure all the concepts existing in this field. For a person without any understanding of business process modeling the provided information will help to establish a base for future developing of understanding.

Appendix 2 discusses fundamental things connected with business process modeling, which are usually not understood by people who have no previous background in this field. They are connected with the process of models creation itself; people involved in this process and other main issues. Nevertheless in order not to overload the first chapter of the master thesis and not to discuss in detail very broad issues here, the decision was made to transfer this information to the Appendix 2 and leave references in the text of master thesis on more detailed discussion whenever needed.

Lots of problems exist in business process modeling which have to be solved. Unfortunately, there is no study representing all of them together, but as soon as writers with vast experience in the field in question, for example, Bridgeland and Zahavi (2008), Kalpic and Bernus (2002), Trkman (2009), start discussion about business process modeling they can't omit different difficulties concerning it and usually this enumeration is not easy to stop.

Further in the master thesis the fact when business process modeling is not used in real business life is named for the sake of space and clarity – disuse of business process modeling. The cases when business process modeling is used but with significant errors harming organization more when helping are called misuse of business process modeling. Thus the term “disuse and misuse of business process modeling” comprising these both cases is constructed. All the causes of disuse

and misuse of business process modeling were divided in this master thesis according with managerial perception of the issues into three groups: “people”, “process” and “theoretical support”, which are explained in details below.

People-Related Problems in Business Process Modeling

Very leading article (Fernández et al. 2009) represents existing problems in business process modeling. Most of them are concentrated around necessity of specially educated person, so-called business analysis, for creating business process model (for more information consult Appendix 2). But this expert is expensive for the organization as he/she has to be recruited from outside and usually there is lack of such experts inside the organization.

An ordinary business person, who is not familiar with business process modeling, is not able to use difficult methodologies which are usually used for such purposes (Fernández et al. 2009). This creates cases of misuse of existing notations which leads to consequent problems.

The accompanying economical problems comprise, for example, the costs of educating a person to be able to use difficult methodologies and to be capable of creating an applicable business process model. Corresponding costs of teaching a business person not familiar with business process modeling to read and use business process models in business life are high. This process is also quite time-consuming and difficult which creates additional resistance of business representatives against using and learning how to use business process modeling results. Due to the same reasons self-education is complicated and time-consuming as well.

One more important consideration presented by Lu and Sadiq (2007) urges to think about importance of educating business process owners: industry research showed that they are more often business process modelers than any qualified technical specialist. Business process owners are in vast majority just ordinary business people who have no or very limited understanding of business process

modeling peculiarities. Therefore a quick guide with comprehensible explanation of how to start and proceed in business process modeling is of great potential use in the research field in question.

Special formal model interpretation skills are also required in order to understand the results of business process modeling (Kalpic and Bernus 2002). It is not possible to interpret the content of information presented in some formal model, created with the use of some modeling techniques or language, without special preliminary training, which will provide special interpreting skills. Mendling and Strembeck (2008) exploring process model understandability have proved that there is a need for guidelines for understandable process models creation and a need for training because the more experience you have in modeling the easier understanding will be.

Process-Related Problems in Business Process Modeling

Lots of difficulties arise while capturing the information about business processes, which involves intense communication between model designer and business process owner. Kalpic and Bernus (2002) confirm that it is extremely difficult for people to express their implicit knowledge. Therefore capturing the information about the process is a very complicated and time-consuming task. The design of business process models is usually a long and iterative process, which includes lots of interaction between model designer and process owner. The designer and process owner continue their meetings and iteratively build business process models until the models fully represent the reality (for more information on business process modeling process consult Appendix 2).

In this respect ability to absorb and analyze the information is needed from model designer as he is listening to process owner and capturing his knowledge. The ability to understand the model is usually required from process owner as he/she discusses intermediate results with model designer and comments them. This knowledge process owner usually gets from model designer's instructions and

explanations. Lots of misunderstandings can occur during this process so it might start consuming more time and efforts and is difficult to plan.

Paraphrasing Trkman (2009) we can say that the field of business process modeling is quite complicated because even taking the best practices and copying them to another case won't bring the same benefits, if anything at all. Nevertheless best-practice approaches towards business process modeling can help to avoid pitfalls. Therefore need for different approaches in different circumstances exist. That's why there is a necessity to select different methodologies for business process modeling and a set of criteria in order to choose between them.

Failures of Theoretical Support in Business Process Modeling

Lack of theoretical base in the field leads to difficulties in persuasion of business people that business process modeling is useful and effective tool, which can bring definite business value (Trkman 2009). Big confusion in definitions exists (for more information consult Appendix 2).

It is very difficult to find a common definition in the literature for 'business process modeling methodology', even though the term is used in some literature (Toussaint, Bakker, and Groenewegen 1997; Mentzas, Halaris, and Kavadias 2001; Lu and Sadiq 2007). Quite often the term is used to describe different notions. On the other hand, quite often the meaning or idea of methodology is only mentioned, but there is not named as. Lots of additional problems connected with methodologies arise as well (Rosemann 2006).

Theories in business process modeling are not structured due to rapid growth and development in the field and a wide variety of literature and technologies connected with it. Therefore it is easy to get lost in all the variety of technologies, which are constantly appearing and changing. Organizations and companies wish to find the best possible technology which reflects the way they understand their business (Smith 2003), but fail in that. Therefore, this research picked up the idea

of providing business people with recommendations on how to orient in the vast amount of existing information. There is a great need for a simple guide which provides clear set of instructions for organizations on how to easily choose an appropriate and suitable modeling methodology and start successfully applying it into practice.

Cause-and-Effect Diagram Summarizing Key Problems of Business Process Modeling

Despite its obvious values, business process modeling is not widely used in business life. The main issue in business process modeling from managerial point of view is the possible disuse and misuse due to wrong application of the methodologies, which arises from the complicated nature of the field.

In order to summarize the key problems presented in this section, the following cause-and-effect diagram was created (figure 1). The figure describes the main problems from managerial point of view. Unfortunately, there is no study representing all of them together, but as soon as writers with vast experience in the field start discussing about business process modeling, they can't omit different difficulties concerning it. Thus there was a possibility to collect all this drops during wide literature review performed.

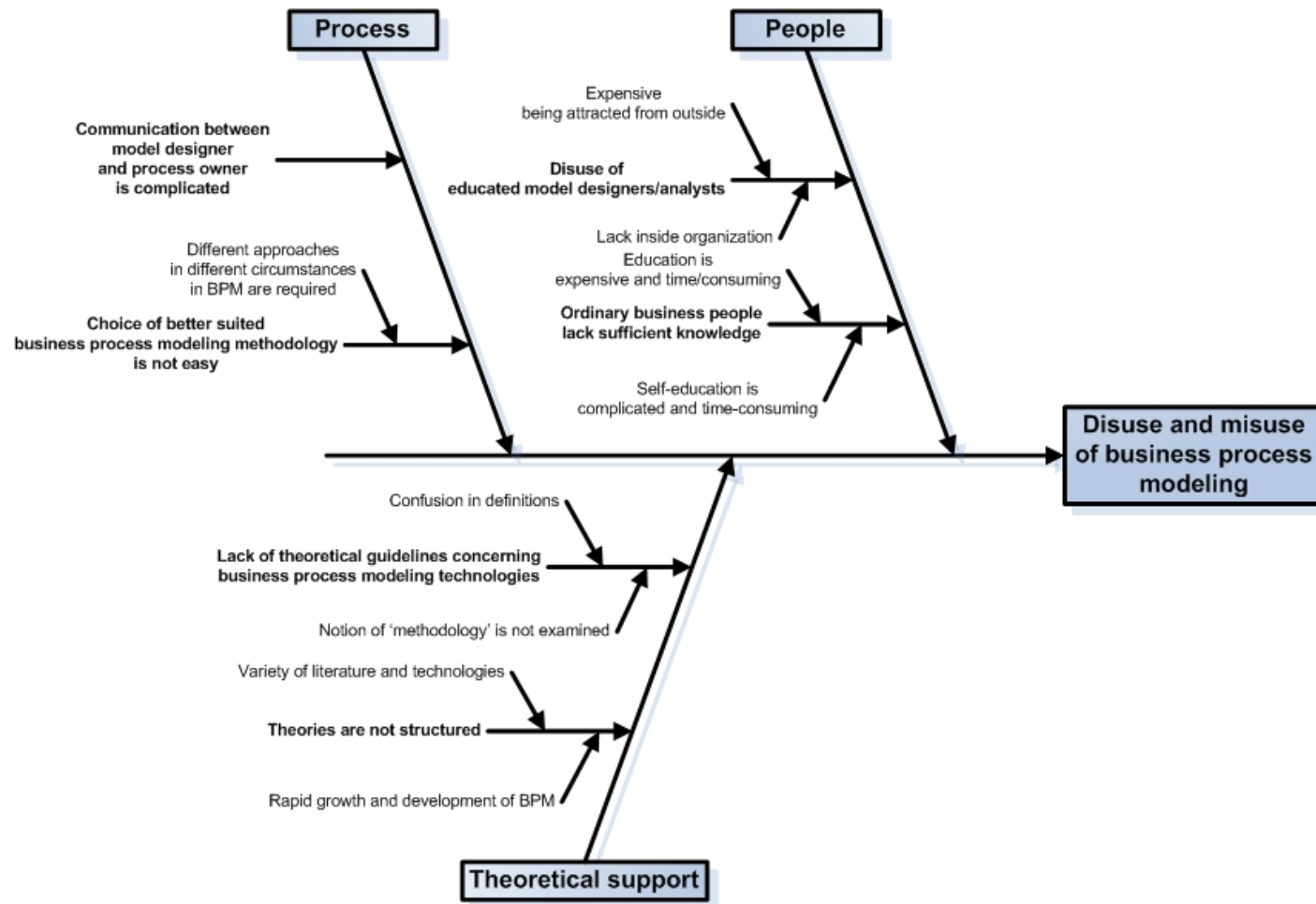


Figure 1. Problems causing disuse and misuse of business process modeling

This figure should be interpreted as following according to usual rules of reading cause-and-effect diagrams. There exist three main groups of problems causing disuse and misuse of business process modeling. They are ‘process’, ‘people’ and ‘theoretical support’ connected problems. For example, in process-related issues causing disuse and misuse of business process modeling following ones can be distinguished: “communication between model designer and process owner is complicated” (consult Appendix 2 for detailed explanation on ‘model designer’ and ‘process owner’ term and aspects of their communication involved in business process modeling) and “choice of better suited business process modeling methodology is not easy”. The second level problem causing the problem called “choice of better suited business process modeling methodology is not easy” exist – “different approaches in different circumstances in BPM are required.

Analysis of Key Problems of Business Process Modeling

Analysis of the reasons leading to misuse and disuse of business process modeling, from the managerial point of view, shows that there is no cheap and obvious solution for the problem. Therefore a deeper analysis of the problems is required and performed.

What can be the leading factor of problems in communication between model designer and process owner? One of them is definitely the fact that process owner knows nothing or little about business process modeling methodologies because even the concept of business process modeling methodology is not widely understood and used in practice.

Why the choice of suited business process modeling methodology is not easy? First of all, it is due to the fact mentioned in the previous paragraph, but also it is affected by the fact that there is no answer in the literature on how to choose an appropriate business process modeling methodology in a specific business case.

Knowing the concept of business process modeling very deep an analysis was conducted of all the managerial problems mentioned in this section in the described manner. After that it was found out that all these problems are based on several connected issues: concept of business process modeling methodology is not widely understood and thus used on practice, there is no answer in the literature on how to choose an appropriate business process modeling methodology in specific business case.

1.2.3. Business Process Modeling Methodologies

Before introducing readers to research problem following directly from the key problems in business process modeling discussed above, it is wise to present the concept which is connected with fundamental reasons of these problems and which is the central concept of the master thesis. Therefore this section is totally devoted to notion of ‘business process modeling methodology’, examples of those and different approaches existing in the literature.

The term ‘business process modeling methodology’ itself is not widely used in the literature. Lots of reviewed sources use it without providing any definitions (Toussaint, Bakker, and Groenewegen 1997; Mentzas, Halaris, and Kavadias 2001; Lu and Sadiq 2007). One article brings more use than the others (Toussaint, Bakker, and Groenewegen 1997). The authors are not concerned with terminology and they call business process modeling techniques differently from time to time, rather often use the term ‘methodology’. Despite this fact it is possible to get an understanding of the term ‘methodology’ and feel the difference between it and ‘technique’.

The best definitions existing in various sources are following. Chackland (1991, quoted in Kettinger, Teng and Guha 1997, 58) calls methodology “a collection of problem-solving methods governed by a set of principles and a common philosophy for solving targeted problems”. Barbara, Gable, and Rosemann (2005) define modeling methodology as “a detailed set of instructions that describes and guides the process of modeling”. It is important to make a distinction between a business process methodology and business process technique. More information can be found in the Appendix 2.

Obviously these definitions are quite complicated. Paraphrasing them in simple words, business process modeling methodology means a way how business process models should be created, which ideas should be followed, which sequences of step should be used, which diagrams types (complemented with the

rules how to create them) should be selected on every step. This interpretation of the concept is going to be referred throughout the paper.

Various methodologies exist. Some examples are: Flow Charts, Data Flow Diagrams, Control Flow Diagrams, Functional Flow Block Diagrams, Gantt/PERT Diagrams, IDEF, UML, BPMN (Dufresne and Martin 2003). They all have different history of emerging.

Usually business process modeling methodology is developed when some modeling technique becomes a standard as, for example, happened with IDEF, UML, BPMN. Methodology based on this technique is suggested by organization, which develops this standard and introduces it. In this case methodology will be a sequence of steps which one may implement in order to create a good business process model using only this technique. Nevertheless sometimes due to some circumstances, usually tool support or researches held, business process modeling methodology is engaging several techniques.

Different approaches for business process modeling methodology selection exist. How to do the choice reasonably is the main question of this study. Lots of researches have investigated the selection of various business process modeling techniques (Damij 2007; Filipowska et al. 2009; Shen et al. 2004) or even methodologies. Different criteria were suggested, which we are going to explore in theoretical part of the study as well.

1.3. Research Problem, Objectives, Delimitations

As the conducted analysis of existing problems revealed, the key reasons causing misuse and disuse of business process modeling are as following. First of all, concept of business process modeling methodology is not widely understood and thus used on practice. Secondly, there is no answer in the literature on how to choose an appropriate business process modeling methodology in specific business case.

Thus the following question was formulated which later on became a research question for the master thesis: *how to choose business process modeling methodology in specific business case*. In order to give the answer on this question several issues should be discussed: what to choose from, by what means to choose and how to make the choice. They were reformulated into a set of sub-questions to answer:

1. What would be an appropriate (from business perspective) set of business process modeling methodologies to choose from?
2. What would be a set of criteria helping to choose business process modeling methodology for a specific business case?
3. How to choose business process modeling from the set (1) using the criteria (2)?

This research question and its sub-questions can be reformulated in the form of objectives. Thus the main goal of the master thesis is *to support a choice of business process modeling methodology in specific business case*. Respectively several objectives should be reached before this goal will be achieved:

1. Define an appropriate set (from business perspective) set of business process modeling methodologies to choose from.

2. Construct a set of criteria supporting choice of business process modeling methodology in a specific business case.
3. Explain how to choose business process modeling from the set (1) using the criteria (2)?

Obviously this study had several delimitations. First of all, it is not possible to analyze all the business process modeling methodologies existing. Therefore the choice was made and several leaders in the opinion of modern researchers were identified. At the same time for selection of methodologies for analysis business perspective was selected, which brought certain restrictions and defined the choice.

Second group of delimitations was connected with a case study. Process of business process modeling is consuming big amount of resources, including time (for explanation consult Appendix 2). Therefore search for a case company was done among the SMEs and departments, which hare easier to describe due to their relatively small size.

Also the important issue was eagerness of a company to participate in the research. The anticipated amount of interviews was more than 10 and quantity of interviewees more than 7 people. Of course this became a big issue to lots of potential participants due to the crisis.

At the same time there were no possibility to attract several case companies under the limitations of master thesis project therefore the organization with quite special business process structure was searched for. Meaning of this will be more explained below and advantages of the case company choice done also will become obvious.

1.4. Research Methodology and Organization of the Study

Managerial studies on business process reengineering have discussed different methodologies for implementing a reengineering process. They have introduced to the public lots of criteria for making a choice between the methodologies. In this master thesis the theory is reflected in the comparison of business process modeling methodologies by means of certain criteria.

Business process management is used to provide visual tools for managers in order to support their usage of theoretical concepts, such as business process models, balance score cards, etc. That's why in this master thesis also a special innovative solution is developed – a special tool supporting the choice of business process modeling methodology. There were no analogies of such kind of tools found in the literature comparing various business process modeling concepts. At the same time the tool helps to make more sensible allocations of money and other resources in the organization.

The research methodology was created after analysis of several researches with a case study held in the field (Fernández et al. 2009; Kapcic and Bernus 2002; Trkman 2009). The research design is shown in figure 2. It represents the whole research idea starting from origins of theoretical framework and ending with additional practical outcomes.

Literature overview gave a foundation to a structure field domain presented in Appendix 2. This information was sufficient enough to construct a whole theoretical framework. At the same time central concept of the study was derived from the literature – business process modeling methodology.

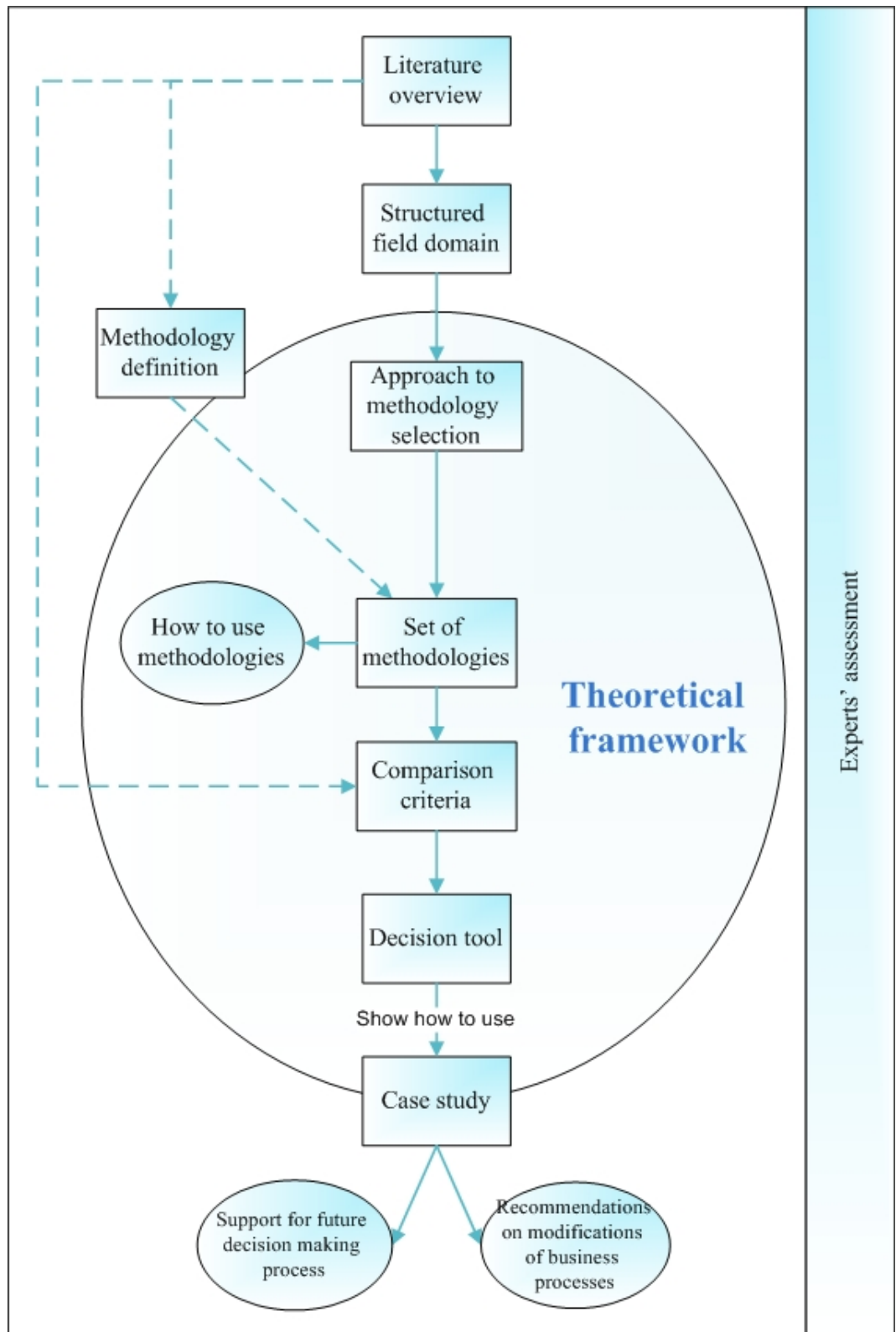


Figure 2. Research design

In the following theoretical chapter the approach to selecting business process modeling methodologies is going to be discussed. After which the choice of methodologies for further analysis is going to be done. Description of business process mapping in general and how it is realized by selected methodologies will be represented as well. This description will provide potential users proposed solutions with sufficient information on how to use selected methodologies in real life.

Analysis of the literature will also provide adequate base for constructing a comparison criteria for the selection of business process modeling methodology. Plusses and minuses of every methodology in respect to all criteria items are revealed. Recommendations and special decision tree are going to be built in order to provide business user with support on how to use this set of criteria.

The case study shows how all the theoretical constructs of the paper can be used in practice. It was conducted according to recommendations of similar constructed studies (Kapcic and Bernus 2002; Trkman 2009). On example of Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology the usage of the innovative solution was shown. The answer was at the same time checked by applying different business process modeling methodologies to the business processes of NORDI. Additional outcomes to the case organization in question were developed: support for future decision making process and recommendations on modifications of business processes.

The outcomes of the paper can be a useful support in a task of choosing a business process modeling methodology. At the same time the innovative solution requires the user to have some background in business process modeling. The potential user is a person who is going to create a model of business processes of an organization. Therefore this person should be familiar with the concepts of business process management, business process reengineering, business process modeling and be able to create business process models. Additional knowledge of business processes of organization is required. If the user lacks the knowledge, then he or she should be able to get information needed for applying of innovative

solution from the people in the organization with sufficient knowledge. The suggested innovative solution allows to make this phase quickly and efficient.

In addition, the research is going to be assessed by experts in the field which will confirm its value and applicability.

1.5. Summary of Chapter 1

The main aim of the first chapter is to provide overview of the trends existing in the literature about research in the field in question, to state the place of the problem to be solved in this knowledge and to describe the solution which will follow.

The chapter starts from description of business process modeling background. Its place in business process management and its particular case business process reengineering is stated.

Then literature overview follows. Various benefits of business process modeling are described. The importance of this concept for a company's strategy and implementation of the strategy is explained. Examples of engagement of business process modeling in business process management, and thus in business process reengineering shown.

Next step of the literature overview is a discussion of the key problems within the field of business process modeling. The analysis of problems is done from managerial point of view. Nevertheless, the deep understanding of the issues involved allowed distinguishing main reasons lying in the roots of all these problems: concept of business process modeling methodology is not widely understood and thus used on practice. There is no answer in the literature on how to choose an appropriate business process modeling methodology in specific business case.

Finally, the literature overview is concluded with discussion of main concept of the master thesis – business process modeling methodology. Researches held in this area and involving comparison of related concepts are mentioned.

Research problem of the master thesis is stated in its turn. Research questions and objectives are formulated. Delimitations of the study are discussed in details. References for a further explanation of those in the master thesis are done as well.

The chapter also provided the research methodology and organization of the study. The sequence of the steps in the theoretical study of the following chapter is described. The main specifics of the case study are mentioned. At the same time the references provided on the literature there the similar research methodologies took place and analogous case studies are held. People and their qualities, to whom the developed innovative solution in the master thesis is developed and who are its potential users, are widely explained.

2. Choice of Business Process Modeling Methodology

2.1. Grounds for Innovative Solution Development

There might have been different approaches to the search of an answer to the master thesis main research question – how to choose an appropriate business process modeling methodology in particular business case. In this section the choice of the selected approach is justified and explained.

Managerial studies on Business Process Reengineering are used to discuss different methodologies of implementing a reengineering process. They have introduced to the public lots of criteria for making a choice between the methodologies. In the master thesis this managerial theory is reflected in business process modeling methodologies. Their comparison by means of certain criteria is also discussed.

Business Process Management is used to provide visual tools for managers in order to support their usage of theoretical concepts, such as business process models, balance score cards, etc. That is why a special innovative solution is developed in this master's thesis – a special tool supporting the choice of business process modeling methodology.

Business process modeling is an approach within Business Process Management. As described in the first chapter, business process modeling is crucial for the implementation of Business Process Reengineering as well. That is why these reasons led to decision about creating an innovative solution for the research problem. One more cause for that was the fact that approaches existing in previous studies didn't work for the case company selected, i.e. Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology.

Suggestions for a choice of different Business Process Management concepts existing in the literature were analyzed. The solutions proposed by Lam (1997, quoted in Damij 2007), Avison and Fitzgerald (2003, quoted in Damij 2007),

Damij (2007), Flipowska et al. (2009), Shen et al. (2004) are most representative and tightly correlate with the selected in the study field domain. They all have the similar advantage that comparison of business process modeling methodologies or similar concepts is done in different perspectives, from different points of view. For example, in case of user-friendliness point of view, such issue as understandability is important. If the perspective of software support is analyzed, then the fact how many tools support this methodology is crucial. At the same time only selected studies, for example Flipowska et al. (2009) try to create some kind of order in the criteria set by distinguishing different groups.

The main research question though is concerned more with particular criteria elements related to business case. In aspect of business process modeling dealing with business processes representation it means that criteria should describe business processes of organization. Searched criteria should compare different methodologies on expressing capabilities for different elements of business processes of the selected organization. At the same time NORDI itself was interested in choice of business process modeling methodology which is most appropriate for business processes of research centre. Thus the balance between theoretical and empirical part is held.

At the same time one more additional disadvantage is common to existing solutions for a choice of business process modeling methodology: some criteria for methodologies comparison is suggested but guidelines for this criteria usage are weak or not present at all. Thus for NORDI representatives possibilities of application of such kind of solutions were not obvious. The special need from theoretical and empirical perspective emerges – to provide a tool supporting a choice of business process modeling methodology, based on constructed criteria.

The last but not the least minus of existing approaches discussed is the fact that most of criteria there are formulated in quite technical way. That is why their understanding is difficult for a business user. The need for theoretical and empirical study to translate even suitable criteria for the master thesis solution into business language appeared. This necessity is well correlated with one of the

background research goals – to explain difficult IT concepts related to business process modeling in understandable language.

2.2. Appropriate Set of Business Process Modeling Methodologies to Choose From

2.2.1. Approach to Selection of Methodology from Business Perspective

Various methodologies exist in business process modeling. There is a need firstly to define some kind of pattern for selection of appropriate methodologies for the research reasons. Several issues are important in this respect from the master thesis' point of view.

First issue was a necessity to assure master thesis value in current moment and in the nearest future. In this respect, obviously, current and future leaders among business process modeling methodologies should be searched for. For that reason the decision to address reviews of analytical agencies is made. This provides information about which methodologies are widely used nowadays, what are the trends in this set and which ones are most likely to be used in nearest future.

A second issue is the selected and stated in research methodology description business perspective. This point of view is taken because of the managerial and business direction of the research, since master thesis is written for the “Master of International Technology and Innovation Management” program. Also so-called business perspective better suites needs of the case organization – Northern Dimension Research Centre (NORDI), where managers are interested in methodologies which are well-known, can be with less amount of efforts understood by process owners (who are they reader can find in Appendix 2) and are supported by different software tools so the usage of methodologies would be more conformable.

The business perspective selected concluded three points. First of all, standardization is important, i.e. if the methodology is recognized as standard then there will be more literature and software support for it, it will be well-known among business process modeling community and fewer explanations in

communication involving corresponding business process models will be needed (Repin 2001).

Second point is so-called user-friendliness. This perspective's prism measures how understandable methodology is for its potential users. Methodology should be easily learned by future model designers. At the same time it is beneficial if methodology can be easier explained to process owners (more information about designers and process owners can be found in Appendix 2).

Third point is standardization. Availability of tools supporting business process modeling methodology is very important in business life. Tool can make modeling easier, models modifications more comfortable. The more tools supporting selected methodology exist the easier the process of selection of the most appropriate one for the organization will be.

According to Bridgeland and Zahavi (2008, xii) standards are very important in business process modeling. The most obvious reason is that business process models created by one person should be understood by others. Of course, if the former uses standards in business process modeling then minimum additional explanations is required for a person familiar with this standard in order to be able to read and interpret the diagrams created.

To summarize, the selected approach toward constructing of appropriate set of business process modeling methodologies to choose from in this master thesis looks as following. First the whole set of existing methodologies is checked. Then business perspective is used as a prism or funnel to pick up the most relevant methodology for the study. In the end the smaller set of current and future leaders in whole methodologies set is found. This small group of methodologies is discussed, analyzed and compared further in the study.

2.2.2. Current and Future Methodologies-Leaders

Various business process modeling methodologies exist. Some examples of them are: Flow Charts, Data Flow Diagrams, Control Flow Diagrams, Functional Flow Block Diagrams, Gantt/PERT Diagrams, IDEF, UML, BPMN (Dufresne and Martin 2003). They all have different history of emerging.

In the previous section the approach of this master thesis towards choice of methodologies for analysis was stated. The whole set was going to be reduced by examination under business perspective. The latter includes several issues: standardization, user-friendliness and software support.

As it usually happens with everything in IT field in the 1980s and 1990s, there were just a few business modeling standards (Bridgeland and Zahavi 2008). But even though some standards existed they were not widely used. On contrarily during recent year lots of standards have emerged. They are widely used nowadays.

Rational Software Corporation initiated development of the Unified Modeling Language (UML) in the 1990s. Object Management Group adopted UML as a standard in 1997 (Ko, Lee, and Lee 2009).

IDEF was developed also in 1980s by the US Department of Defense (DoD). According to some authors IDEF0 is the most commonly supported methodology (Yu and Wright, 1997). Starting from that period the correspondent methodology is believed to be the most popular and lots of modifications appeared. The most popular one is to supplement IDEF0 with some techniques allowing sufficient representation of sequential processes on the lower levels of hierarchy of business processes (Kalpic and Bernus 2002; Trkman 2009). In order to support simplicity in modern consulting Swimlanes are used as such kind of technique.

Lots of modifications are introduced to it. The most popular one is to supplement IDEF0 with some techniques allowing sufficient representation of sequential processes on the lower levels of hierarchy of business processes (Kalpic and

Bernus 2002). In order to support simplicity in modern consulting Swimlanes are used as such kind of technique.

BPMN (Business Process Model Notation) was originally published in 2004 by the organization Business Process Management Initiative. BPMN was officially adopted as an OMG specification in 2006, and updated in 2008 (Bridgeland and Zahavi 2008).

One more recent standard is suggested by IDS Sheer, EPC (Event-driven process chains). It is modern business process modeling trend in business life (IDS Sheer AG – Business Process Excellence b).

Thus from standardization point of view in business perspective following business process modeling methodologies can be chosen: UML, BPMN, EPC and IDEF with its various modifications, for example IDEF0+Swimlanes. At the same time IDEF-based methodologies are leading in analysis from this point of view.

Talking about software support of different business process modeling methodologies we can say that BPMN is unquestionable leader here if current and future trends are considered. BPMN is widely used nowadays (Oracle White Paper 2008). During 4 years of its existence most vendors have committed to supporting this standard and more of them are heading towards that.

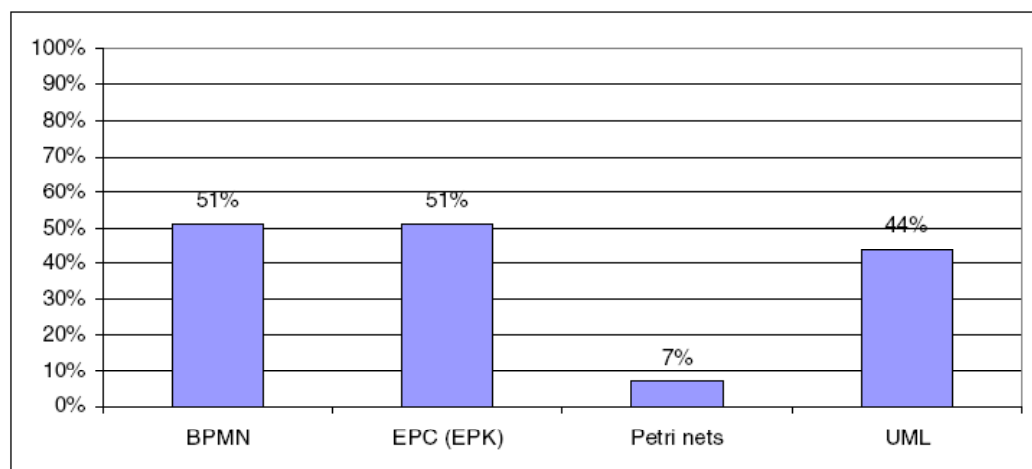


Figure 3. Supported notations, date of analysis: September 2008
(Schmietendorf 2008, 151)

Figure 3 represent the current situation on the business process modeling market according to Gartner analytical reviews (2008, quoted in Schmietendorf 2008). Figure shows how well the following methodologies are supported by software tools participated in the review (almost whole market). Percentage values means what amount of software tools supporting business process modeling from the whole amount of tools analyzed supports this or that methodology. For example, 51% of software tools on business process modeling market analyzed support BPMN. The same goes to EPC.

There still are tools which were not analyzed by Gartner agency. Nevertheless we can notice that BPMN and EPC are leading in this respect. UML holds following positions. Despite absence of information on IDEF-based methodologies knowledge of some quite cheap tools supporting IDEF0+Swimlanes (for more information consult Appendix XXX) allows us not to through this methodology away from the analysis. Especially assuming that these known tools are cheaper then corresponding for the support of other three methodologies. Special request from Northern Dimension Research Centre representatives to include some IDEF-based methodologies into analysis also took place, because IDEF logic was known by some motivated people.

Lots of studies discuss user-friendliness. They all agree that more or less all the four methodologies discussed are able to be understood by business people with some additional training. Some of them perform better in this respect, some worse. Nevertheless due to limitations of master thesis in time and scope there was a need to leave only three methodologies for analysis. Therefore in understandability perspective following issue was considered: UML is more oriented on software designing and simulation (Ng 2002). Thus the decision was made to pay more attention to its ancestor BPMN, which is more sharpened for business process modeling (Sparx Systems 2007).

To summarize following business process modeling methodologies were selected in the set of appropriate methodologies to make choice from for needs of this study:

1. Business process modeling methodology, which is based on EPC. It is developed by IDS Sheer and supported by ARIS. Therefore this methodology is called below as “EPC from ARIS”.
2. Business process modeling methodology, which is a combination of famous IDEF0 methodology supplemented with Swimlanes on lower levers of detalization. Therefore this methodology is called below as “IDEF0+Swimlanes”.
3. Business process modeling methodology, which is based on BPMN. It is supported by lots of business process modeling tools, for example becoming recently popular tool IBM WebSphere Business Modeler. This methodology is called below as “BPMN”.

2.2.3. Process Mapping Guidelines

Business process modeling allows capturing of aspects “which matters to businesses, such as business processes and policies, key performance indicators, business events and situations, and the corresponding response actions” (White 2006, 8). This process is usually called process mapping and it helps to identify where business problem lies and set a base for future process improvement, which can be done quickly and efficient (Wahli et al. 2007; White 2006). Process mapping is performed with the help of some business process modeling methodology.

The goal of business process modeling initiative defines requirements on process mapping. In general the model of business processes should clarify following issues (Repin 2001; Wahli et al. 2007):

- What is the process flow? In other words: which procedures, tasks should be implemented in order to obtain the result set; what is the consequence of these procedures; how procedures inside the business process are implemented?
- What are input documents and information for each business process procedure?
- What are output documents/information for each business process procedure?
- What are the resources used in the process? In other words, what are the resources necessary for implementation of every procedure?
- Which regulations on business process in question exist; what regulates implementation of every procedure?
- Which indexes characterize implementation of procedures and whole business process?

In order to create as accurate model as possible, “the business modeler/analyst must first document and sketch the current process flow, and list all of the key resources (people, equipment, material), business items (documents, records, products), and business rules (decision logic) included in the process” (Wahli et al. 2007, 78). Understanding of how the process actually works and where the actual problem lies is gained by interviewing each employee involved in the process – business process owners. Reviewing of available data reports is not the fundamental action in this work, but the information gathered there can support creation of business process model. The following items are recorded during this work:

- Activity inputs and outputs;
- Task variations and when those variations occur;
- Alternative tasks;
- Complete task descriptions;
- Roles associated with tasks.

When all the sufficient information is gathered business analyst is able to sketch out the process. For creating of a process draft, business process modeling tool can be used or it can also be simply drawn using pencil and paper (Wahli et al. 2007). When the sequence flow of business process is outlined, all the business items, which were used, modified, created during the processes are marked on the model as well. The resources and roles required to complete each of the activities are key elements of any process mapping initiative as well. The regulations existing for the implementation of business process in question should be reflected on the model as well. Under regulations we understand any regulations, description, recommendations, instructions and other information which guides or restricts the implementation of activities. They exist in vast amount in every organization.

Talking about how in-depth the process in question should be described, Kalpic and Bernus (2002) use and define the notion of “level of granularity of business process models”. In their opinion level of modeling granularity depends on modeling purpose. It is driven by understanding of current state of affairs and usually limited to the pragmatic needs of future models utilization.

Business modeling is an iterative process. Model of business process should be shown, explained to and discussed with process owner. After that it is corrected. And then the process repeats till model satisfies both business analyst and business process owner and is suitable for the current task representation of reality (Wahli et al. 2007; Kalpic and Bernus 2002).

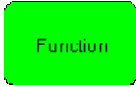


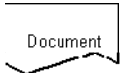
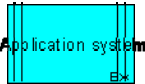

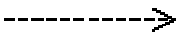
2.2.4. Process Mapping by Means of Leading Methodologies

In this section additional information about how process mapping should be performed with the usage for selected methodologies is represented. These rules are not overwriting the previous section. They just complement the general approach represented in that section with peculiarities of realization by different methodologies.

Process Mapping by Means of “EPC from ARIS” Methodology

The methodology in question is based on EPC (Event-driven process chains). It is developed by experts from German company IDS Sheer AG (Repin 2001). The methodology is supported by ARIS toolset produced by this vendor. Table 1 shows the main elements used in EPC notation. The table will be expanded with the description of the items.

Table 1. Objects used in EPC notations

Object name	Graphical representation
Function	
Event	
Organizational unit	
Document	
Application system	
Information cluster	
Workflow arrow	

Object name	Graphical representation
Logical “AND”	⋀
Logical “OR”	⋁
Logical “XOR”	⊗

Lots of additional elements can be used in diagrams of this type. This usually affects the readability, e.g. understandability of the model. Figure 4 shows the simplest business processes modeled in EPC notation.

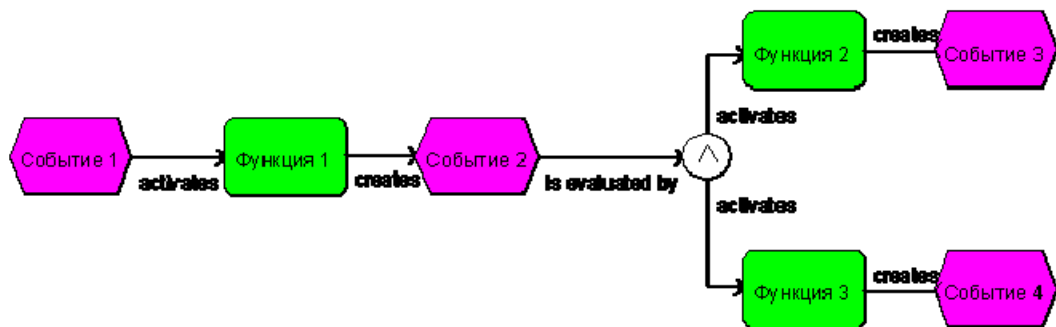


Figure 4. Simplest business process, EPC notation (Repin 2001)

The main rules used are:

- Each function is initiated by an event and ends with event,
- Every function can have only one input arrow, starting it, and only one output arrow, symbolizing its finalization.

Process Mapping by Means of “IDEF0+Swimlanes” Methodology

This methodology is a combination of well-known IDEF methodology supplemented with Swimlanes on lower levels of detalization. On the upper levels of model the IDEF0 notation is used. Figure 5 shows an IDEF Meta Model which is a rule in IDEF0 and IDEF0+Swimlanes by extension.

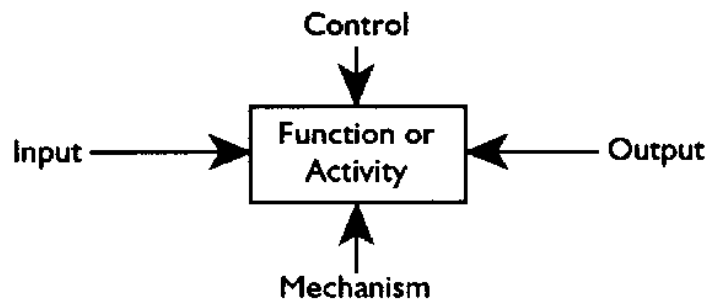


Figure 5. IDEF Meta Model (Hanrahan 1995)

Then the principle of detalization is applied. Hierarchy of diagrams is shown in Figure 6.

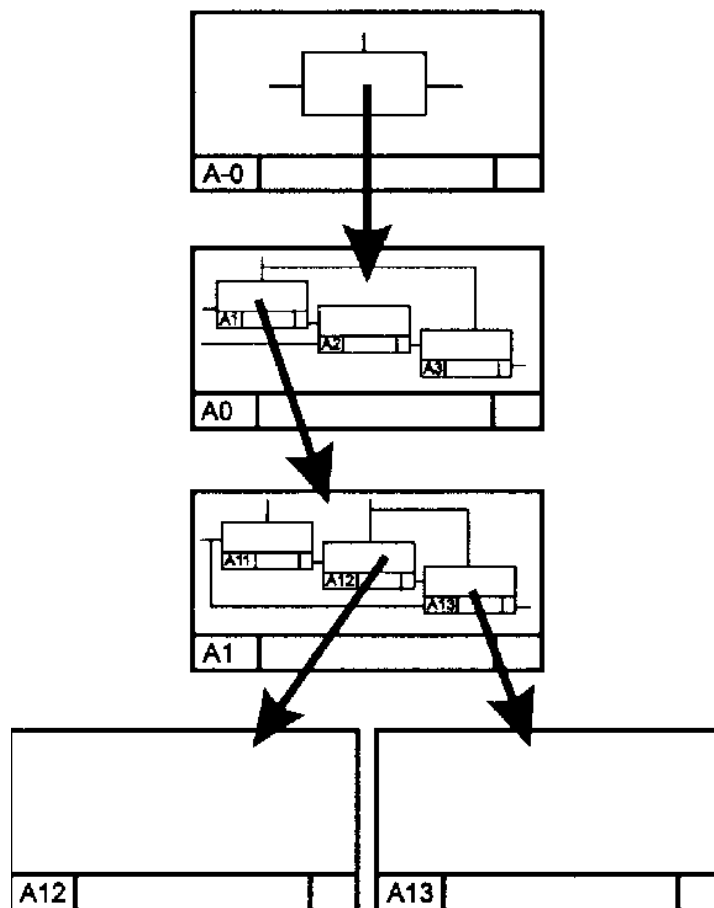


Figure 6. Hierarchical View of IDEF0 Modeling (Hanrahan 1995)

Figure 7 shows the standard process in IDEF0 notation.

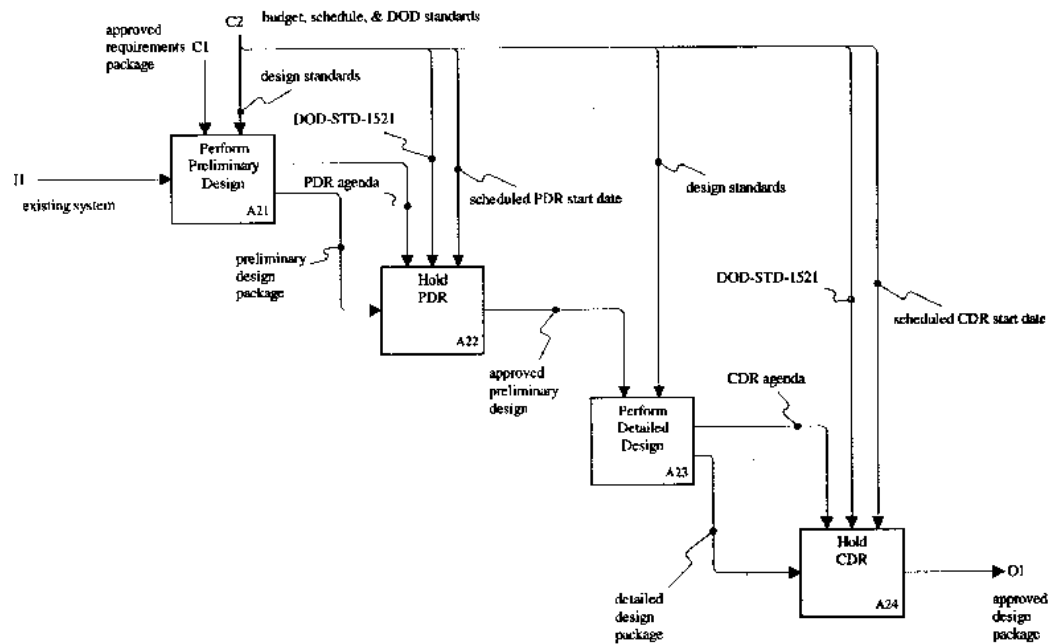


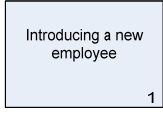

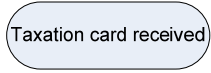

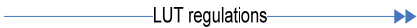
Figure 7. Example of the process in IDEF0 notation (Hanrahan 1995)

Swimlanes is a normal workflow type representation of the process; those blocks are shown in different rows or columns called “Swimlanes” in correspondence with roles, which are responsible for implementation of them.

Guidelines according the usage of functional models from Kalpic and Bernus (2002), they were using IDEF0 themselves, are as following. These models are well-suited for describing of tasks where main aim is to identify the processes and co-operation between them rather than develop step-by-step process model. The former is useful and the latter is quite difficult in the processes there the variety of sequences of steps may occur according to nature of their activities. Of course, subsequent processes can be described using other models supporting building of step-by-step sequence if the need for that exists. No restrictions are set on this.

Following elements are used in IDEF0+Swimlanes notation (table 2):

Table 2. Objects used in IDEF0+Swimlanes notations

Object name	Graphical representation
Process	
Decision point	
Event (starting or terminating the process)	
Transition between process or decision blocks	
Flow of documents	

Process Mapping by Means of “BPMN” Methodology

This methodology is based on BPMN (Business Process Modeling Notation). It is supported by lots of business process modeling tools, for example becoming recently popular tool IBM **WebSphere Business Modeler**.

IBM doesn't suggest any methodology recommendations except for following (White 2006, 16-17):

- A process is chronological. Accurate models must therefore be oriented on a time line (in general, from left to right in sequence).
- Processes begin with triggering events, and work their way through to significant business results.

- All tasks or activities are assigned to roles that are meaningful to people in the business. Be sure you have captured all relevant roles, which may sometimes be outside of the client's company.
- Flow modeling should display how objects or data (or both) are transferred and where they are going. The majority of business problems stem from interdependent relationships, which are best identified in a flow chart.
- A process can be modeled in a hierarchical fashion and can be viewed from many levels. That is, processes can contain other processes.
- The choices made for decisions, which occur within a process, determine which of all potential paths will be taken.

Therefore we are building description of this methodology on BPMN standard recommendations. Figure 8 is representing the typical process in BPMN notation.

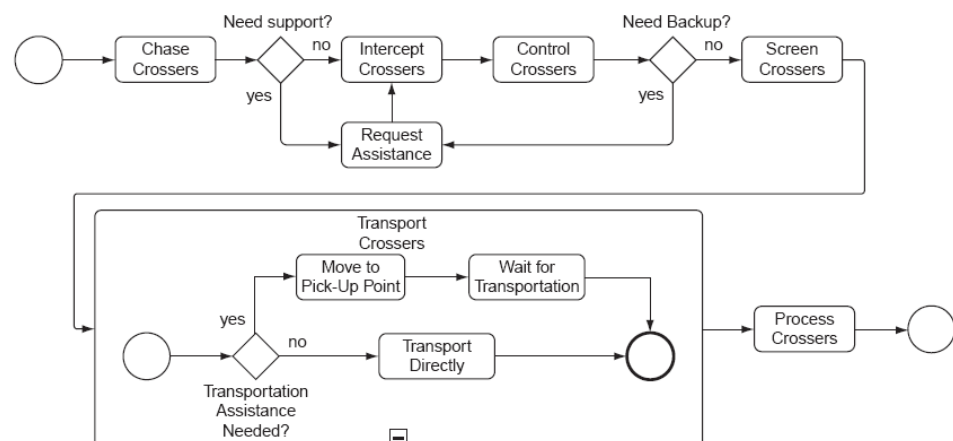


Figure 8. Business process example in BPMN (Bridgeland and Zahavi 2008)

2.3. Set of Criteria Supporting Choice of Business Process Modeling Methodology for Specific Business Case

2.3.1. Construction of Criteria for a Choice of Methodology

Different researches postulate different criteria for selection of business process modeling methodologies, or how they sometimes also call them methods or approaches. They all regard methodologies from some point of view. This research is going to merge the criteria selected by these authors and suggest ones related directly to business processes of organization.

Lam (1997, quoted in Damij 2007, 83) suggested four criteria in particular for distinction between good and better methodology. They are: adequacy of the technique for requirements identification, as well as the ability to include software development phases; to what extent to do the analyst's experience with the technique influence the deployment and implementation of the technique; what support is offered to technique; simplicity of the technique.

Avison and Fitzgerald (2003, quoted in Damij 2007, 86) developed the criteria in a form of 16 questions. Some of them are: what aspects of the development process does the methodology covers; what overall framework or model it utilize; what representations, abstractions or models are employed; what tools and techniques are used; is the content of the methodology well defined and described, such as a developer can understand and follow; how are the results of each stage expressed; what situations and types of application is it suited to.

Damij (2007, 86) herself defines five criteria based on those: simplicity, flexibility, visibility, user involvement, software support.

Flipowska et al. (2009) suggest multilevel criteria for BPM methodologies comparison. Its top levels are: motivation, applicability and usability of methodology, completeness and support, extendibility/adaptability,

readability/understability, correctness. These criteria are complemented with sub-levels.

All these four criteria are quite abstract and more related to methodology. The aim of this research on the contrary is to reveal criteria connected with organization activities, business processes in other words.

Shen et al. (2004) compare methodologies using such kind of criteria: structure, ease of creation, strictness of syntax/semantic rules, information expression, sequential expression, logical expression.

These criteria comprise both approaches to criteria creation: from methodology properties point of view – three first criteria, and from mapped business processes' point of view – three last ones. Therefore latter are important and can be reused in this research.

Thus all the criteria can be divided into several groups. For example, user-related criteria are discussing qualities which a user of methodology should possess or not possess in order to be able to read business process models or create them. Support-related criteria are concerned with support of methodology by various software tools, strict guidelines or acceptance of this methodology as a standard.

In this study a group related to business processes of organization was selected. Thus these criteria compare methodologies depending on their abilities to represent different business process modeling elements. They are: “Nature of activities”, “Communications with external players”, “Amount of decision-intensive activities”, “Amount of event-driven”, “Importance of regulations”, “variety of executors”, “Objects characteristics”.

2.3.2. Explanation of Criteria Details in Business Language

In order to give an explicit description of the criteria set, the explanation of every comparison criterion is to be provided.

First of all, “nature of activities” shows activities of which nature prevails in all organization activities. Activities of sequential basis are in their essence step-by-step tasks, which are to be implemented in order to accomplish the work. For example, it can be processing of an order or introducing a new employee in organization.

Activities of project nature in contrast are worse understood by business people. In these activities different steps of activity are not implemented one by one, several steps can be implemented at the same time, the next step can be started while the previous is still under processing, cyclical returns are allowed, whole activity can be started from one or another step, etc. Typical examples of such activities will be research process or well-organized development process. According to Kalpic and Bernus (2002) in these cases it is more important to identify the processes and co-operation between them rather than develop step-by-step process model.

Secondly, “communication with external players” implies existing of such kind of activities inside organization as, for example, orders from distributor (Bridgeland and Zahavi 2008) or outsourcing some parts of works. Of course, this criterion is considered in the respect of how much of these processes are integrated into activities of organization and therefore has to be documented with them as well.

“Event-driven, event-evoked activities” are activities which are evoked by some event happening inside or outside organization, i.e. implementation of the activity starts after this event occurs. Examples of this activities can be registering of incoming order, which starts immediately after customer calls and makes an order, or creating a budget plan for the next year, which starts in the beginning of

every December, due to the fact that it should be approved before Christmas holidays.

According to Le Clair and Teubner (2007) “decision-intensive activities” are activities which require employee to make decisions. It has decision criteria and after decision point the implementation of the whole process takes one way (in some cases several ways) from the set of different ways. Good examples are underwriting or sales promotion and rebates.

“Executors” are important part of every activity in organization. Frequently information about who is responsible for implementation of each step of process is crucial for organization. Good models are believed to have this information. It is better if methodology helps user to include such information in graphical representations. Kalpic and Bernus (2002) also say that “the precise definition of authorities and responsibilities over the decisions is essential for the successful and transparent execution of the process”.

Under “regulations” we understand any regulations, description, recommendations, instructions and other information which guides or restricts the implementation of activities. They exist in vast amount in every organization.

So-called “Objects” criterion checks role of objects in activities of organization. Sometimes it is important to distinguish different objects types, e.g. papering document, electronic documents, items in date bases, information. For example, activities using not only databases and electronic documents, but also consuming and creating paper documents will be better described if methodology will allow distinguishing different types of objects in models.

In some case organizations have wide flow of these objects therefore their transitions and transformations are important. These objects are not only created and used in one step of activity, but widely distributed from one step to another, modified during this process, serve for purpose of new documents creation. For example, activities which in any case will include lots of paper work or analogical work in electronic format: claims processing (Le Clair and Teubner 2007) or

insured event processing (Hammer and Champy 2006). This kind of activities are going to be call “object-intensive activities” below in criteria for selection of business process modeling methodologies.

The importance or type of parts of whole activities of organization matching any criterion defines the need for their depicting during documentation process. This also determines the need to represent them precisely in models created. Table 3 shows comparison criteria with the notion of specific elements it concerns which are discusses above.

Table 3. Comparison criteria and values

Comparison criteria	Matching elements of business process models	Values and their names
Nature of activities	Project vs. sequential nature of activities	Project, Mixed, Sequential
Communications with external players	Communications with external players	Insignificant, Active
Amount of decision-intensive activities	Decision-intensive activities	Small, Big
Amount of event-driven activities	Event-driven, event-evoked activities	Small, Middle, Big
Importance of regulations	Regulations	Not so important, Very important
Variety of executors	Executors	Small, Large
Objects characteristics	Objects	Different types of objects are important, Object-intensive activities, Not object-intensive activity

2.3.3. Requirements from University Research Context

Recent researches have shown that business processes concepts are of highly important in university research context (Macbeth 2002; McAdam et al. 2005; McAdam et al. 2006; Kock and McQueen 1998; Philbin 2008).

Authors apply process approach to university research context and emphasize various crucial business processes in this respect. Amongst them will be idea generation (McAdam et al. 2005, 1422; McAdam et al. 2006, 451) and funding search (Macbeth, 396; McAdam et al. 2005, 1423; McAdam et al. 2006, 451). Philbin (2008) mentions also university-industry collaboration. Macbeth (2002, 394) pays special attention to decision points in their activities.

From research point of view different typical processes are also predicted (Macbeth 2002, 397), for example, development and testing of methodologies, accessing and analysis of data, results generation, knowledge transferring through teaching, building reputation for personal future research support.

As university research department is a part of university body consequently importance of regulations in its life can be anticipated. Directing regulations are to be given for research organization from university managerial boards and control of their implementation is to be performed.

All these named processes are typical for university research institution. Therefore their appearance in empirical part of the study is anticipated and developed criteria should work with such kind of activities types as well. Such kind of criteria elements as nature of activities, communication with external players, amount of decision-intensive activities, importance of regulations complete these additional requirements sufficiently.

2.3.4. Comparison of Business Process Modeling Methodologies

The analysis of selected methodologies was held. After that it became possible to create a table representing plusses and minuses of how the methodologies in question match the requirements of the defined criteria, which are describing activities of organization (table 4).

Table 4. Comparison of selected business process modeling methodologies:
“EPC from ARIS”, “IDEF0+Swimlanes”, “BPMN”: plusses and minuses

Comparison Criteria		Methodology 1 “EPC from ARIS”	Methodology 2 “IDEF0+Swimlanes”	Methodology 3 “BPMN”
Communications with external players	+	Variety of additional elements can be used	Swimlanes allow depicting external players as roles	Good in documenting communications with external players (message flows between roles exist for that purpose)
	-	No specified opportunities for distinguishing between external and internal players if they are included into described system	IDEF0 has no specified opportunities for distinguishing between external and internal players if they are included into described system	Some additional training is required
Event-driven, event-evoked activities	+	Events have to precede activities Events should have names	Comments can be used in case of necessity	Event element is a part of notation Different types of events can be graphically shown

Comparison Criteria		Methodology 1 “EPC from ARIS”	Methodology 2 “IDEF0+Swimlanes”	Methodology 3 “BPMN”
	-	<p>Time for creation of diagram increases (especially for a business person)</p> <p>Lots of additional elements make diagram less “readable”</p> <p>Sometimes it is difficult to formulate an event so they are admitted and rules of EPC notation are not followed</p>	Swimlanes allow depicting of starting and ending events of a hole activity sequence	There is no opportunity to name events
Decision-intensive activities	+	<p>“AND” and “OR” elements are easily understood by business people and bring more clarity than one decision making element</p> <p>Starting and ending points of paths affected by decision are visible</p>	Swimlanes has one special element for depicting decision point in workflow, which has to be named	<p>Special element for depicting decision point in workflow is used</p> <p>This element has to be named</p>
	-	<p>“XOR” element is more technical one, that creates problems with comprehension for business people</p> <p>There is no opportunity to name decision point, only events following it - lots of additional elements make</p>	IDEF0 doesn’t have any decision making blocks, transitions from process to process are not obvious	Name of decision point is situated outside the block

Comparison Criteria		Methodology 1 “EPC from ARIS”	Methodology 2 “IDEF0+Swimlanes”	Methodology 3 “BPMN”
		diagram less “readable” Nonequivalent consequent processes after decision point damage “readability”		
Project vs. sequential nature of activities	+	Business processes are sets of step-by-step tasks – easily understood by business people	IDEF0 is good for depicting activities of project nature Swimlanes are good for depicting activities of sequential nature	Good for depicting activities of sequential nature
	-	Difficulties in depicting cyclical and parallel implementation of processes	Business people require additional training to understand IDEF0	Difficulties in depicting activities of project nature
Objects	+	Different elements are used for representation of different instances, for example, data and documents	Easy to follow transmission of objects from activity to activity	Not presented – no mess on the diagrams
	-	Difficult to follow transmission of objects from activity to activity	Impossible to express type of object graphically	Not presented on the diagrams – lots of information used in real business life is missing
Executors	+	Can be evidently presented on diagram	Swimlanes are good in representing tasks executed by several roles; IDEF0 is good in representing tasks executed by any amount of roles	Good in representing tasks executed by several roles

Comparison Criteria		Methodology 1 “EPC from ARIS”	Methodology 2 “IDEF0+Swimlanes”	Methodology 3 “BPMN”
	-	Lots of additional information make diagram less “readable”	Representation method might be misleading for business users	In case of high variety of executors this information is better to be omitted
Regulations	+	No overloading information	Revealed explicitly in IDEF0	No overloading information
	-	Not specifically revealed	Not specifically revealed in Swimlanes	Not specifically revealed

The information is presented in the Table 4 shows what plusses and minuses each methodology has in capturing certain business process models’ elements. First column can be combined into a set of criteria for comparison of different organizations in order to select proper methodologies for needs of their business process modeling initiatives.

2.4. How to choose a Business Process Modeling methodology

2.4.1. Recommendations for Proposed Criteria Usage

Recommendations for making decision according which methodology to choose were derived from the information carefully described above. They are presented in table 5. In their construction the specific of usage by business people has been considered: recommendations were formulated on the basis what might be simpler and more convenient for a person with no previous professional training in the area of business process modeling.

Table 5. Recommendations for methodology selection

Comparison criteria	Value of comparison criteria	Best methodology to choose
Nature of activities	Project	IDEF0+Swimlanes
	Mixed	IDEF0+Swimlanes, BPMN
	Sequential	Any
Communications with external players	Insignificant	Any
	Significant	IDEF0+Swimlanes, BPMN
Amount of decision-intensive activities	Small	Any
	Big	IDEF0+Swimlanes, BPMN
Amount of event-driven activities	Small	Any
	Middle	BPMN
	Big	EPC, BPMN
Importance of regulations	Not so important	Any
	Very important	IDEF0+Swimlanes
Variety of executors	Small	IDEF0+Swimlanes, BPMN
	Large	EPC, IDEF0+Swimlanes
Objects characteristics	Different types of objects are equally important	EPC
	Object-intensive activities	IDEF0+Swimlanes
	Not object-intensive activity	BPMN

These recommendations should be read and interpreted in the following way. For, example, first one (table 6) should be executed in this way: if nature of activities in analyzed organization is sequential then any methodology can be selected on this step, please, proceed to the next recommendation. More information on recommendations sequence is presented in following sections.

Table 6. Recommendation for methodology selection

Comparison criteria	Value of comparison criteria	Best methodology to choose
Nature of activities	Project	IDEF0+Swimlanes
	Mixed	IDEF0+Swimlanes, BPMN
	Sequential	Any

2.4.2. Application of Proposed Criteria for Business Cases

Different criteria are of different importance in different business cases. Without supportive cases only some general guidelines can be proposed at this point. This is one of delimitations of the master thesis and at the same time space for future research. Table 7 represents different anticipated importance of criteria for different business cases.

Table 7. Guidelines for proposed criteria application for business cases

Task	Comparison Criteria						
	Nature of activities	Communications with external players	Amount of decision-intensive activities	Amount of event-driven activities	Importance of regulations	Variety of executors	Objects characteristics
Outsourcing some parts of work	+	+	+	-	-	-	+
Executing customers orders	+	+/-	+	+/-	-	+	-
...

For example, in the case when organization outsources some parts of its work to some other companies, different criteria will be differently important. As it was already discussed above nature of activities, communication with external players, amount of event-driven activities and object characteristics will be of big importance. At the same time other criteria are anticipated to be of lower importance.

It can be even predicted that in this case communication with external players will be the most important criteria due to the fact that the company outsources some parts of its work and constant communications are needed with contractors. For example, objects characteristics will be important because for sure lots of objects will be floating from organization to its contractor. These objects most likely will be of different types as documents, information, products, and others.

Using the same logic we can predict the possible ranking of the criteria for an organization which main business process will be executing customers' orders. We can anticipate that the most crucial criteria will be nature of activities, amount of decision-intensive activities and variety of executors. Then in the ranking communication with external players and amount of event-driven activities will follow. The last ones will be importance of regulations and object characteristics.

The fact that every organization is unique is quite obvious. Therefore in every single case the ranking should be performed. It can be done by a person with preliminary understanding of business process modeling, who has read the explanations for the criteria set above. After that if this person lacks sufficient information to make decision on ranking him/herself, he/she can conduct small interviews with the people in organization who possess this knowledge.

Depending on various cases criteria can be ranked differently. The ranking for a case of university research centre was done in the master thesis and in particular Northern Dimension Research Centre. Information collected through interview was sufficient enough for a person with preliminary understanding of business process modeling to collect the needed information. After that criteria were ranked in the following order:

1. Nature of activities,
2. Communications with external players,
3. Amount of decision-intensive activities,

4. Amount of event-driven activities,
5. Importance of regulations,
6. Variety of executors,
7. Objects characteristics.

2.4.3. Construction of Innovative Solution for a Choice of Methodologies

Following the ranking created in the previous section and basing of the various sources (Baek 2007; Coles and Rowley 1995; Crowe and Rolfes 1998; Temtime et al. 2004) from this data the following decision tree was induced (Figure 9). This is a graphical form of representation of the proposed innovation solution. Basically the logic of the decision tree is as following.

Applying the first rule in the new order “if nature of activities in organization is project the methodology “IDEF0+Swimlanes” should be selected” the upper brunch of the very left level is created. If the nature of activities on organization is sequential then any methodology is suitable on this step and one should proceed to execution of the next rule.

The special attention should be paid to the mixed nature of activities in organization and corresponding brunch of the tree. The first rule recommends us to make subsequent choice from “IDEF0+Swimlanes” or “BPMN”. In case of next rule application, concerned with “communication with external players”, in any choice no additional reductions will be made to this restricted set. Thus there is no need of representing this layer on the diagram. Still it is reasonable to fight for space and readability of the tool.

There is a need to apply the rules furthermore if on some level the choice has been recommended. Respectively the brunches of the decision tree are followed till the point when some leaf is reached. It the leaves different choices for business process modeling methodology are situated.

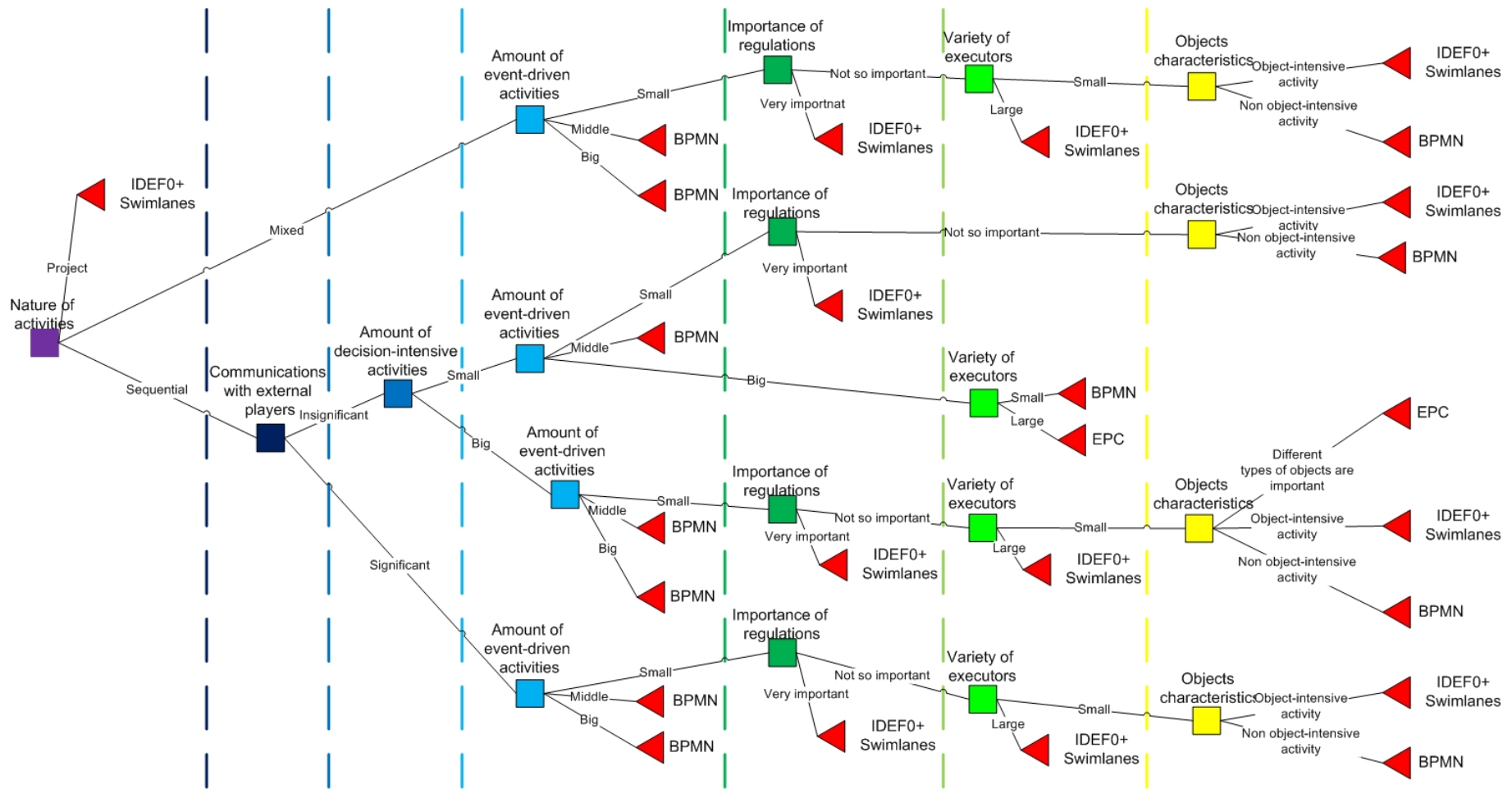


Figure 9. Decision tree for selection of business process modeling methodology

At the same time the innovative solution requires the user to have some background in business process modeling. The potential user is the person who is going to create model of business processes of organization, therefore this person should be familiar with business process management, business process reengineering, business process modeling concepts and be able to create business process models. Additional knowledge of business processes of organization is required. If the user lacks them then he or she should be able to get information needed for applying of innovative solution from the people in the organization with sufficient knowledge. The suggested innovative solution allows to make this phase quickly and efficient.

2.5. Summary of Chapter 2

This chapter concerns three main issues in respect to choice of business process modeling methodology: what to choose from, by what means to choose and how to make the choice. In other words they are set of methodologies, set of criteria and innovative solution for making a choice between former using the latter.

At the same time chapter starts from the justification of this approach and necessity of innovation solution creation. Existing approaches, its plusses and minuses discusses. Why they don't suit case organization selected, Northern Dimension Research Centre, is explained. Thus necessity for an innovative solution is stated.

Appropriate set of business process modeling methodologies to choose from is constructed. Business perspective is vastly involved in this process. Finally three methodologies for the future discussion are chosen: "EPC from ARIS", "IDEF0+Swimlanes", "BPMN".

Chapter provides guidelines to process mapping initiatives and description of how it is realized by selected methodologies. This explanation can support user in starting business process modeling initiatives.

Second main issue of the chapter is criteria for a choice of business process modeling methodology in a certain business case. The way how the criteria are constructed on the findings in the literature is explained. The criteria and its values are translated into business language. Then possible additional requirements from university research context are discussed. And finally comparison of selected methodologies is performed by means of these criteria.

The final step is discussion on how the choice of business process modeling methodology can be done in practice. For this reason innovative solution is developed. First of all, recommendations for proposed criteria usage are presented with wide explanation. Then possible application of proposed criteria for various business cases is discussed. The user is provided with guidelines on how to act in

certain business case. And finally tool in the form of decision tree is created which will support a choice of methodology by a user with preliminary preparation and ability to obtain necessary knowledge.

3. Case Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology

3.1. NORDI's Description as an Innovative University Research Centre

Northern Dimension Research Centre (NORDI) is an institute inside Lappeenranta University of Technology (LUT), which main aim is Russian related research (NORDI a).

NORDI's scope of activities is research and cooperation with private sector, searching funding for it, increasing the knowledge about Northern Dimension¹, organization seminars and specialists meetings. NORDI organizes and conducts research in four areas of its expertise: business and economy, innovations, energy and logistics.

Research centre is currently working on amount of projects, which current number is 7, and also has a list of successfully finished ones. All the projects are done in collaboration with various LUT units and departments, other universities in Finland and abroad, private and public sector representatives.

Being an LUT body NORDI vastly uses international cooperation agreements of the university: focusing on Russia NORDI mainly cooperates with Russian partners of LUT, but it also does research in cooperation with other European partners.

NORDI has a number of active collaborators, financing their research projects. Nowadays it is 14 companies in total, which vary vastly from SMEs with turnover 1 – 5 million euro to, for example, such large global paper company, as UPM-Kymmene, which turnover might be around 1 milliard euro.

¹ “The Northern Dimension (ND) partners are the European Union, the Russian Federation, Norway and Iceland. The USA and Canada hold observer status. The objective of the ND is to support sustainable development, stability, welfare and security in the northern parts of Europe.” (NORDI b)

The main outcome of NORDI's activities is publications in highly recognized international publication sources. Yet NORDI publication series exist which publish applied research reports several times per year. Centre's research reports have two focuses: geographical – on North-West Russia, Baltic Sea region, Eastern Europe – and functional – business and economy, innovations, energy, logistics.

In average this research center publishes 3-5 scientific journal articles per year, 4-8 conference papers per year and 2-3 issues of NORDI series per year.

NORDI is one of number of research centre's of LUT. Figure 10 represents all the research centers in the university.

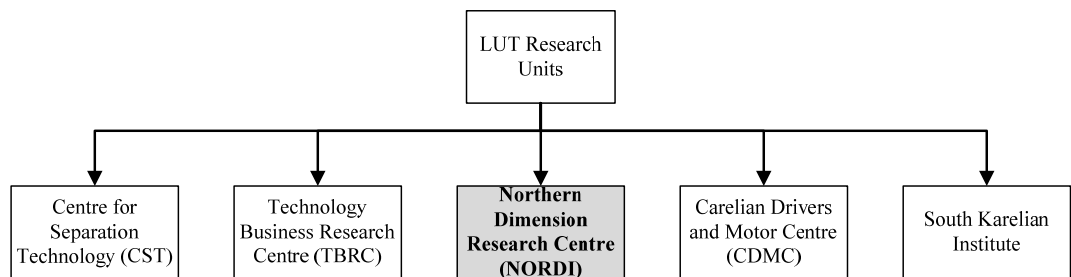


Figure 10. Research centres of Lappeenranta University of Technology

Research centers of LUT are positioned differently inside LUT: some of them are parts of any department, others are independent research units. NORDI in its respect is a part of department named School of business.

NORDI's organizational structure is presented on figure 11. Current number of research center's employees is 15. But from the structure we can see that projects are done in tight collaboration with research staff from other university's faculties therefore total number of people working in NORDI projects even inside LUT is bigger. Usually in addition to that collaboration with other research partners is very close and sometimes even business partners are taking some part in the research process.

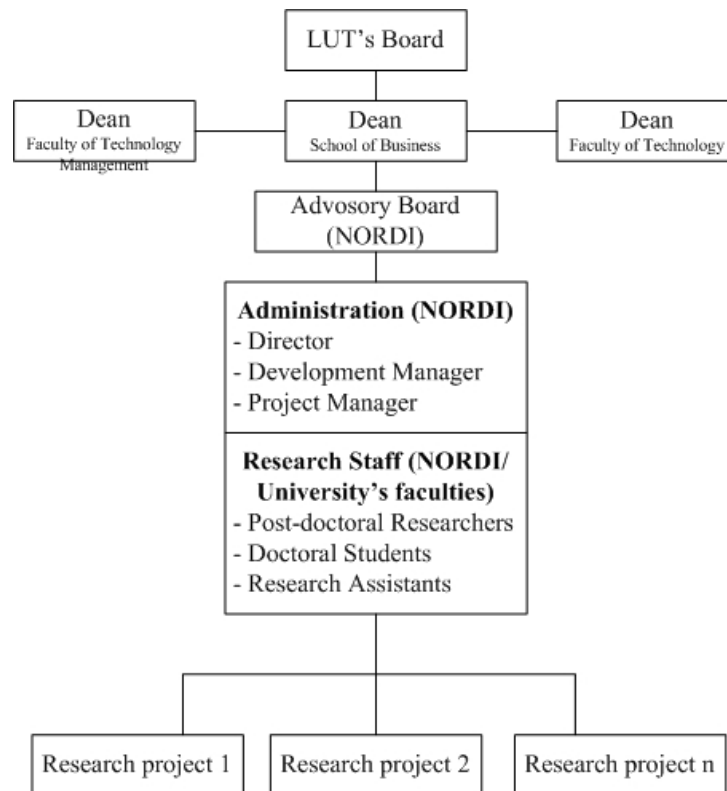


Figure 11. NORDI's organizational structure

Being part of LUT NORDI receives budget money from university about 250 000 euro per year. This amount has to be spent only on administrative issues.

Project money is searched by NORDI itself. They comprise all the project expenses including salaries to all researches. Amount of project money available depends on number of research projects. Currently it is 1 500 000 euro per 2 years (time here limit is set like that due to the fact that project period is 1-3 years).

According to the words of director NORDI has two main businesses, which are equal in their importance:

1. NORDI is making Russian-specific research,
2. NORDI is promoting university expertise outside and inside university.

Several business processes are aimed on realization of the first business:

- Conducting research,
- Supporting education,
- Holding seminars.

Several business processes are aimed on achieving the goals of second business:

- Network advancing activities,
- Marketing, task force activities, face to face meetings,
- Holding seminars, workshops.

Main business process of NORDI is carrying out of a research. But this one is supported with usual business activities, like budgeting, organization of various meetings, HRM processes and etc.

3.2. Grounds for a Case Choice

3.2.1. Reasons for NORDI's Participation in the Master Thesis Project

Decision to model business processes in Northern Dimension Research Centre was done under several circumstances. Their description is going to follow.

First of all, almost no position regulations or processes regulations existed in the organization. Guidelines provided by Lappeenranta University of Technology helped and restricted the implementation of NORDI processes but were not covering all the unique activities of research center. Therefore process mapping initiative could give a prosperous background to future documentation of NORDI's activities.

Key person knowing all business processes happening in research center leaves the LUT. She trains a successor, but of course some valuable tacit knowledge will be lost. Business process modeling often applied in knowledge capturing initiatives (Bandara, Gable, and Rosemann 2005) was selected in this case as a mean of saving this valuable knowledge.

Head organization of NORDI, LUT was in front of a big restructuring and changes. NORDI's destiny is going to be decided: either its authorities are going to be restricted to university's unit helping in conducting Russian-related research to other university's entities or enlarged to independent unit, the only one conducting all Russian-related research in whole university. Therefore NORDI's Director decided that he wants to have a possibility to see the whole picture of how NORDI can be useful to the future university. The models can be beneficial support while managing these strategic changes inside NORDI.

One more issue was concerned with necessity of transparent business processes model of organization. NORDI is a very innovative research centre. Therefore it is rapidly changes incorporating some new practices into its activities and throwing

away another. For this reason future business process model was going to help to see the level of development of different business processes: all of them are obviously perfected in different degree. In additional business process models would support future minor improvements in organization.

All this reasons led to starting of process mapping in NORDI. Director personally was highly interested in investigation which business process modeling methodology would be the most appropriate for the research centre. There were also special requirements, which perfectly correlated with master thesis project requirement, to ground choice of methodology on wide theoretical investigations.

3.2.2. Suitability of NORDI for the Study

In this section we are going to discuss again why the choice of NORDI as a case company for the master thesis was so relevant. To summarize all what has been said above in the paper I am going to refer to the stated delimitations of the work at first.

There was a group of delimitations connected with a design of a case study selected. Process of business process modeling for a whole organization is consuming big amount of resources, including time. Therefore search for a case company was done among the SMEs and departments, which have easier to describe due to their relatively small size. NORDI's size was perfect for a case study planned.

At the same very important was an innovative spirit of the research centre. It was possible to convince Director to participate in such kind of project despite crisis and overload of employees in importance of the study. At the same time the promises to convince NORDI's employees was received. Involvement of a leader of organization into a business process modeling project is very important.

At the same time there were no possibility to attract several case companies under the limitations of master thesis project therefore the organization with quite special business process structure was searched for. In this particular case it is possible to pick out separate business processes which in bigger organizations could be performed by separate departments and apply developed innovative solution to them. This will be shown below in the corresponding section.

The reasons why NORDI was interested in participation in the master thesis project were also in the spirit of the research. They later on turned out to be additional plusses to the study.

3.3. Empirical Study

3.3.1. Case Study Design

Empirical study was designed according to analogical studies in previous research (Kalpic and Bernus 2002; Trkman 2009) and typical business process modeling project. It consisted of several parts.

First of all, series of interviews was held in order to obtain information about business process of Northern Dimension Research Centre (NORDI). The idea of this phase was to collect enough information for following phases. At the same time this information was planned to be sufficient for the needs of proposed innovative solution application.

After that basing on information collected preliminary model of NORDI's business processes was created. This model was then modified through the second series of interviews with correspondent process owners.

Then process mapping was applied to this preliminary model. In other words this model was transferred into three different model of the same business process of the same organization. The difference between these models was the methodology used in their creation. This information allowed understanding, which model is better suited for representation of NORDI processes.

Some strategic applications for obtained models in Business Process Management and Business Process Reengineering were presented. This activity is voluntary but represents how the models can be used further by case company. It also emphasized managerial value of created models once more time.

In the end proposed innovative solution was applied to the case organization. The process of application is described step by step. The results are discussed.

3.3.2. Interviews and Interviewees

Before first phase of interviews started interviewees were divided into 4 groups: top position, administration, Research Project Managers and highly experienced Research Project Managers (figure 12). The difference between two last categories is that the latter has already managed 10 research projects. As the main aim of interviews was to obtain information about business process in organization this separation was important.

Different questioners were then created for every distinguished group. Questioner #1 for top position is presented in Appendix 3. This group of questions was aimed on retrieving general picture of business processes from the top managers' heads.

Questioner #2 was developed for administrative positions. It is presented in Appendix 4. Part of this questioner was built after interviews with so-called top positions when general understanding of NORDI's business processes was constructed. These questions brought understanding of administrative processes' organization.

Questioner #3 was created for a highly experience Research Project Managers. It is represented in the Appendix 5. The idea of these questions was to obtain understanding of organization or research process in general – main process inside NORDI.

Questioner #4 was created for interviews with Research Project Managers. It is represented in the Appendix 6. The idea of these questions was to collect different examples of concrete research projects organization. This information allowed to test the perception of experienced Research Project Managers on standard organization of research project. At the same time some different patterns of standard research project were derived and then discussed with experienced Research Project Managers.

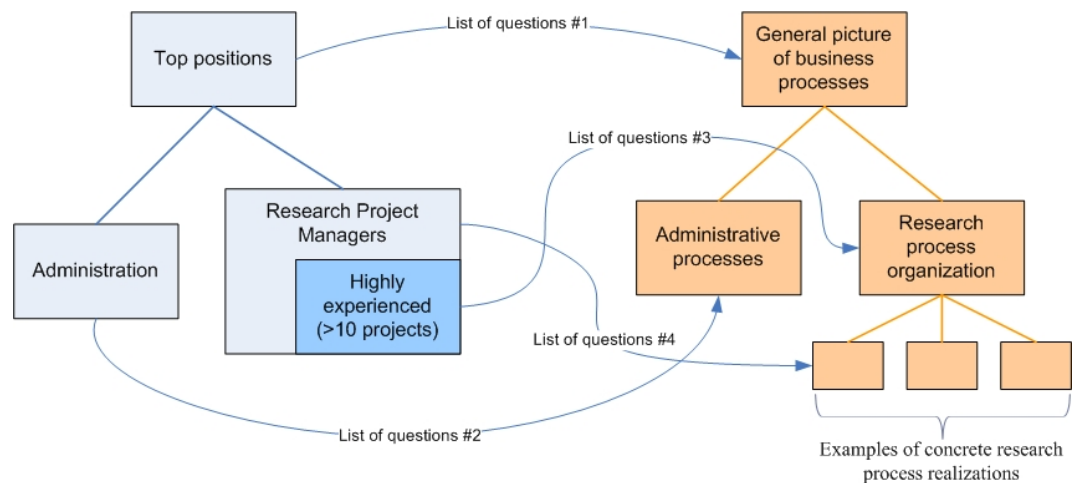


Figure 12. Data collection: interviewees

Several respondents were selected from each distinguished group. In total 8 different people were interviewed with the amount of interviews 11 on this phase.

Interviews were conducted in a complicated manner, which is presented in figure 13. This so-called questioner was used only by business analysis in order to check if all the necessary information was retrieved. Discussion was held around these questions in a form suitable for each interviewee. The idea of interviews was to collect information sufficient for process mapping.

First of all, interviews were held. Each interview was done in a form of discussion around questions planned in the questioners. Business analyst was asking process owner questions from the list in arbitrary order in such a way so not to disturb the flow of speech of interviewee, but guiding his deductions toward the goals, which business analyst kept in mind all the time. The goals were postulating end results, precise information business analyst is to receive from this interviewee after interview. During the interview business analyst was keeping track of notes, marking immediately interesting to the task in question moments.

The information gathered during interviews was analyzed and structured. Summaries on each interview were created. These summaries were sent to the interviewees afterwards on preliminary agreement. This was done in order to diminish the misunderstandings, which are integral part in communications

between model designer and process owner. The room for additional feedback was also left. It was an opportunity to rethink again what was said for interviewees and provide some information they forgot during interview or ideas.

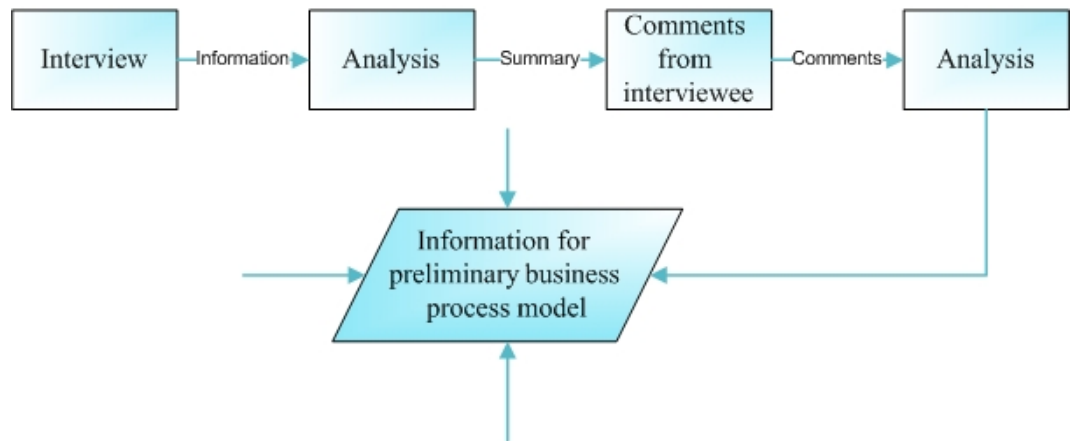


Figure 13. Data collection: interviews

Interviewees were commenting on summaries. Very rarely they noticed some misunderstandings. But usually they sharpened some points and provided interesting remarks thinking again on the same issue.

All this commented summaries were analyzed again afterwards. All the information was gathered in order to create preliminary model of business processes of organization. Before the whole situation on business processes of NORDI became clear this information was kept in a registry.

3.3.3. Business Process Model Creation

After the first data about organization's operations was collected the preliminary business process model was created (figure 15). The huge picture was created which hardly ever suited on A0 page. It is not going to be presented in the master thesis in detail due to the fact that being divided into A4 pieces it becomes unreadable. Nevertheless, the full model can be presented on further request.

The decision was made not to do it in any specific methodology (figure 14). So the following method was selected: all business processes of organization were represented on the same big page and only simplest elements of business process models, which exist in some form in any methodology, were used: such as activity (rectangle), decision point (diamond) and transition from one step to another (arrow).

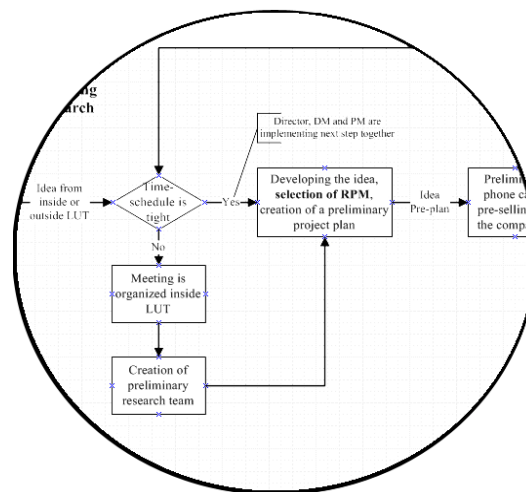


Figure 14. Part of preliminary business process model

Then preliminary model was justified in consequent interviews with business users. This phase of interviews consisted of discussing step by step parts of this model with business process owners of those parts and modifying it according to their comments. This stage was repeated iteratively until business process model build became a reliable representation of reality.

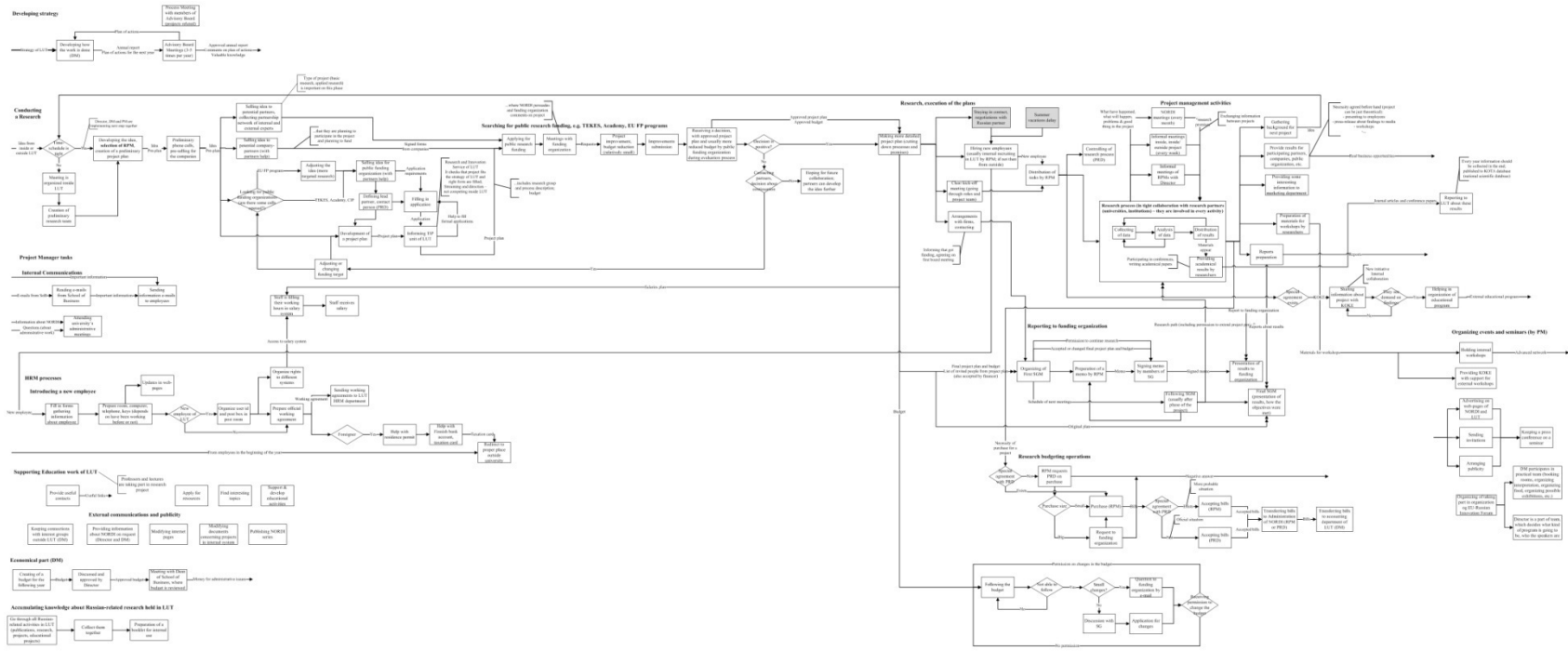


Figure 15. Preliminary business process model

3.3.4. Practical Example of Process Mapping

After reliable representation of business process of case organization was build, selected methodologies were applied to gathered data (figure 16).

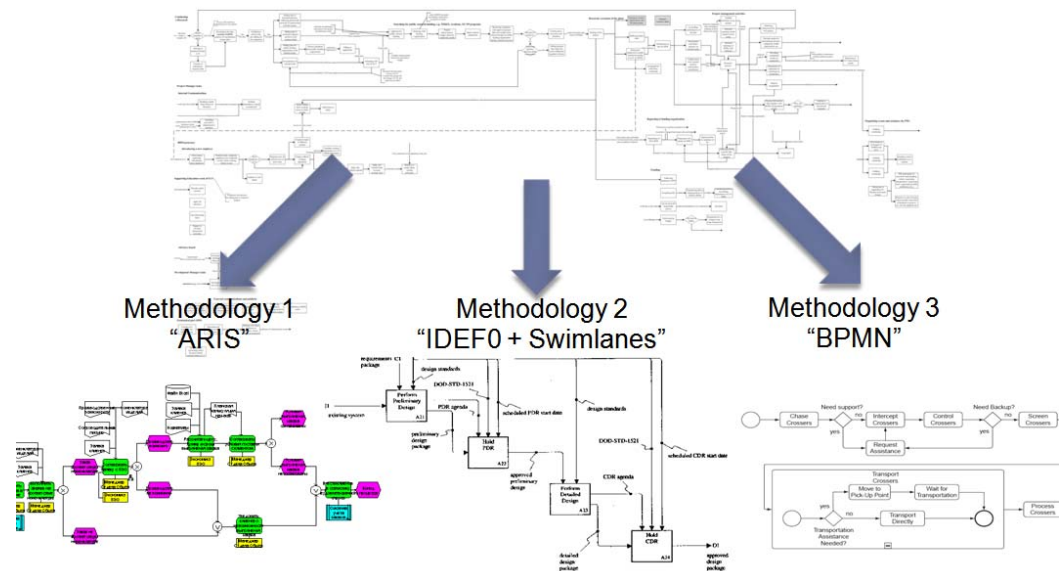


Figure 16. Application of three different methodologies

As a result three different business process models were created for the same case example organization.

Due to the space limitations the decision was made not to present all these three models constructed in the in appendices. Same business processes are presented differently three times. At the same time they are still quite difficult for understanding of a person not related to business process modeling.

One business process model was selected for representational reasons, implemented by means of “IDEF0+Swimlanes” notation. In my opinion this model represents business processes of NORDI fully and is more suitable one for an organization in whole. In case of wish to assess the volume of the work done amount of diagrams from Appendix 7 can be multiplied by three. In addition similar amount of pages can be added for preliminary model of business processes

of NORDI, described in the previous section. Nevertheless, the omitted models can be presented on further request.

3.3.5. Strategic Applications of Models in Business Process Management and Reengineering

This section is devoted not to the description of precise future additional applications of business process models created in NORDI, but just sketches of those. This topic is out of the master thesis study. Nevertheless this section is useful in sense of providing a general understanding and advocating again managerial use of business process modeling.

According to the words of NORDI's Director the following balanced scorecard can be outlined. Let the main strategic goal be "to implement the NORDI's plan of actions". It will have to sub-goals which have to be obtained in order this main will be achieved: "to conduct Russian-specific research" and "to promote university expertise outside and inside university". The former will goal will have some sub-goals: "to conduct research", "to support education" and "to hold seminars". The latter in its turn: "to advance networks", "to market NORDI and LUT" and "to hold seminars and workshops".

Now let's have a look on the diagram of NORDI's business processes of the high level. The connection between goals set and business processes is quite obvious, for example "conducting a research" implements goal "to conduct research", "internal and external communications" – goal "to advance networks". With the use of KPIs business processes performance can be connected with organization's goal implementation. That would be a full ground for Business Process Management (BPM) initiatives in NORDI.

At the same time business process models created can be considered as "as-is" model of NORDI's business processes. Therefore they are ground for any Business Process Reengineering (BPR) initiative. If the new "to-be" processes will be designed then strategic change of organization can be easier managed. Or these models can be just a sufficient background for minor changes in organization.

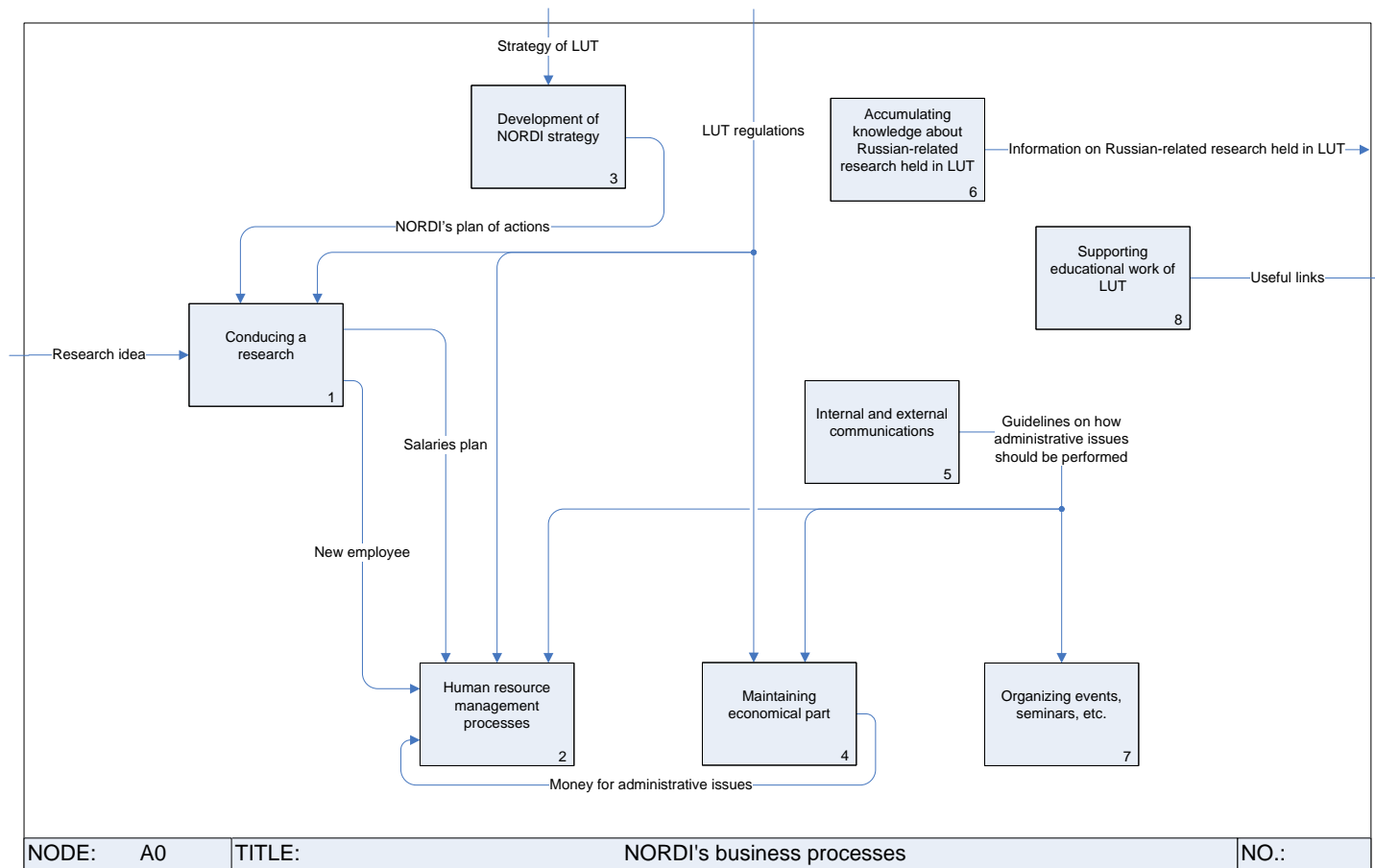


Figure 17. Main processes of NORDI

The point is that NORDI itself was interested in possibilities of support to whole range of all described activities. That was so due to the fact that it was not possible to predict which exactly BPM or BPR initiative will be selected, due to unpredictable changes in the head organization – LUT. But at the same time the need to support any of them in the future existed which was successfully satisfied by created business process models.

3.4. Example of Application of Proposed Innovative Solution for the Choice of Business Process Modeling Methodology

After analysis of interviews held the following criteria values were derived:

- Nature of activities for NORDI is mixed: there are business processes with obviously project nature, as conducting of research, and with sequential one, as introducing a new employee;
- Amount of event-driven activities is absolutely insignificant: the best example will be providing Project Manager with taxation cards in the beginning of every year;
- Since research center in question is a part of universities, regulations are of high importance in its daily activities: for example, plan of actions for whole research center is approved by Academic Board, university regulations and plans are to be followed. At the same time part of processes is regulated by written or unwritten norms or should be supervised by Project Responsible Director or Director himself. Thus regulations which take this form are even more numerous in this case.

These issues lead to the fact on the first decision point of decision tree presented in this research mixed nature of activities is selected. Therefore, after that amount of event-driven activities is checked. On this path of decision tree “communications with external players”, which is a second step in general structure, is omitted, due to decision tree construction process described above. Amount of event-driven activities is insignificant and therefore “importance of regulations” value is checked after that. The importance of the latter brings us to the answer for a selection of business process modeling methodology in this case – IDEF0+Swimlanes. The described selection path is represented on figure 18.

In order to describe more in detail how this decision tree can be used let's discuss several hypothetical cases, for example, hypothetical research department whose activities are just conducting of research. In this case they will be similar to brunch under business process "conducting a research" in NORDI. In this case on the first step of decision tree will give an answer (figure 19).

If we will consider some hypothetical human resource management department, it is activities with an effect of scale will resemble the corresponding activities of NORDI. In this reduced case criteria values will be different and search for a choice will end in the end of tree with the different result – BPMN (figure 20).

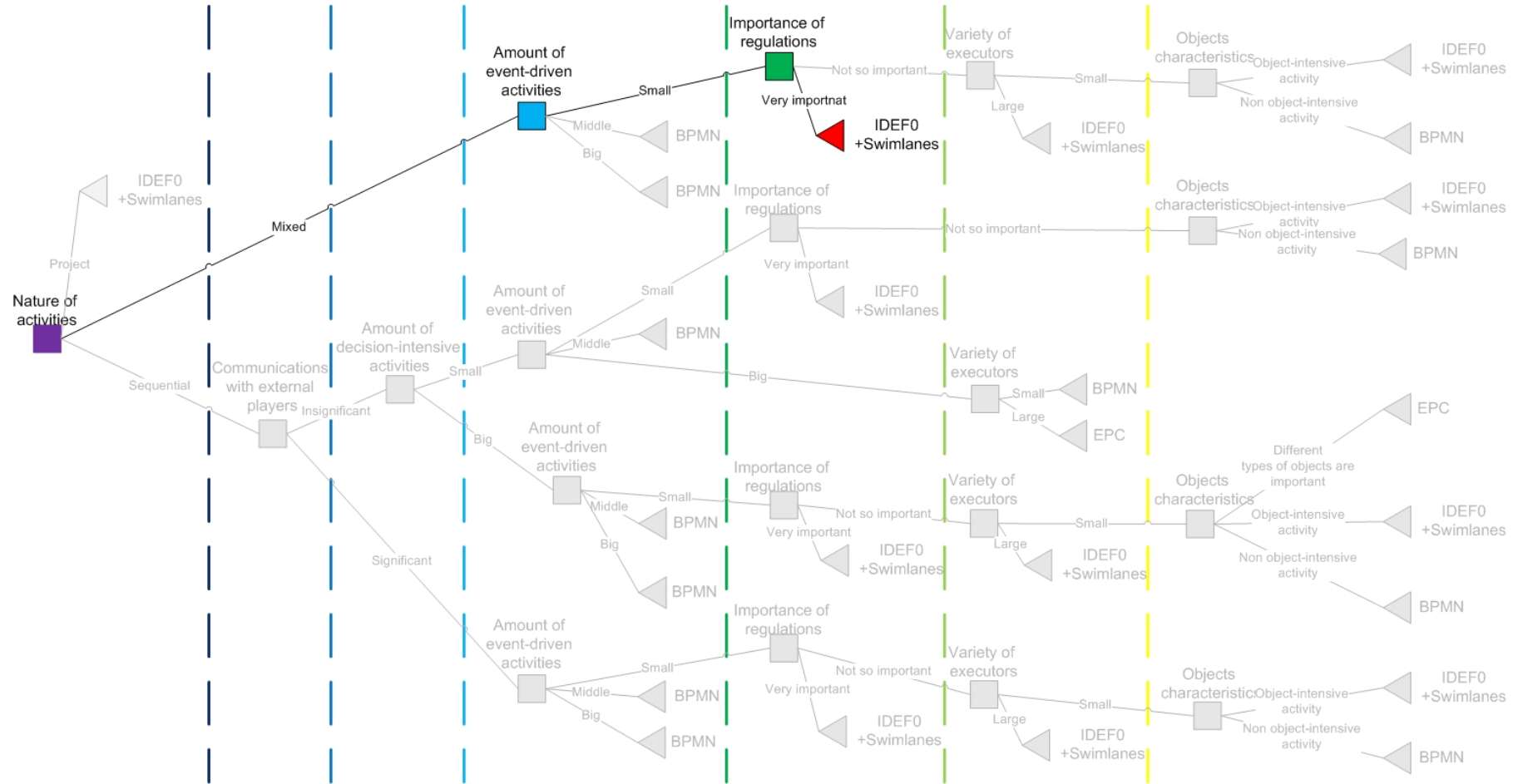


Figure 18. Selection of business process modeling methodology – case Northern Dimension Research Center (NORDI)

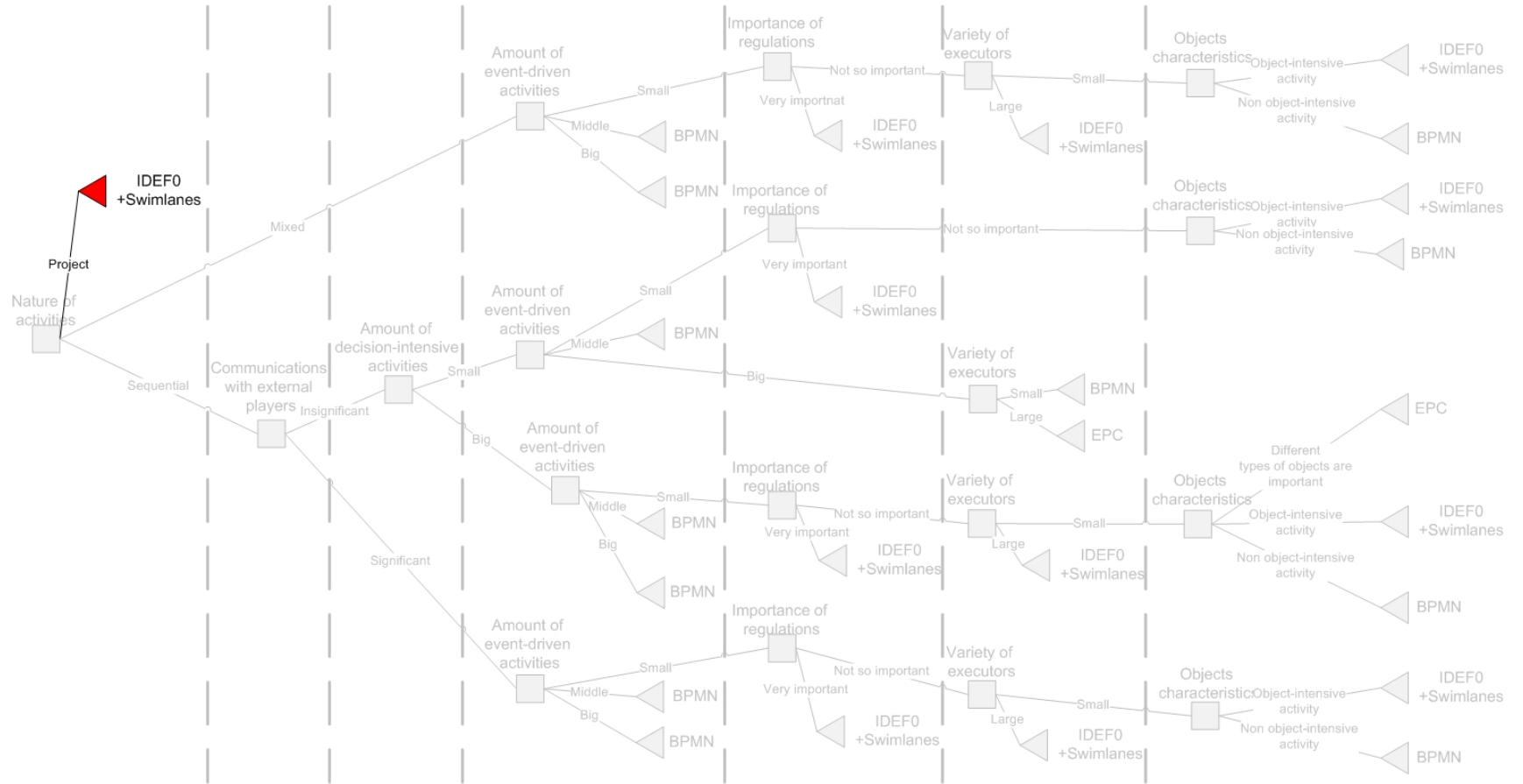


Figure 19. Selection of business process modeling methodology – case potential research department

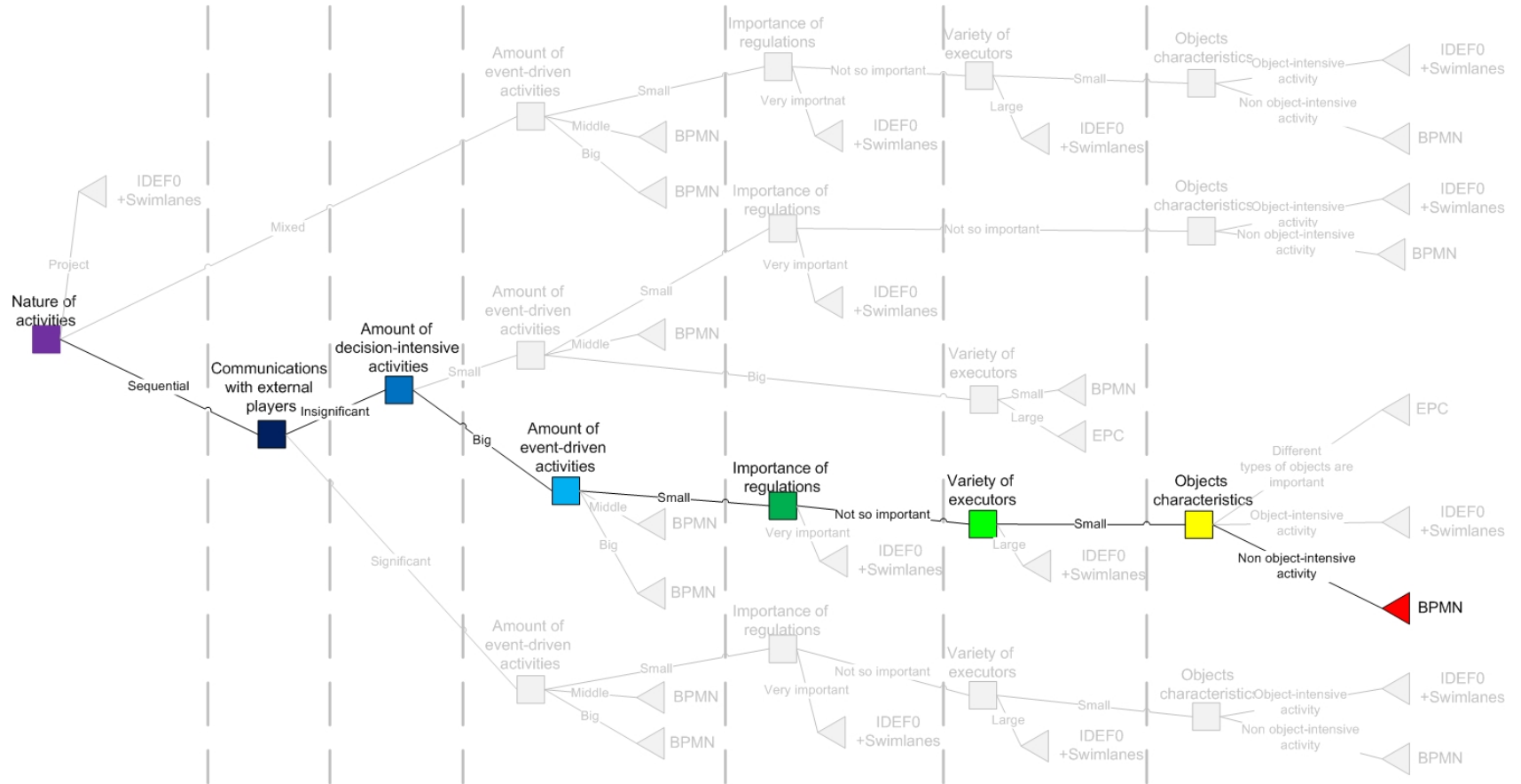


Figure 20. Selection of business process modeling methodology – case potential human resource management department

3.5. Summary of Chapter 3

This chapter is devoted to the empirical part of the study.

It starts from the description of the selected case example – university research center. Main businesses and goal of Northern Dimension Research Centre are complemented with statistical information obtained by interviews. Organizational structure of NORDI is presented and understand how it incorporates into structure of Lappeenranta University of Technology comprising it is provided. Main business processes are mentioned.

The discussion about how the data collection was organized follows. It consists from problem statement, description of interviewees, interview process and business process modeling correction. The necessity of the second phase of interviews for the latter part is justified. In the end data is collected in the form of reliable and approved business process model.

Then story continues with application of the three selected methodologies to the data collected – business process model built. Three more models are created on the basis of this one. Each of them is generated by one business process modeling methodologies. These models are thoroughly analyzed.

Meanwhile criteria for selection of business process modeling methodology are used and most suitable methodology is selected for the case organization. The mechanism of decision tree is explained in this respect. Comparison with real situation from the models built is held.

CONCLUSIONS, IMPLICATIONS and FUTURE DIRECTIONS

Master thesis discusses the place of 'business process modeling' concept in the row of managerial disciplines. First of all, the new wave of managerial treatment of organization as 'process approach' is discussed. After that the managerial discipline of Business Process Management (BPM) is discussed. Also its particular case, Business Process Reengineering (BPR) theory is discussed.

One of the main contributions of the master's thesis is that every concept is explained precisely, referring to numerous sources, and at the same time written in understandable language for ordinary business persons. It took lots of efforts to translate notions familiar to IT researchers in easy language, because they were not precisely defined in business literature. . The work on reflecting all the concepts from IT world to business and managerial world was planned beforehand and therefore may be considered as one of the background goals of the research.

Place of business process modeling in BPM is advocated. It is explained from managerial point of view why this concept is so beneficial in business life and brings definite business value. Strategic benefits are emphasized among all other benefits of business process modeling. Strategic benefits are related to the implementation of strategic goals of an organization. How business process modeling supports those strategic goals was explained. At the same time the aspects of application of the concept in BPR were also revealed. The study explained also the similar correlation with strategic goals of the organization.

Despite its obvious values, business process modeling is not yet widely used in business life. The reasons for that are found and analyzed from managerial point of view. This is one of the significant contributions of the master's thesis because the information about the problems was collected through a big amount of sources and then analyzed.

A brainstorming was held in order to understand what can help to solve the problems, which cause that business process modeling is not used in business life or used with inexcusable errors. The misuse and disuse of business process modeling can harm the organization instead of helping it. The main issue why organizations are reluctant to use modeling tools is the fact that the concept of business process modeling methodology is not widely understood and thus used in practice. In addition, there is no answer in the literature on how to choose an appropriate business process modeling methodology in specific business case. This is how the main research question of the study was formulated – how to choose an appropriate business process modeling methodology in a certain business case.

In order to find an answer for this question several more significant results were obtained in the master's thesis. First of all, structured field domain was created including standards and notations used in the field of research and classification of the terms and concepts. This information can help a person with previous background in business process modeling plunge into the set of concepts used in the master thesis and structure them with ease. At the same time for a reader without such kind of background it will help to create some basis for future absorption of literature on business process modeling.

Secondly, the study was held on choice of business process modeling methodology. Researches in this field were discussed. The selection of the better suitable criteria for comparison of methodologies was done and this comparison was held. At the same time the preliminary selection of current and future leader in business process modeling methodologies was performed in order to assure master thesis current and future value.

Innovative solution was created to support a choice of business process modeling methodology. On the basis of constructed criteria for methodologies comparison, a special tool in a form of decision tree was made. It allows choosing an appropriate business process modeling methodology in certain business case simply following the sequence of suggested steps. The potential user of proposed

innovative solution is a person who is going to create a model of business processes of an organization. Therefore this person should be familiar with business process management, business process reengineering, business process modeling concepts and be able to create business process models. Additional knowledge of business processes of the organization in question is also required. If the user lacks the required information, needed for applying the innovative solution, it can be acquired from the people in the organization with sufficient knowledge. The suggested innovative solution allows to make this phase quickly and efficient.

A case study was conducted In order to show how all the theoretical constructs of the paper can be used in practice. The application of the innovative solution was shown using Northern Dimension Research Centre (NORDI) in Lappeenranta University of Technology as an example. At the same time the solution was checked by applying different business process modeling methodologies to the business processes of NORDI.

In addition, it was shown how with the use of business process models created for the organization various Business Process Modeling (BPM) and Business Process Reengineering (BPR) initiatives can be performed. Thus one of the future applications of the results of the study can be performance of a whole cycle of BPM or BPR initiative in NORDI. The decision of that and its scale now can be easily made by NORDI's Director on the basis of information presented about business processes of organization in graphical form. The initial step of selection of appropriate business process modeling methodology for NORDI is already done.

At the same time as the problem of a choice of business process modeling methodology is solved, suggestions for a software tool supporting these methodologies are presented (Appendix 9). This information presented for all of discussed methodologies can also be applied in practice while the investment decision on a business process modeling tool is done.

In addition to a support of future decision making process of NORDI's director one more additional outcome of the master thesis is of a high value for the organization. Analysis of the business process models was performed for the case company. Suggestions for some improvements to the company's activities' organization were formulated. They are presented in Appendix 8.

Of course, there is a necessity to check suggested innovative tool further. Therefore additional future direction can be suggested – justification of the fact that this innovative tool works on different types of business cases. The comprehensive research, which is not possible to fit into boundaries of one master thesis project, with multiple case studies, will be beneficial to discussion of choice of business process modeling methodology.

One more direction of the research can be addition of more criteria to a decision tree. The amount of those was limited in this study due to the common rule of how much information can human being percept. But if for example the special software tool can be developed supporting the choice of business process modeling methodology the research would come to the next level. At the same time similar tendency to all the managerial concepts in Business Process Modeling will work: after some managerial tool is developed and this innovation is accepted by managerial community following software tools working on the same ideas are developed.

REFERENCES

- Aguilar-Savén, R. S. 2004. Business process modeling: Review and framework. *International Journal Production Economics* 90(2004):129-149.
- Al-Mashari, M., and M. Zairi. 2000. Revisiting BPR: a holistic review of practice and development. *Business Process Management Journal* 6(1):10-42.
- Baek, J.-G. 2007. An intelligent condition-based maintenance scheduling model. *International Journal of Quality & Reliability Management* 24(3):312-327.
- Bandara, W., G. G. Gable, and M. Rosemann. 2005. Factors and measures of business process modelling: model building through a multiple case study. *European Journal of Information Systems* 14 (4):347-360.
- Belmiro, T. R., A. F. Rentes, P. D. Gardiner, and J. E. L. Simmons. 2000. Are BPR practitioners really addressing business processes? *International Journal of Operations & Production Management* 20(10):1183-1203.
- Berecz, P. Tools of Business Process Modeling. In *4th Aspects and Vision of Applied Economics and Informatics, March 26-27, 2009, Debrecen, Hungary*. <http://www.avacongress.net/pdf/77.pdf> (assessed February 25, 2010).
- Brache, A. P. 1992. Process improvement and management. *Planning Review* 20(5):24-27.
- Bridgeland, D. M., and R. Zahavi. 2008. *Business Modeling: A Practical Guide to Realizing Business Value*. Burlingon: Elsevier.
- Brodsky, L., V. Kartseva, P. Mika, H. Akkermans, J. Gordijn. 2002. D 1.1 Analysis of Business Modelling Methodologies for Distributed Generation Businesses. In *Business Models in a World Characterised by Distributed Generation*. E³value: Amsterdam.
- Chavan, M. 2009. The balanced scorecard: a new challenge. *Journal of Management Development* 28(5):393-406.

- Choi, C. F., and Chan, S. L. 1997. Business process re-engineering: evocation, elucidation and exploration. *Business Process Management Journal* 3(1):39-63.
- Coles, S., and J. Rowley. 1995. Revisiting decision trees. *Management Decision* 33(8):46-50.
- Coskun, S., H. Basligil, and H. Baracli. 2008. A weakness determination and analysis model for business process improvement. *Business Process Management Journal* 14(2):243-261.
- Crowe, T. J., and J. D. Rolfes. 1998. Selecting BPR projects based on strategic objectives. *Business Process Management Journal* 4(2):114-135.
- Damij, N. 2007. Business process modelling using diagrammatic and tabular techniques. *Business Process Management Journal* 13 (1):70-90.
- Davenport, T. H., and J. Short. 1990. The new industrial engineering information technology and business process redesign. *Sloan Mgmt Review* 31(4):11-27.
- Del-Rey-Chamorro, F. M., R. Roy, B. van Wegen and A. Steele. 2003. A framework to create key performance indicators for knowledge management solutions. *Journal of Knowledge Management* 7(2):46-62.
- Dufresne, T., and J. Martin. 2003. Process Modeling for E-Business. *INFS 770 Methods for Information Systems Engineering: Knowledge Management and E-Business*. Spring 2003.
- Dussart, A., B. A. Aubert, M. Patry. 2004. An Evaluation of Inter-Organizational Workflow Modeling Formalisms. *Journal of Database Management* 15(2):74-104.
- Eicker, S., J. Kochbeck, and P. M. Schuler. 2008. Employee Competencies for Business Process Management. In *Business Information Systems: 11th International Conference, BIS 2008, Innsbruck, Austria, May 5-7, 2008, Proceedings*, eds. W. Abramowicz, D. Fensel, 251–262. Springer.

- EPC Tools. <http://www2.cs.uni-paderborn.de/cs/kindler/Forschung/EPCTools/> (accessed April 20, 2010).
- Fernández, H. F., E. Palacios-González, V. García-Díaz, B. C. Pelayo G-Bustelo, O. Sanjuán Martínez, and J. M. Cueva Lovelle. 2009. SBPMN – An easier business process modeling notation for business users. *Computer Standards & Interfaces* 32 (1-2):18–28.
- Filipowska, A., M. Kaczmarek, M. Kowalkiewicz, X. Zhou, and M. Born. 2009. Procedure and guidelines for evaluation of BPM methodologies. *Business Process Management Journal* 15(3):336-357.
- France, R., A. Evans, K. Lano, and B. Rumpe. 1998. The UML as a formal modeling notation. *Computer Standards & Interfaces* 19(1998):325-334.
- Graham, B. S. 1995. Process analysis without a guesswork. *Empowerment in Organizations* 3(1):26-31.
- Hammer, M. 1996. *Beyond Re-engineering: How the Process-Centered Organisation Is Changing Our Work and Our Lives*. New York: Harper Collins.
- Hammer, M., and J. Champy. 2006. *Reengineering the Corporation: A Manifesto for Business Revolution*. Translated. Moscow: Mann, Ivanov & Ferber.
- Hanrahan, R. P. 1995. The IDEF Process Modeling Methodology. Software Technology Support Center. <http://www.stsc.hill.af.mil/crosstalk/1995/06/IDEF.asp> (accessed February 23, 2010).
- Hill, J. B. 2007. BPM is Not the Same as BPR. BPMInstitute.org, February 9. <http://www.bpminstitute.org/articles/article/article/bpm-is-not-the-same-as-bpr.html> (accessed May 10, 2010).
- IBM. WebSphere Business Modeler Advanced: Advanced Business Modeling and Analysis. <http://www-01.ibm.com/software/integration/wbimodeler/advanced/features/> (accessed March 22, 2010).

- IDS Sheer AG – Business Process Excellence a. Modeling Standards.
http://www.ids-scheer.com/en/ARIS/ARIS_Modeling_Standards/80850.html (accessed March 22, 2010).
- IDS Sheer AG – Business Process Excellence b. The Benchmark for Enterprise-Wide Process Design.
http://www.ids-scheer.com/en/ARIS/ARIS_Platform/ARIS_Design_Platform/6926.html (accessed March 22, 2010).
- IDS Sheer AG – Business Process Excellence c. The First Free Business Process Management (BPM) Software from the Market Leader. [http://www.ids-scheer.com/en/ARIS/ARIS_Platform/ARIS_Express/151392.html?mod_src_h\[result_link\]=1](http://www.ids-scheer.com/en/ARIS/ARIS_Platform/ARIS_Express/151392.html?mod_src_h[result_link]=1) (accessed March 22, 2010).
- Kalpic, B., and P. Bernus. 2002. Business process modelling in industry – the powerful tool in enterprise management. *Computers in Industry* 47 (3):299-318.
- Kettinger, W. J., J. T. C. Teng, and S. Guha. 1997. Business Process Change: A Study of Methodologies, Techniques, and Tools. *MIS Quarterly* 21(1):55-79.
- Khurana, R., and V. V. Mandke. 2009. Business process modeling with information integrity. *Business Process Management Journal* 15(4):487-503.
- Ko, R. K. L., S. S. G. Lee, and E. W. Lee. 2009. Business process management (BPM) standards: a survey. *Business Process Management Journal* 15(5):744-791.
- Kock, N., and R. McQueen. 1998. Knowledge and Information Communication in Organizations: An Analysis of Core, Support and Improvement Processes. *Knowledge and Process Management* 5(1):29-40.

- Kohlbacher, M. 2010. The effects of process orientation: A literature review. *Business Process Management Journal* 16(1):135–152.
- Lawrie, G., and Cobbold, I. 2004. Third-generation balanced scorecard: evolution of an effective strategic control tool. *International Journal of Productivity and Performance Management* 53(7):611-623.
- Le Clair, C., and C. Teubner. 2007. The Forrester Wave: Business Process Management For Document Processes, Q3 2007, July 9. http://www.adobe.com/enterprise/pdfs/forrester_wave.pdf (assessed March 25, 2010).
- Lee, R. G., and B. G. Dale. 1998. Business process management: a review and evaluation. *Business Process Management Journal* 4(3):214-226.
- Lin, F.-R., M.-C. Yang, and Y.-H. P. 2002. A generic structure for business process modeling. *Business Process Management Journal* 8(1):19-41.
- Lu, R., and S. Sadiq. 2007. A survey of comparative business process modeling approaches. In *Business Information Systems: 11th International Conference, BIS 2007*, Poznan, Poland, 25-27 April, 2007, ed. W. Abramowicz, 82-94. Springer.
- Luo, W., and Y. A. Tung. 1999. A framework for selecting business process modeling methods. *Industrial Management & Data Systems* 99(7):312-319.
- Macbeth, D. 2002. From Research to Practice via Consultancy and Back Again: A 14 Year Case Study of Applied Research. *European Management Journal* 20(4):393-400.
- Manganelli R. L., and M. M. Klein. 1994. *The Reengineering Handbook: A Step-by-Step Guide to Business Transformation*. New York: American Management Association. May 2010, Vol. 25 Issue 5, p6-8, 3p
- McAdam, M., B. Galbrath, R. McAdam, and P. Humphreys. 2006. Business Processes and Networks in University Incubators: A Review and Research Agendas. *Technology Analysis & Strategic Management* 18 (5):451-472.

- McAdam, R., W. Keogh, B. Galbright, and D. Laurie. 2005. Defining and improving technology transfer business and management processes in university innovation centres. *Technovation* 25(2005):1418-1429.
- MEGA. Business Process Modeling with MEGA Process.
<http://www.mega.com/en/c/product/p/modeling/p2/business-process-modeling> (accessed March 22, 2010).
- Melão, N., and Pidd, M. 2000. A conceptual framework for understanding business processes and business process modelling. *Information Systems Journal* 10(2):105-129.
- Mendling, J., and M. Strembeck. 2008. Influence Factors of Understanding Business Process Models. In *Business Information Systems: 11th International Conference, BIS 2008, Innsbruck, Austria, May 5-7, 2008, Proceedings*, eds. W. Abramowicz, D. Fensel, 142–153. Springer.
- Mentzas, G., C. Halaris, and S. Kavadias. 2001. Modelling business processes with workflow systems: an evaluation of alternative approaches. *International Journal of Information Management* 21 (2):123-125.
- Ng, P.-W. 2002. Business Process Modeling and Simulation with UML. IBM.
<http://www.ibm.com/developerworks/rational/library/2797.html#author1> (accessed March 22, 2010).
- NORDI a. Northern Dimension Research Centre.
<http://www.lut.fi/en/nordi/Pages/Default.aspx>.
- NORDI b. The Northern Dimension.
http://www.lut.fi/en/nordi/introduction/northern_dimension/Pages/Default.aspx.
- Nubauer, T. 2009. An empirical study about the status of business process management. *Business Process Management Journal* 15 (2):166-183.
- Nurcan, S., A. Etien, R. Kaabi, I. Zoukar, and C. Rolland. 2005. A strategy driven business process modeling approach. *Business Process Management Journal* 11(6):628-649.

- Oracle White Paper. 2008. State of Business Process Management Market. <http://www.oracle.com/technologies/bpm/docs/state-of-bpm-market-whitepaper.pdf> (assessed February 2, 2010).
- Parmenter, D. 2007. *Key Performance Indicators (KPI): Developing, Implementing, and Using Winning KPIs*. New Jersey: John Wiley & Sons.
- Peyret, H. 2009. The Forrester Wave: Business Process Analysis, EA Tools, And IT Planning, Q1 2009. Forrester Research. Retrieved from www.forrester.com (assessed February 27, 2010).
- Philbin, S. 2008. Process model for university-research collaboration. *European Journal of Innovation Management* 11(4):488-521.
- Process-expert. Tendentsii rossiyskogo rynka sredst opisaniya i analiza bizness-processov [Tendencies for Russian market of Business process modeling and analysis tools]. <http://www.process.siteedit.ru/page66> (assessed February 22, 2010).
- Rajala, M., and T. Savolainen. 1996. A framework for customer oriented business process modelling. *Computer Integrated Manufacturing Systems* 9 (3):127-135.
- Recker, J., M. Indulska, M. Rosemann, and P. Green. 2009. Business process modeling - a comparative analysis. *Journal of the Association for Information Systems* 10 (4):333-363.
- Repin, V. V. 2001. Sravnitelniy analiz notatsiy ARIS eEPC / IDEF0, IDEF3 i productov, ih podderjivaiuschih (ARIS Toolset / BPwin) [Comparative analysis of ARIS eEPC / IDEF0, IDEF3 notations and tools, which support them (ARIS Toolset / BPwin)]. Razvitie Biznesa.Ru [Business Development.Ru]. http://www.devbusiness.ru/development/eod/aris_vs_idef_repin.htm (accessed March 1, 2010).
- Revenaugh, D. L. 1994. Business process re-engineering: the unavoidable challenge. *Management Decision* 32(7):16-28.

- Rosemann, M. 2006. Potential pitfalls of process modeling: part B. *Business Process Management Journal* 12(3):377-384.
- Samaranayake, P. 2009. Business process integration, automation and optimization in ERP: Integrated approach using enhanced process models. *Business Process Management Journal* 15(4):504-526.
- Schmietendorf, A. 2008. Assessment of Business Process Modeling Tools under Consideration of Business Process Management Activities. In *Proceedings of IWSM / MetriKon / Mensura 2008 (International Workshop on Software Measurement / DASMA Metrik Kongress / International Conference on Software Process and Product Measurement), Lecture Notes in Computer Science (LNCS), Vol. 5338*, eds. R. Dumke et al., 141-154. Berlin: Springer.
- Seng, J.-L., and W. Lin. 2007. An ontology-assisted analysis in aligning business process with e-commerce standards. *Industrial Management & Data Systems* 107(3):415-437.
- Sethu, S. 2009. Business Process Modeling Tool Selection. Mindomo Maps.
<http://www.mindomo.com/view?m=197f252e5a3e39290c55a0c81cafbe4c>
(accessed February 28, 2010).
- Shen, H., B. Wall, M. Zaremba, Y. Chen, and J. Browne. 2004. Integration of business modelling methods for enterprise information system analysis and user requirements gathering. *Computers in Industry* 54(2004):307-323.
- Smart, P. A., H. Maddern, and R. S. Maull. 2008. Understanding Business Process Management: Implications for Theory and Practice. *British Journal of Management* 20(4):491-507.
- Smith, H. 2003. Business Process Management—the third wave: business process modelling language (bpml) and its pi-calculus foundations. *Information and Software Technology* 45 (15):1065–1069.
- Sparx Systems. 2007. The Business Process Model. *UML Tutorial*.
<http://www.sparxsystems.com/downloads/whitepapers/businessProcessModelTutorial.pdf> (accessed March 22, 2010).

- Temtime, Z. T., S. V. Chinyoka, and J. P. W. Shunda. 2004. A decision tree approach for integrating small business assistance schemes. *Journal of Management Development* 23(6): 563-578.
- Toussaint, P. J., A. R. Bakker, and L. P. J. Groenewegen. 1997. Constructing an enterprise viewpoint: evaluation of four business modelling techniques. *Computer Methods and Programs in Biomedicine* 55 (1):11–30.
- Trkman, P. 2009. The critical success factors of Business Process Management. *International Journal of Information Management*.
- Wahli, U., V. Avula, H. Macleod, M. Saeed, and A. Vinther. 2007. *Business Process Management: Modeling through Monitoring Using WebSphere V6.0.2 Products*. 2nd ed. IBM, Redbooks. Retrieved from ibm.com/redbooks.
- Webster, J., and R. T. Watson. 2002. Analyzing the past to prepare for the future: writing a literature review. *MIS Quarterly* 26 (2):xiii-xxiii.
- Weiss, D., J. Leukel, and S. Kirn. 2008. Concepts for Modeling Hybrid Products in the Construction Industry. In *Business Information Systems: 11th International Conference, BIS 2008, Innsbruck, Austria, May 5-7, 2008, Proceedings*, eds. W. Abramowicz, D. Fensel, 154 – 164. Springer.
- White, S. 2006. *Best Practices for Using WebSphere Business Modeler and Monitor*. IBM, Redbooks. Retrieved from ibm.com/redbooks.
- Witcher, B. J., and V. S. Chau. 2007. Balanced scorecard and hoshin kanri: dynamic capabilities for managing strategic fit. *Management Decision* 45(3):518-538.
- Wolf, C., and P. Harmon. 2010. The State of Business Process Management 2010. A BPTrends Report, February.
http://www.bptrends.com/members_surveys/deliver.cfm?report_id=1004&target=2009_BPTrends_State_of_Market_Rept_FINAL_PDF_CAP_2-1-10.pdf&return=surveys_landing.cfm (accessed February 27, 2010).

Yu, B., and D. T. Wright. 1997. Software tools supporting business process analysis and modeling. *Business Process Management Journal* 3(2):133-150.

Appendices

Appendix 1. Applications of Business Process Modeling in Business Life

As it was mentioned in section describing benefits of business process modeling in the master thesis' main text, business process modeling can be used for following purposes: communication, training and learning, persuasion and selling, analysis, managing compliance, as requirements for developing software, executing directly as software, and knowledge management and reuse (Bandara, Gable, and Rosemann 2005; Bridgeland and Zahavi 2008).

Business process modeling can provide a business with *transparent definition* of its processes therefore it becomes easier to identify real reasons and sources of many deficiencies – hidden factors of the processes are now revealed. In the same time business process modelling can assist *designing* of business processes so they will be better, faster, efficient and more transparent (Bandara, Gable, and Rosemann 2005). Business process modeling also provides support for overall business process *control and monitoring*.

One of important directions of business process modeling is to support *managing of changes* in organization (Coskun et al. 2008). In this respect business process models can help “to *communicate* to the employees what will change and how the change will affect their day-to-day work lives” (Bridgeland and Zahavi 2008, 104).

The third wave ‘approach’ of business process management is based on the idea of modeling business processes directly in executable form (Smith 2003). Modern trend is to model business processes in a standard way. First of all, business process is captured with the help of business process modeling, which is called process mapping. The result of this phase is set of business process models. Then program code is automatically generated out of the models. Code is modified afterwards and deployed creating real working business processes which become

a service or its part of a business. These business processes in their turn can be easily *monitored and controlled*, due to the fact that different performance indicators performance indicators can be automatically mirrored on a special dashboard.

Business process modeling can be used for diverse purposes such as: process documentation, process improvement, compliance, software implementation or quality certification, model-based identification of process weaknesses, adapting best business practices, design of a new business blueprint (as a form of documentation and communication), end-user training.

Business process modelling has been employed in a range of different applications, including: activity based costing, supply chain management, customer relationship management, total quality management, workflow management, knowledge management and simulation (Bandara, Gable, and Rosemann 2005). Authors also distinguish three main process modeling benefits categories: documentation benefit, design benefit and use benefit.

Appendix 2. Structured Field Domain

In order to introduce reader with the selected field domain, the classification of terms and concepts, standards and notations with their various interpretations used in the field of research was created. This information will help reader with previous background on business process modeling to structure all the concepts existing in this field in his or her head. For one without any understanding of business process modeling the provided information will help to establish a base for future developing of understanding. Thus I do not include this discussion into main text of master thesis but leave it for those who are interested in appendix.

Business Process Modeling Concepts Being Analyzed

Trends on concepts existing in the literature on business process modeling nowadays are going to be discussed in this part. The main directions are: discussion on notations, techniques and languages being used in business process modeling.

In conducted analysis lots of works discussing different theoretical concepts, such as notations, techniques, languages, tools were met. But also there were discussions of the terms, which are not as widely recognized and lack any strict definition, such as method or approach. For example, Weiss, Leukel, and Kirn (2008) discuss different modeling methods in their work, but after thorough analysis and comparison with other sources the conclusion was made that these methods are techniques in generally accepted terminology. Also Damij (2007) doesn't make any distinguishing between 'method' and 'technique' in her article using both terms to discuss the same issues.

Talking about term 'approach', if it is not used in order to state that business process modeling is an approach within business process management among other approaches in this field (Smith 2003), then lots of authors use it discussing different business process modeling techniques as well (Lu and Saqid 2007; Mentzas, Halaris, and Kavadias 2001; Nurcan et al. 2005; Recker et al. 2009).

Therefore the decision was made to focus on discussion of three main theoretical concepts in the field of business process modeling: notation, technique and language. One more reason for that was that they are the most beneficial to the master thesis study.

First of all, starting discussion from ‘notation’ definition of this concept should be introduced. *Notation* is a set of rules or constraints on graphical appearance of business process models, i.e. which elements are allowed to be used and in which way.

The most discussed notation is BPMN (Business Process Modeling Notation). It is broadly studied, for example, by Bridgeland and Zahavi (2008), Fernández et al. (2009), Recker et al. (2009).

A breakthrough in discussion about this notation is made by Fernández et al. (2009). This very leading article states some existing problems in business process modeling. As a solution they develop a new notation called Simple Business Process Modeling Notation (SMPMN), which is based on BPMN, analyzed by the authors, which is claimed to be used most in business process modeling recently. SBPMN represents a modified version of BPMN in such a way that it starts to be easier understood by a person with no preliminary knowledge in the field. Authors claim that this notation is applicable to be used by business people and are going to complement it with a modeling tool and a special language in order to be able to translate into BPMN in order to be able to use all the advantages of notation recognized nowadays as a standard (Bridgeland and Zahavi 2008, 132).

According to Kettinger, Teng, and Guha (1997, 58) *technique* is “a set of precisely described procedures for achieving a standard task”. “Business process modeling is complex and difficult problem” (Damij 2007), therefore there exist lots of techniques for that: Petri nets, ANSI flowcharts (American National Standards Institute), DFD (Data Flow Diagrams), ISO TC87, Merise, EPC (Event-driven Process Chains), IDEF3, ebXML BPSS (Electronic Business using eXtensible Markup Language Business Prospect Specification Schema), BPML

(Business Process Modeling Language), WSCI (Web Service Choreography Interface), WS-BPEL (Business Process Execution Language for Web Services), BPMN (Recker et al. 2009).

Comparison of those has been an aim of lots of research works (Aguilar-Savén 2004; Damij 2007; Mentzas, Halaris, and Kavadias 2001; Luo and Tung 1999; Recker et al. 2009). All this researches have the same aim – to compare different existing techniques with each other in order to select the best option.

Other group of researches (Nurcan et al. 2005; Rajala and Savolainen 1996; Toussaint, Bakker, and Groenewegen 1997; Weiss, Leukel, and Kirn 2008) proves that existing modeling techniques are not enough for specified need of organization or task. In this respect they try to suggest using different combinations of existing techniques in business process modeling or develop enhanced techniques: SMPMN - Fernández et al. (2009), enhanced EPC - Samaranyake (2009).

According to Bandara, Gable, and Rosemann (2005) modeling *language* is “the grammas or the “syntactic rules” of the selected process modeling technique”. Some examples of graphical modeling languages are: Behavioral Trees, BPML (Business Process Modeling Manguage), EXPRESS and EXPRESS-G, Extended Enterprise Modeling Language (EEML), Flowchart, Fundamental Modeling Concepts (FMC), IDEF family, Jackson Structured Programming (JSP), LePUS3, Object Role Modeling (ORM), Petri nets, Southbeach Notation, Specification and Description Language (SDL), SysML, Unified Modeling Language (UML), Service-Oriented Modeling Framework (SOMF).

Studies on different business process modeling languages were performed. They can be divided into discussion about one particular item (Seng and Lin 2007; Smith 2003) or again comprehensive comparison of several representatives (Dussart et al. 2004; Lu and Sadiq 2007).

Quality and Success Issues in Business Process Modeling

According to Trkman (2009) there have been lots of research on modeling techniques and tools and little research on success factors in this field. In order to satisfy interest in the best practices in business process modeling and their drivers, literature overview in this area was done as well. Notions ‘quality’ and ‘success’ go hand in hand here therefore the section name is “Quality and Success Issues in Business Process Modeling”.

The discussion of main direction in research on quality and success in business process modeling can be divided into several parts. Some authors choose more critical approach and mainly explore what leads to low ‘quality’ in business process modeling, for example, business process modeling techniques do not usually correlate with customers expectations about business processes performance (Rajala and Savolainen 1996).

The question of business process models quality is often discussed (Bandara, Gable, and Rosemann 2005; Khurana and Mandke 2009; Mendling and Strembeck 2008). Usually in this respect some factors are derived (Bandara, Gable, and Rosemann 2005; Khurana and Mandke 2009; Trkman 2009).

People Involved in Business Process Modeling

Business process modeling concerns not only organization, technologies and processes, but also people. In this group studies were selected, which are concerned with people involved in business process modeling and their desired competences or cover these issues, significantly presenting them in the study, nevertheless making research mainly on other topics.

Eicker, Kochbeck, and Schuler (2008) postulate that people competencies are important because might be crucial competitive advantages. The need for new specialized and competent personnel in this field is obvious though concepts haven’t been completely established yet. This people have to be good listeners,

possess perfect communication skills, ability to see situation as a whole and study quickly (Hammer and Champy 2006). Eicker, Kochbeck, and Schuler (2008) also make clear distinction between the specialized personnel which responsibility is business process modeling implementation and business process owner.

A very leading article (Fernández et al. 2009) states the necessity of specially educated person, so-called business analysis, for creating business process model. The ordinary business person is not able to use difficult notations which are usually used for such purposes. The term, “business analyst” for naming such kind of people is used in the master thesis.

Lu and Sadiq (2007) say industry research showed that business process owners are more often business process modelers than any qualified technical specialist. Business process owners are in vast majority just ordinary business people who have no or very little understanding of business process modeling peculiarities.

Kalpic and Bernus (2002) also provide hints and recommendations on qualification of people, who are involved in business process modeling process. They state that in order to perform formalization of knowledge in business process modeling form special skills are required. So model designer/analyst should possess them. Also there is an issue that in order to understand the results of business process modeling, e.g. any kind of models it provides users with, special formal model interpretation skills are also required. Usually process owner gets them from model designer/analyst therefore some additional teaching skill for the latter required as well.

Talking about terminology which is used in the master thesis: “model designer” is going to mean a person who implements business process modeling, and “business analyst” if this person in addition is correspondingly qualified. “Business process owner” is going to be used for naming the person who actually implements certain process in organization.

Procedural Guidelines for Business Process Modeling

There is no comprehensive research conducted on the process of business process modeling itself, meaning how to start and implement business process modeling in certain cases. According to Recker et al. (2009) who provides a wide literature review in their paper there is no research done in the field of procedural guidelines. Nevertheless we managed to obtain some results for discussion of the mentioned topic (Kapcic and Bernus 2002; Trkman 2009).

Procedural guidelines in Trkman's work (2009) appear in a form of case study, author is holding, description. He is thoroughly explaining why every business process modeling step was done by him.

Kapcic and Bernus (2002) also provide us with some more valuable guidelines according process of building of business process models. Their detailed study description is well-theoretically supported. They discuss main issues, such as choosing the type of model on different steps, detailing and in-depth of analysis, what additional descriptions should accompany graphical models, as-is and to-be models; two different approaches to model development: the bottom-up and top-down approaches – and their features and usage.

Mind Map of Structured Field Domain

The description provided above was then analyzed and following mind-map representing the structured field domain was created (figure 10). It represents that literature on business process modeling can be divided into four main groups: concepts, quality, people and procedural guidelines related issues. The first group of concept-related issues can be divided in its turn into several groups of works exploration notations, techniques or languages. Different researches concerned with every group are connected in the form of references with group's name itself. For example, Kapcic and Bernus (2002) and Trkman (2009) conducted researches which can be treated as procedural guidelines examinations.

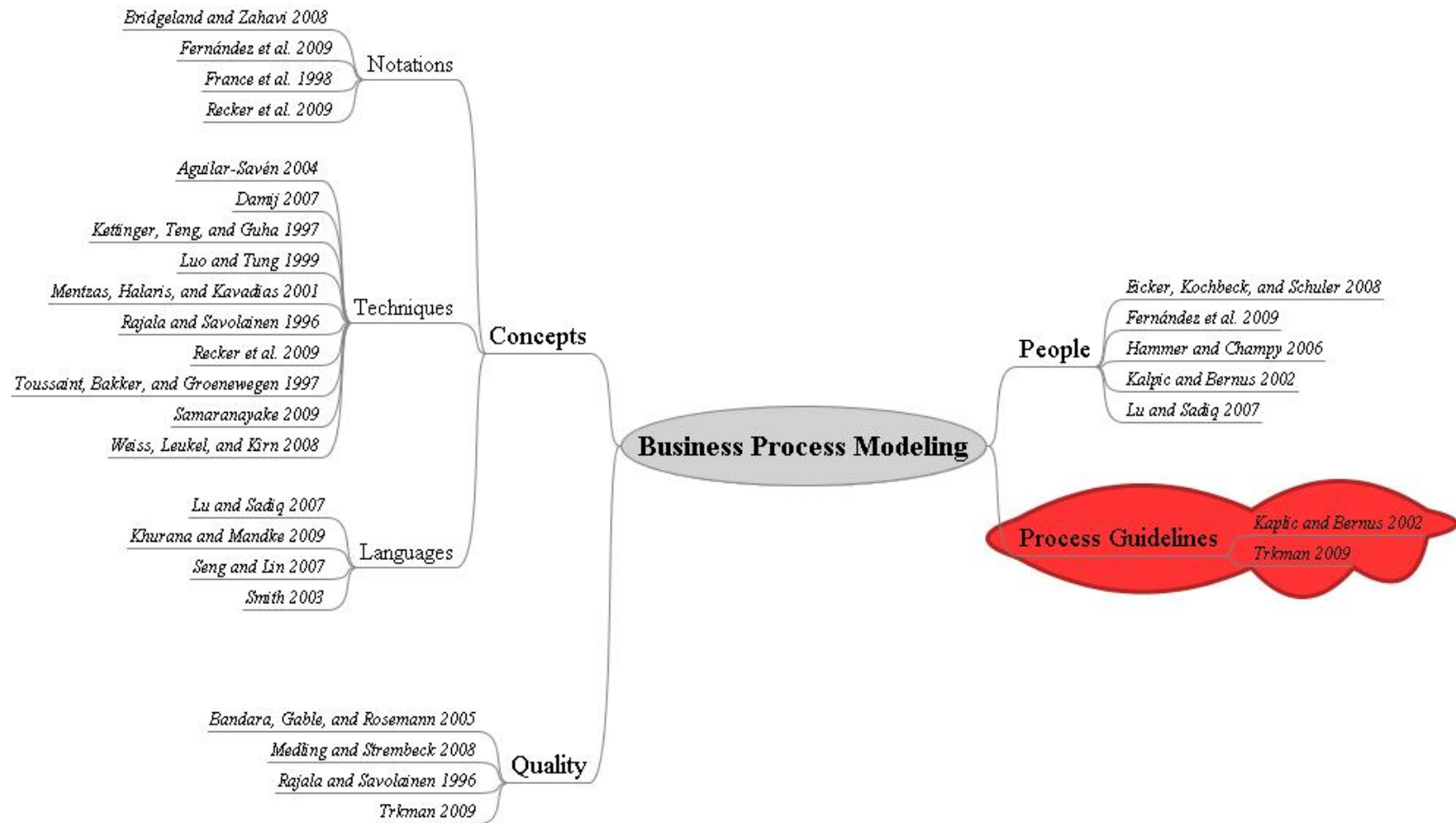


Figure 21. Business process modeling field of study

Appendix 3. Questioner #1 for Interviews with Top Positions of NORDI

During analysis of this questioner it is recommended to keep in mind that interviews were help in a form of semi-structured discussion. This so-called questioner was used only by business analysis in order to check if all the necessary information was retrieved. Discussion was held around these questions in a form suitable for each interviewee. The idea of interviews was to collect information sufficient for process mapping.

Main section of the questions:

1. What is the business of NORDI?
2. How NORDI is managed?
3. What is your sphere of competences in NORDI?
4. What are the competitive advantages of NORDI?
5. What are the tendencies on the market?
6. What are the strategic plans for development?
7. Who are the competitors, what are their strengths and weaknesses? Does NORDI have any competitors?
8. What are the main business processes in NORDI?
9. How the main business-processes are connected? (What information flows exist between them?)
10. What are main NORDI problems?

Additional questions concerning master thesis project:

11. What is the main idea of this particular project in NORDI's point of view?
And main goal?
12. In which way the current project is going to help NORDI?

Appendix 4. Questioner #2 for Interviews with Administrative Positions of NORDI

During analysis of this questioner it is recommended to keep in mind that interviews were help in a form of semi-structured discussion. This so-called questioner was used only by business analysis in order to check if all the necessary information was retrieved. Discussion was held around these questions in a form suitable for each interviewee. The idea of interviews was to collect information sufficient for process mapping.

General questions:

1. What are your main duties?
2. What additional business processes are you taking part in?
3. What controlling functions are you implementing?

More detailed questions based on the information retrieved from the previous interviews.

4. How seminar organizing process going on?
5. How budget process is organized?
6. How the NORDI budget operations and research budget operations are separated?
7. How HRM processes are organized in NORDI?
8. Accumulation of Russian-related knowledge inside the university – what this business process is about?

Appendix 5. Questioner #3 for Interviews with Experiences Research Project Managers of NORDI

During analysis of this questioner it is recommended to keep in mind that interviews were help in a form of semi-structured discussion. This so-called questioner was used only by business analysis in order to check if all the necessary information was retrieved. Discussion was held around these questions in a form suitable for each interviewee. The idea of interviews was to collect information sufficient for process mapping.

Background information about Research Project Manager:

1. For how long have you already been in this position?
2. How many projects have you had? Were they with similar research topics?
3. What are the similarities/differences in organization of projects?

Set of questions about current project of experienced Research Project Manager. Business analyst constantly asked to reflect on standard way of research project organization during description of current research project:

4. The name of the project. Main idea.
5. When the project began, going to end, Research Project Manager took leadership?
6. In which main phases the project can be divided?
 - a. Research perspective,
 - b. Administrative,
 - c. Implementation.

7. What is the project team? What are their roles and responsibilities?
8. Who are the partners? How collaboration is organized?
9. How the project started?
10. How the project ended/going to end?
11. How the reporting is organized?
 - a. To funding organization
 - b. To Director
12. What are the expected results of the project?
13. What are the problems?
14. Could you, please, share a project plan if you have one?

Appendix 6. Questioner #4 for Interviews with Research Project Managers of NORDI

During analysis of this questioner it is recommended to keep in mind that interviews were help in a form of semi-structured discussion. This so-called questioner was used only by business analysis in order to check if all the necessary information was retrieved. Discussion was held around these questions in a form suitable for each interviewee. The idea of interviews was to collect information sufficient for process mapping.

1. The name of the project. Main idea.
2. When the project began, going to end, Research Project Manager took leadership?
3. In which main phases the project can be divided?
 - a. Research perspective,
 - b. Administrative,
 - c. Implementation.
4. What is the project team? What are their roles and responsibilities?
5. Who are the partners? How collaboration is organized?
6. How the project started?
7. How the project ended/going to end?
8. How the reporting is organized?
 - a. To funding organization

b. To Director

9. What are the expected results of the project?

10. What are the problems?

11. Could you, please, share a project plan if you have one?

Appendix 7. Business Process Model of NORDI by Means of “IDEF0+Swimlanes” Methodology

The following list of abbreviations was used in the diagrams:

DM – Development Manager,

HRM – Human Research Management,

LUT – Lappeenranta University of Technology,

PM – Project Manager,

RP – Research Project,

RPM – Research Project Manager,

SG – Steering Group,

SGM – Steering Group Meeting,

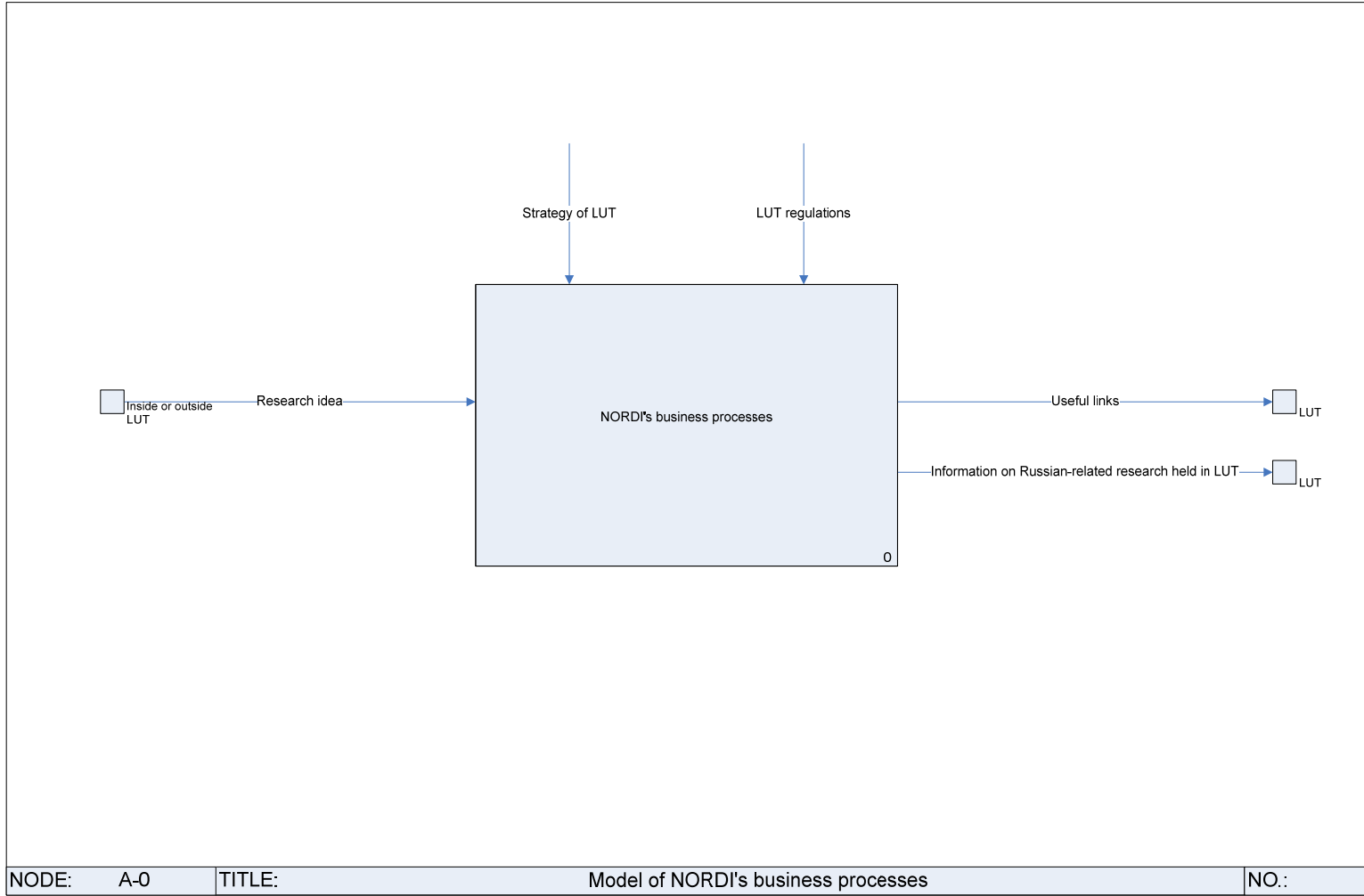
SoB – School of Business, one of departments of LUT,

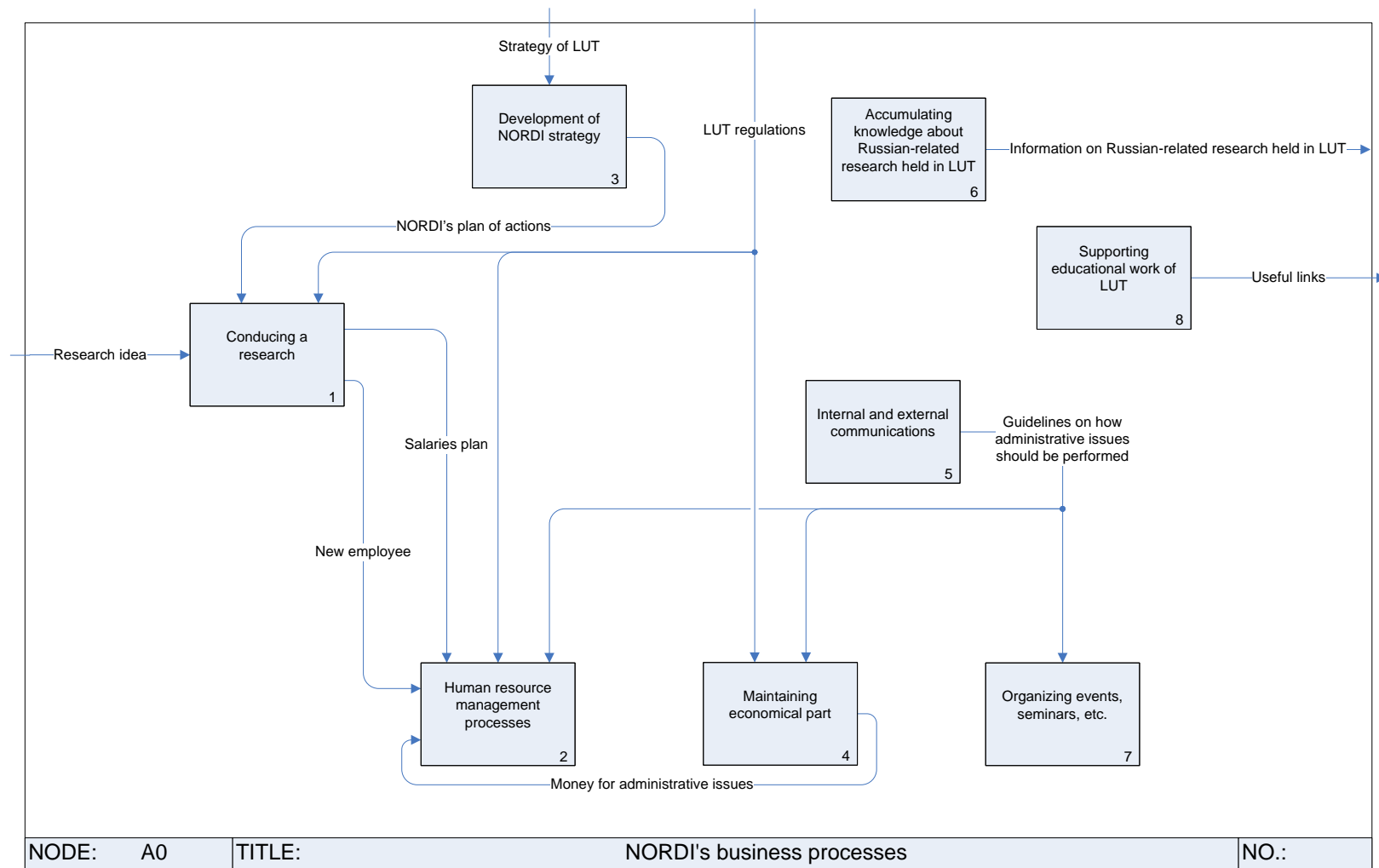
PRD – Responsible Director of the project.

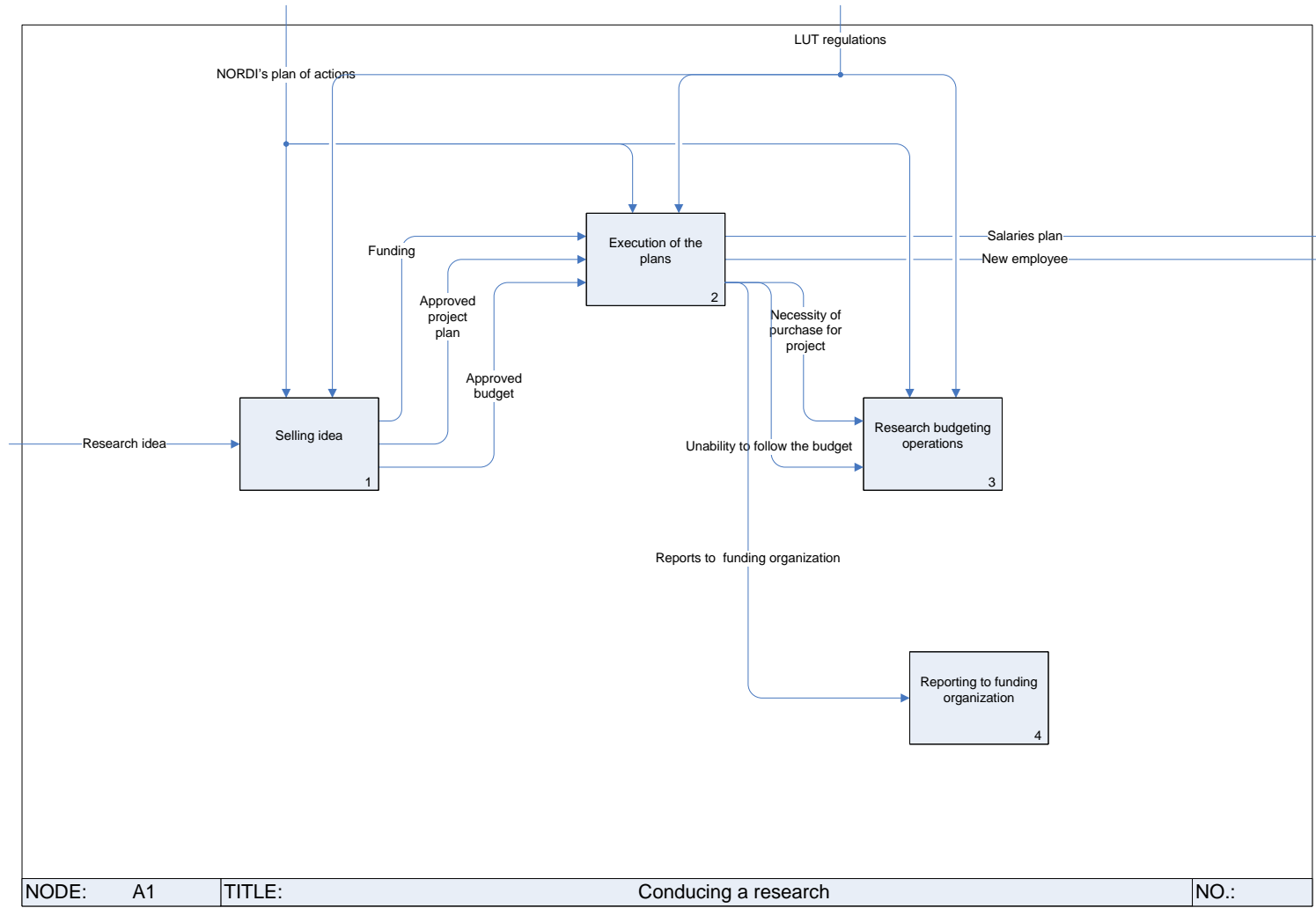
Some additional notes are:

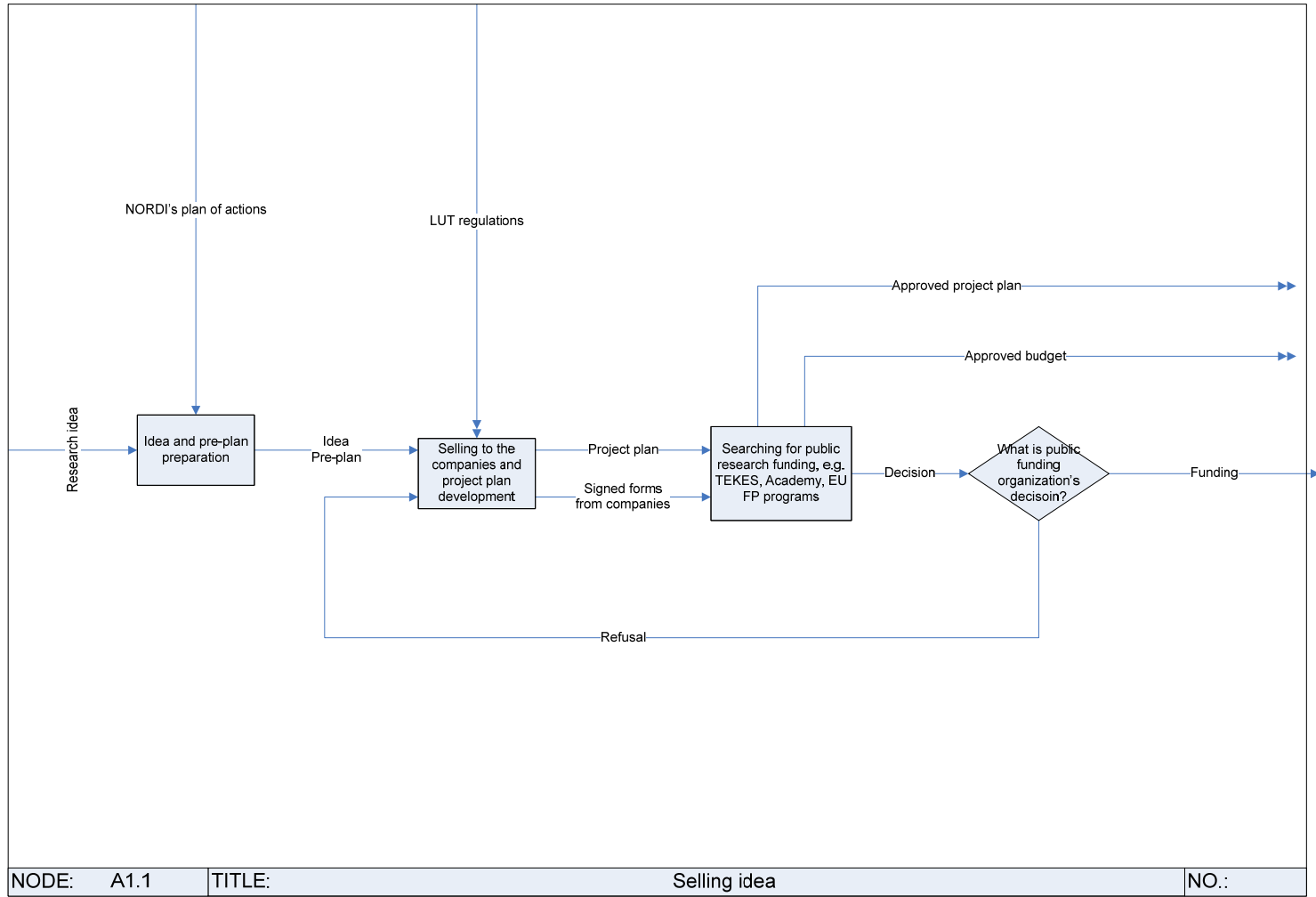
Names of activities sometimes end with notion of responsible person in the brackets. This person is responsible for execution of the activity. Sometimes this person coincides with the executor of the activity, but not necessarily.

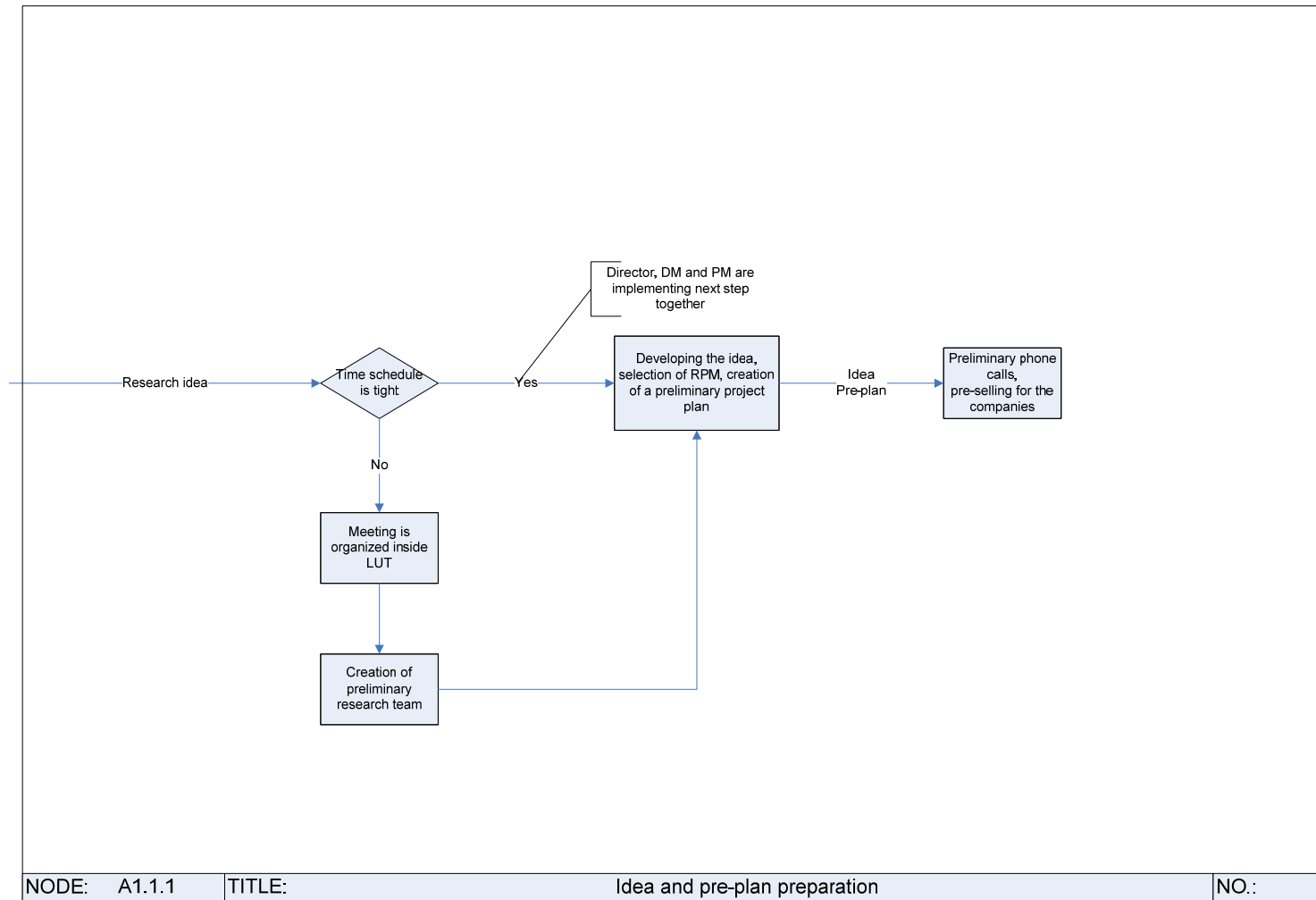
Only selected diagrams are represented not to overload the appendices.

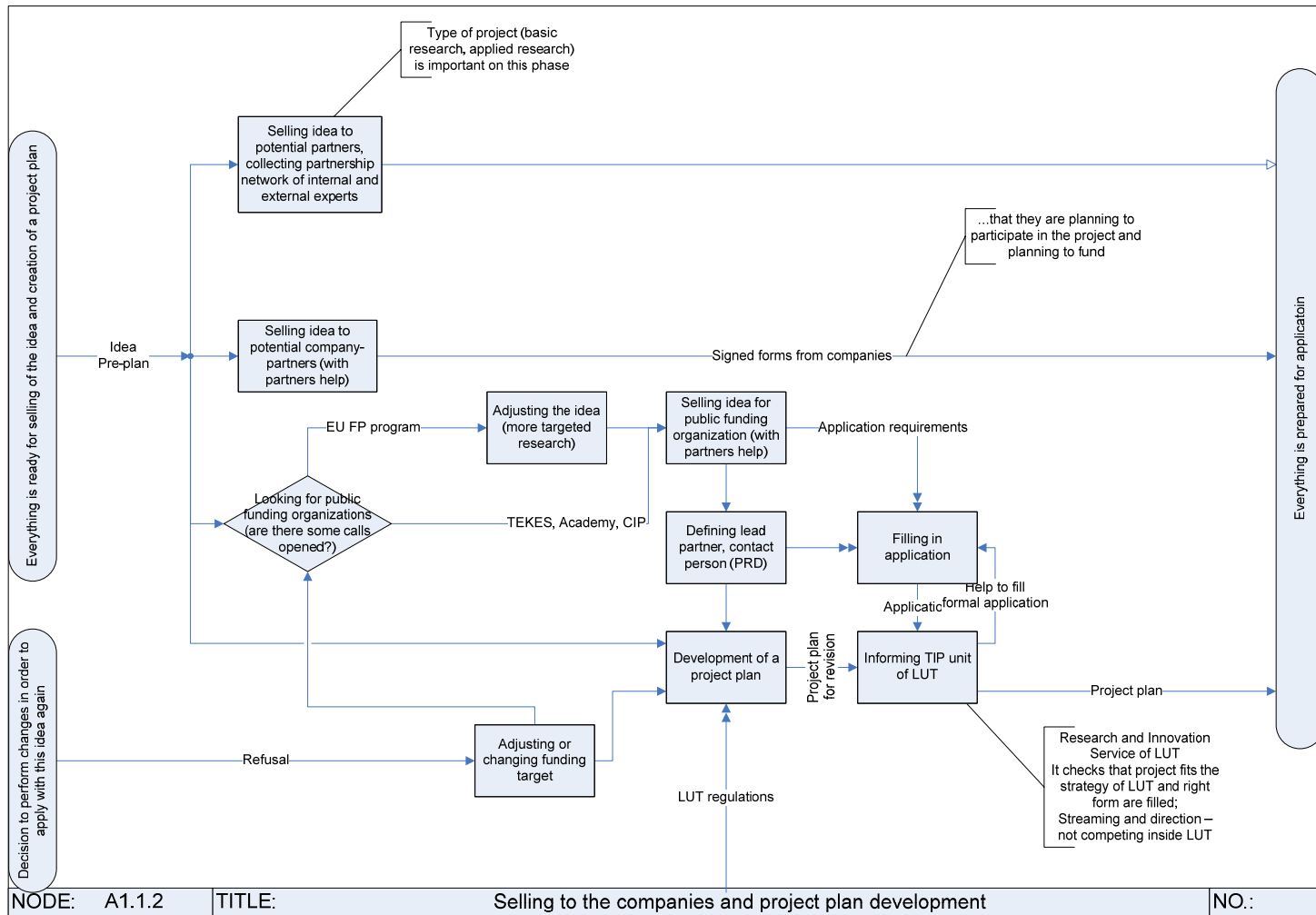


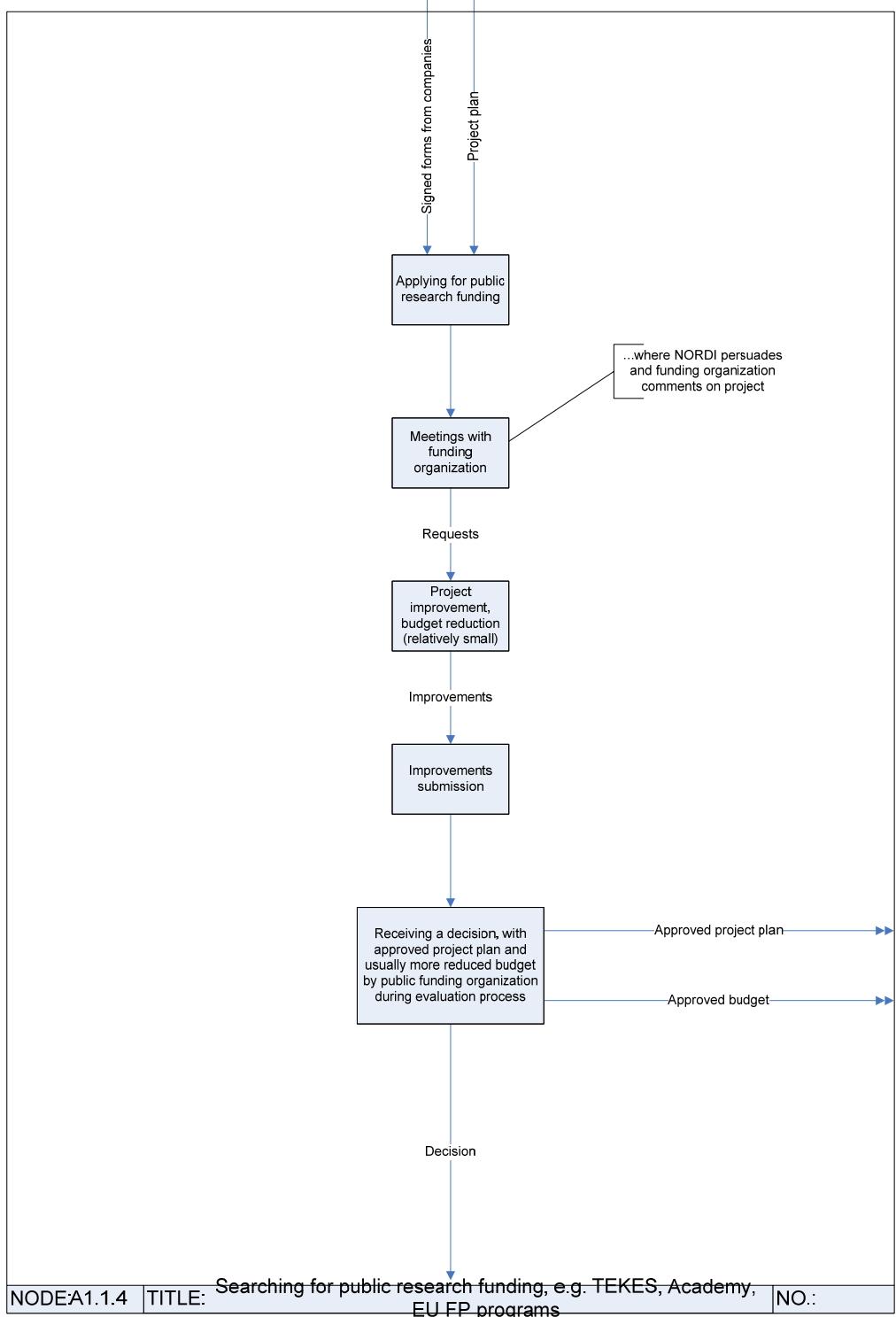


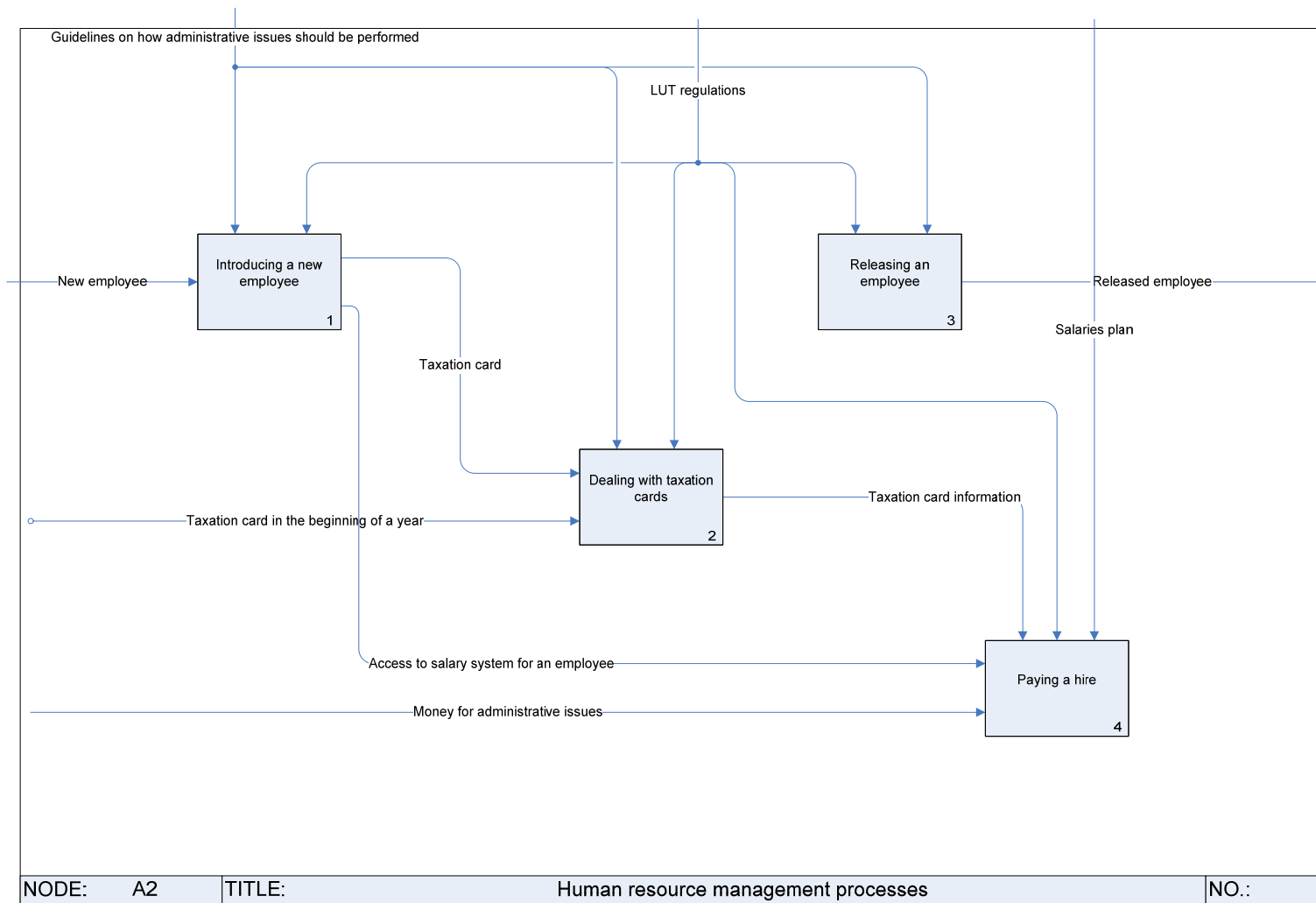


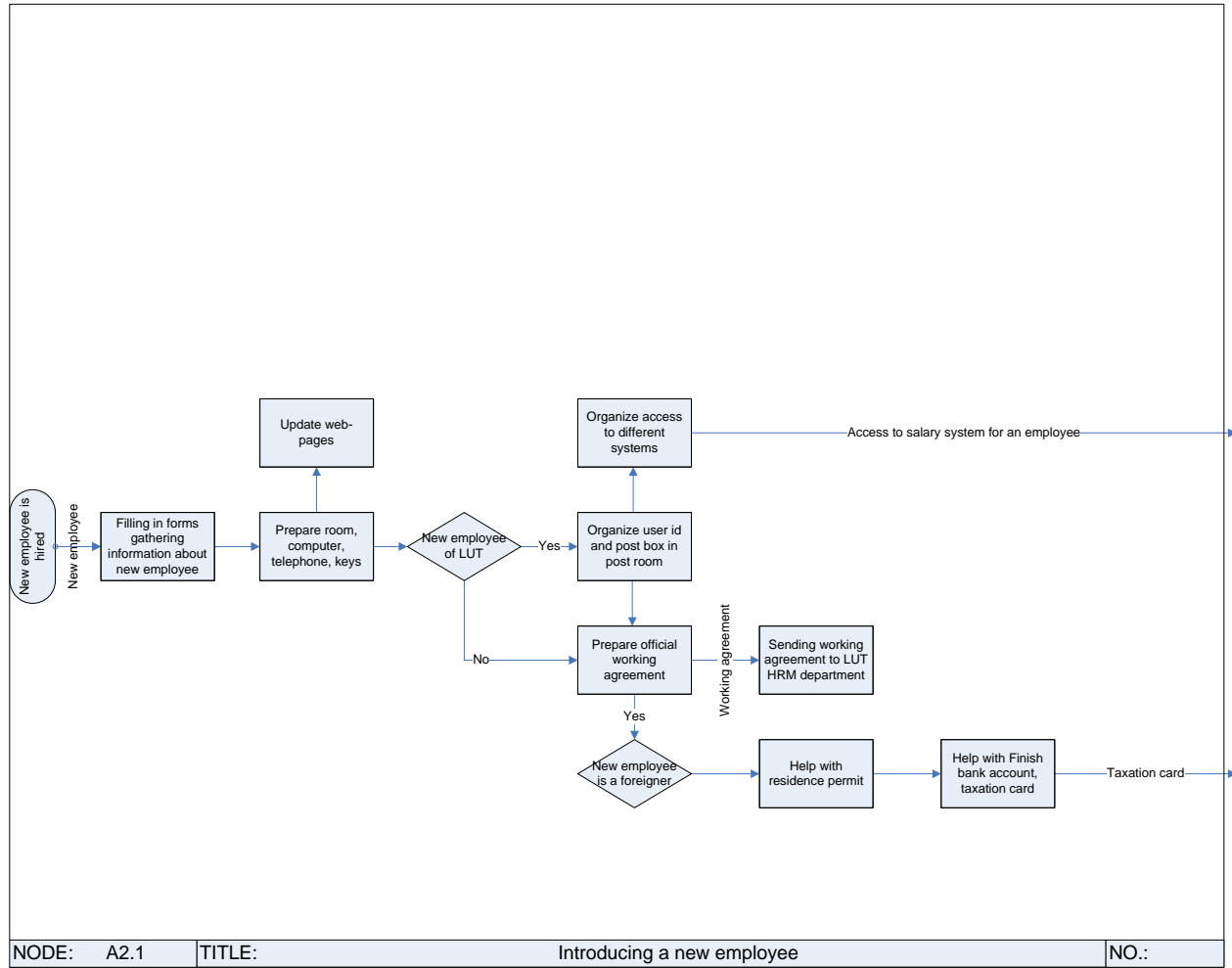






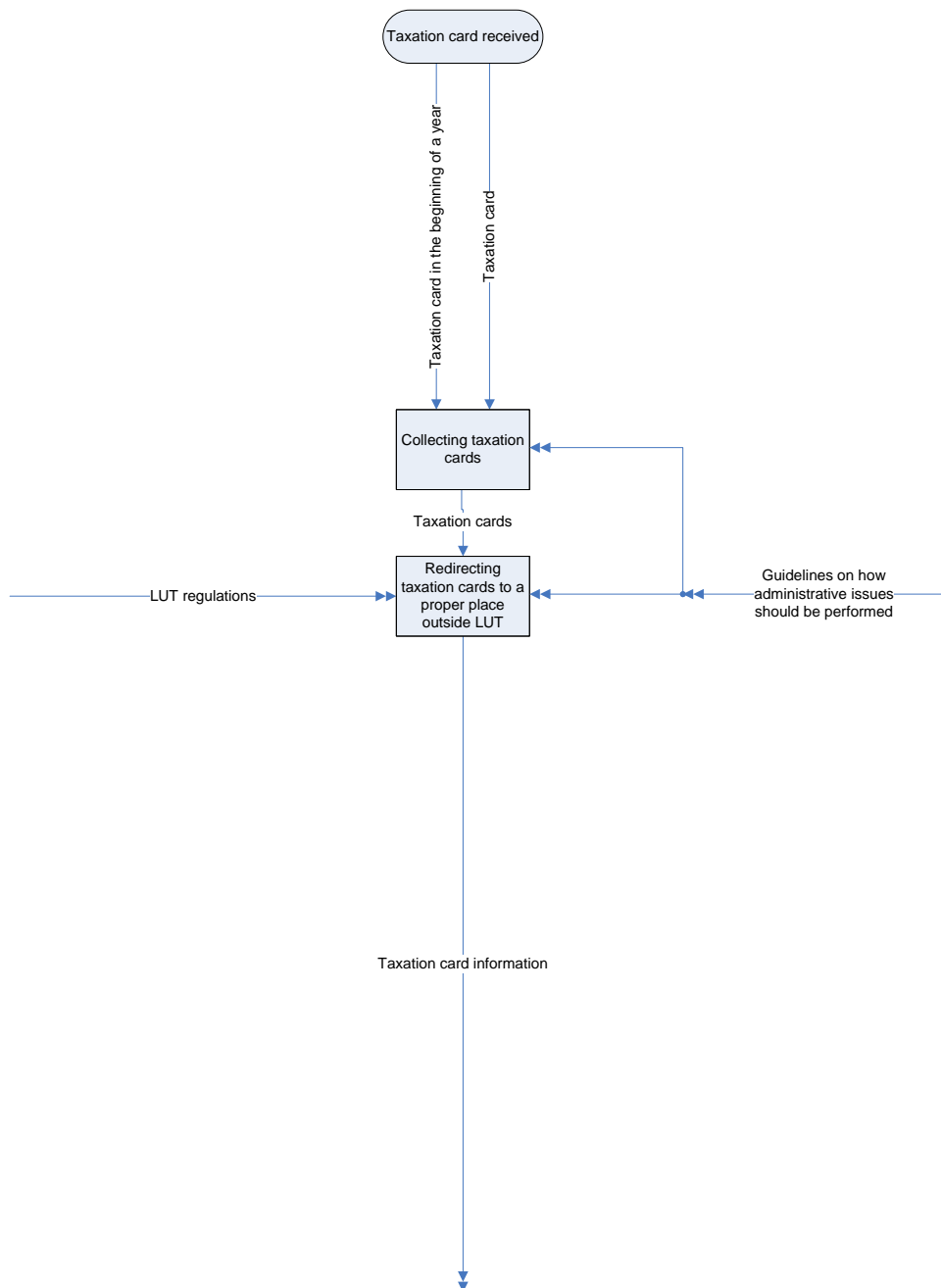


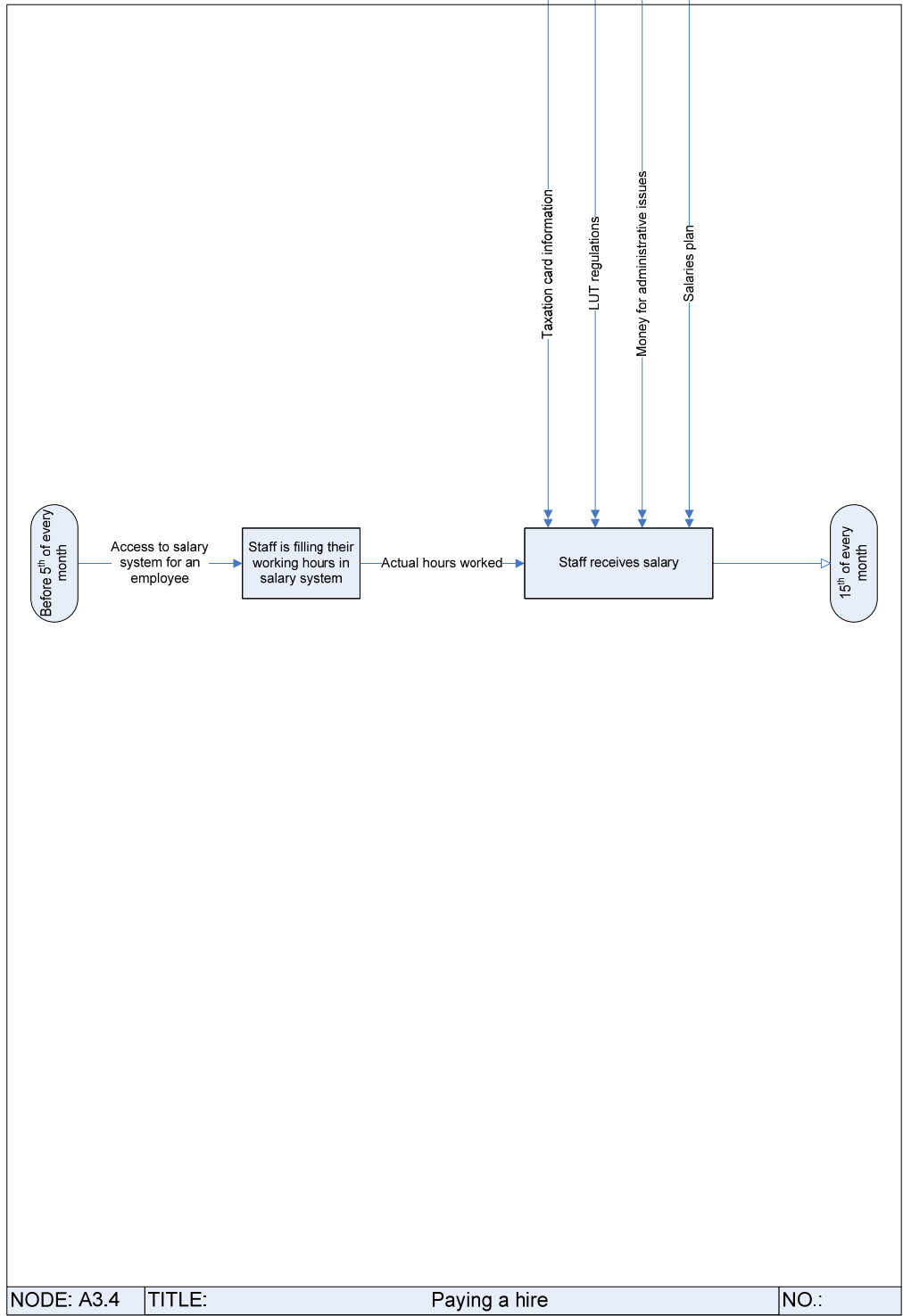


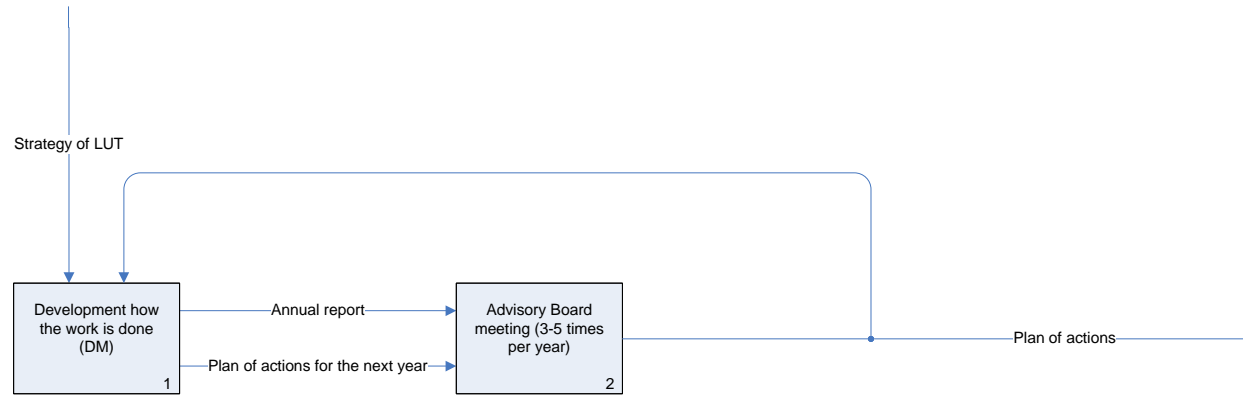


A2.2 Dealing with taxation cards

Project Manager



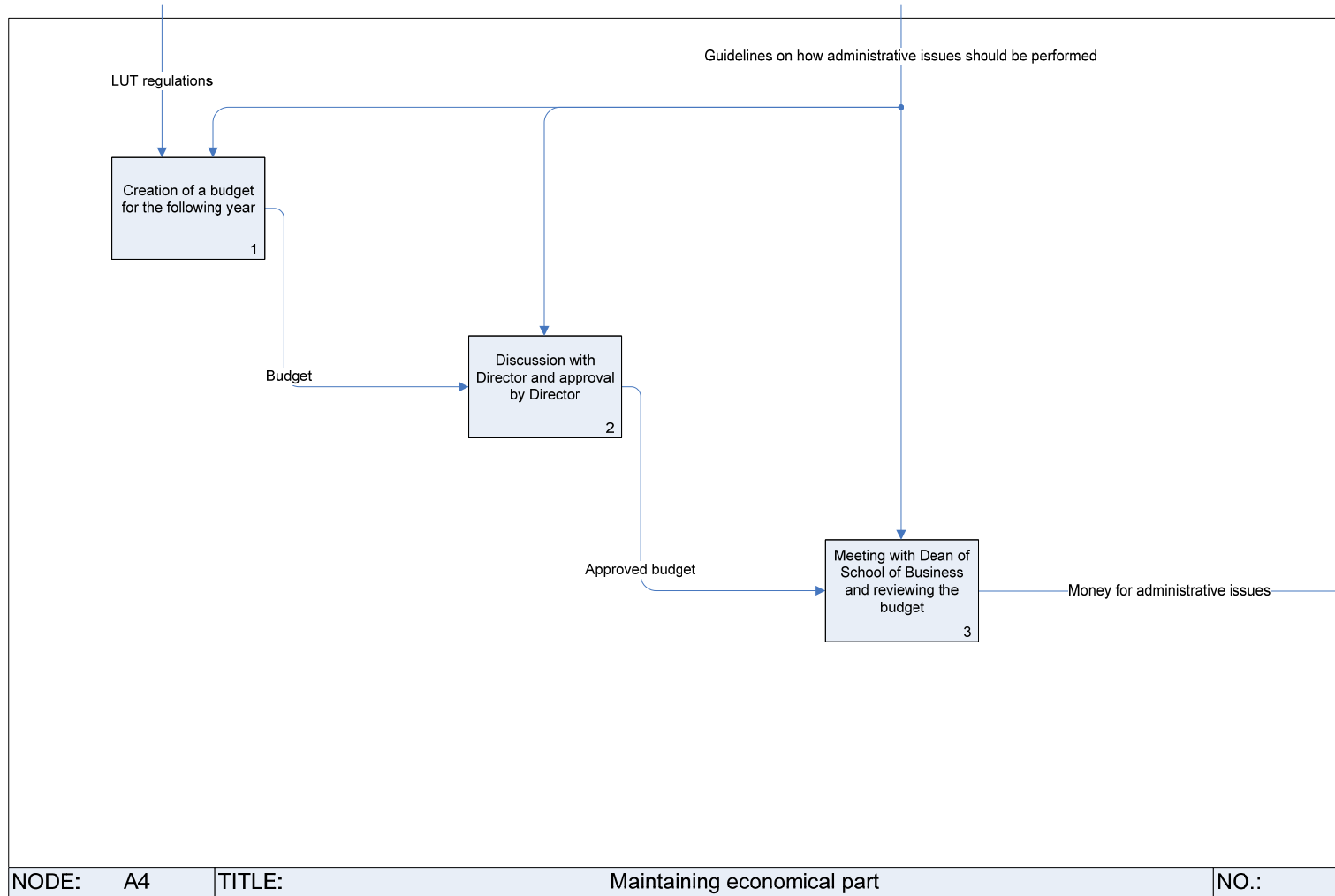


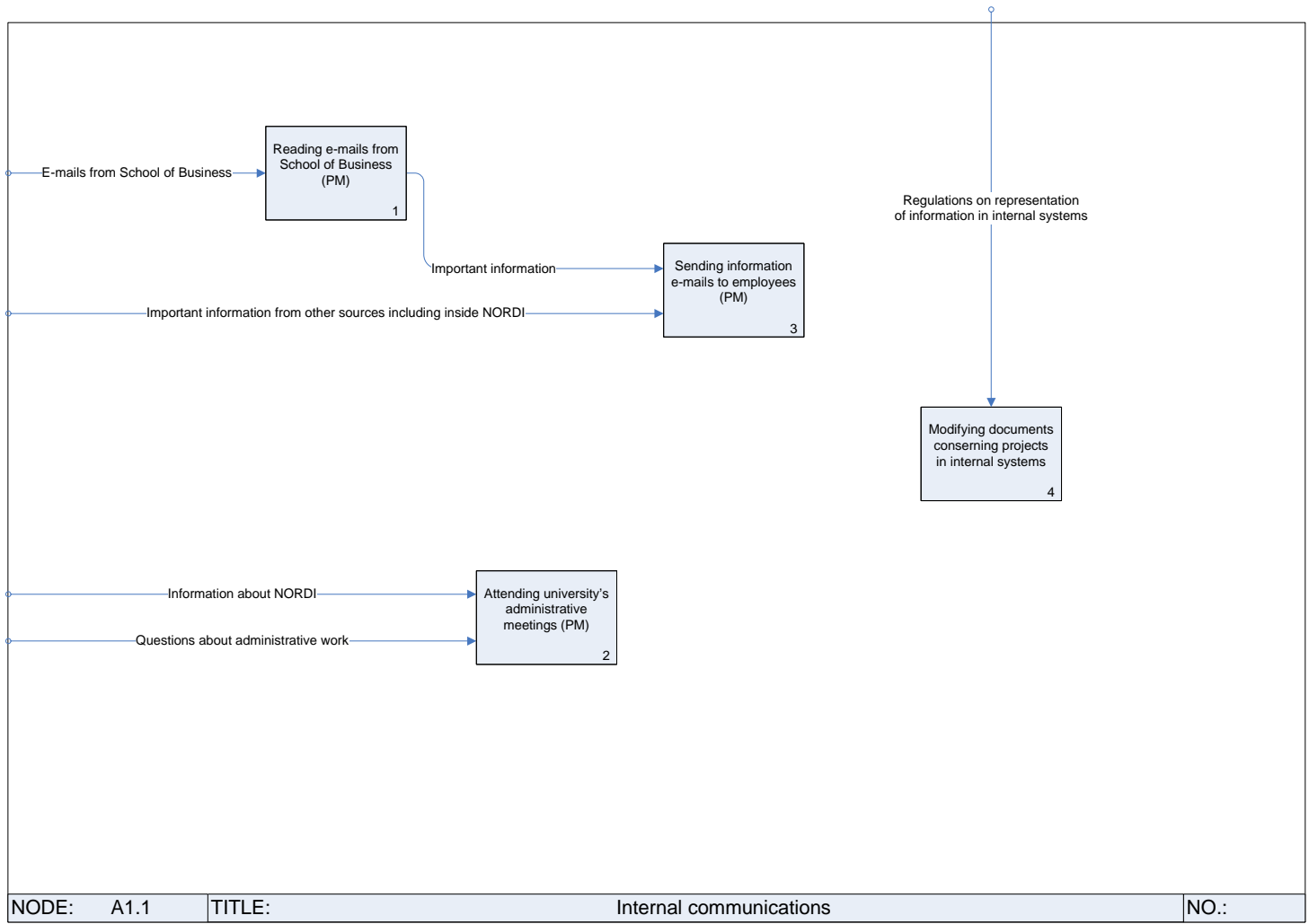


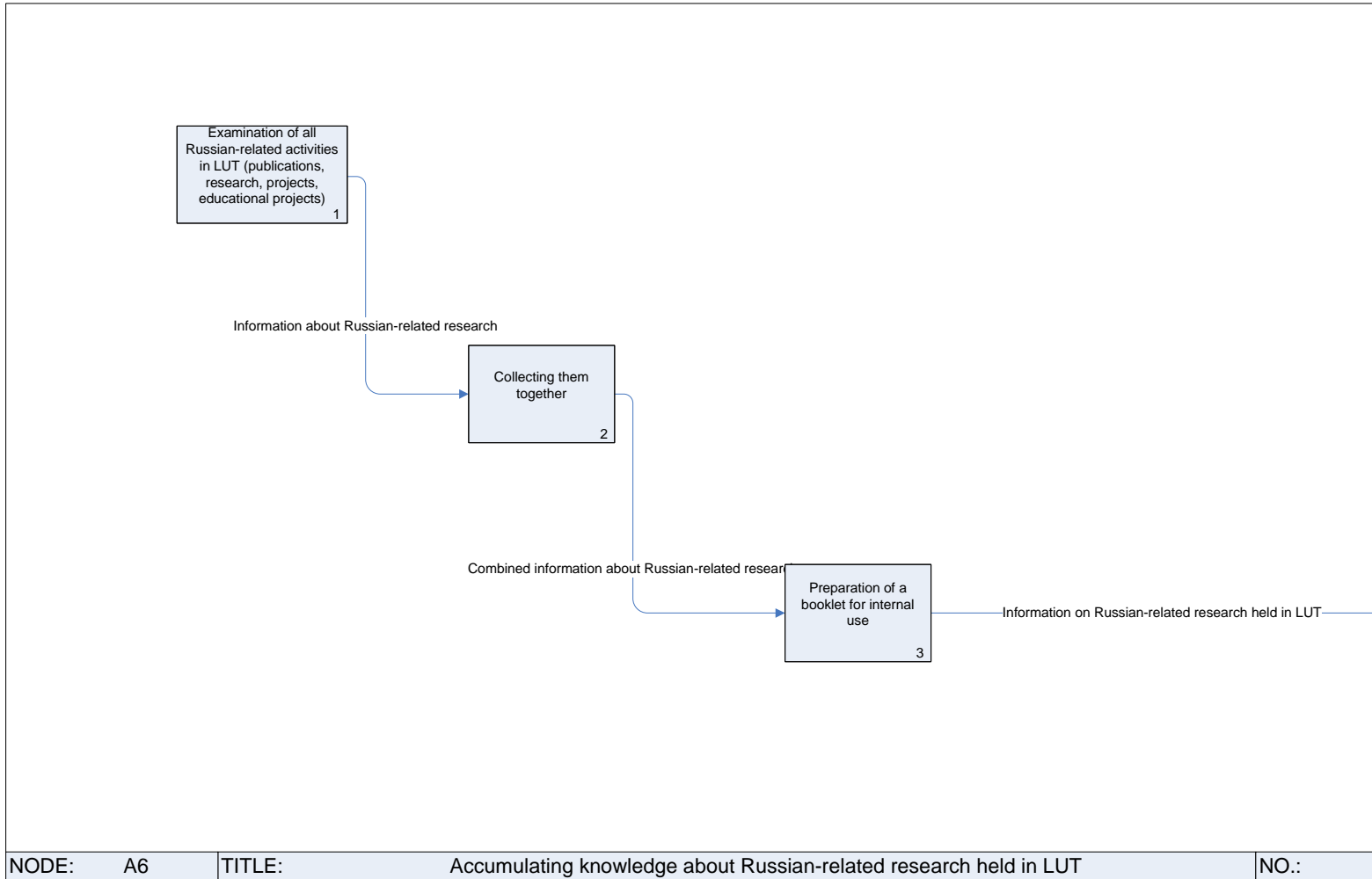
NODE: A3

TITLE: Development of NORDI strategy

NO.:







Appendix 8. Improvement Suggestions for NORDI

During creation and analysis of model of business processes of NORDI following possible improvements revealed themselves.

First of all, Research Project Managers stated the existence and importance of such processes as “Staying in contact, negotiations with Russian partner” and “Summer vacations delay”.

These processes create significant delays in projects and in order to solve occurring problems temporary human resources are searched for, which is usually very difficult due to scarce resources. The suggestion occurred to take these issues more into consideration in the future work, for example, may be they can appear in project plans and become planned in evident manner.

The purpose for that is that the former processes leads to the necessity of a new role and the latter – to requests about increasing project time to funding organizations.

Second of all, combination of Development Manager and Project Manager tasks is very challenging due to their variety which affects time consuming badly. Either two different people for this role are required or more careful planning is needed.

Thirdly, it is useful to arrange such kind as initiatives as it is done in one project with KOKE unit of LUT. It allows advancement of NORDI services and increases collaboration inside LUT. This initiative is recommended to be turned into beneficial practice.

Forth point: there is a sense in dividing “conducting a research” business process depending on a project type and, may be, taking funding type into consideration as well. This will allow analyzing and optimizing the work done in a better way.

And the last issue is as following. Some processes are still on the starting phases of development: are not standardized or introduced for the first time. They are

easily seen on the business process model's diagram in "IDEF0+Swimlanes" notation, such as "Supporting educational work of LUT". Obviously, more consideration of these issues is required. Some of them should be restructured. The most promising one become best practices incorporated into organization everyday life. As a matter of fact making these issues more transparent was one of the reasons of NORDI's participation in this master thesis project.

Appendix 9. Tools Supporting Business Process Modeling Methodologies

ARIS Toolset supports both standards: EPC and BPMN (IDS Sheer AG – Business Process Excellence a), so is suitable in case of both choices. This choice would cost a company around 8 000 euro.

In this respect several free solutions exist as well, for example, ARIS Express or special package working only with EPC – EPC Tools. These solutions will be less functional, but free.

Microsoft Vision will perfectly support “EPC” methodology and also “IDEF0+Swimlanes” methodology. This product will cost not much more than 100 euro. But it is not specifically designed for business process modeling therefore not so convenient in usage.

In order to support “IDEF0+Swimlanes” methodology it will be enough to purchase Russian product called “Business Studio” which price will be around 1000 euro. This tool provides comfortable work with methodology and even allows reports generation and lots of other additional features.

IBM WebSphere Business Modeler will perfectly support development of business process model in “BPMN” methodology, which will cost organization around 1 000 euro.

Oracle Business Process Analysis (BPA) Suite designed on the basis IDS Scheer ARIS Design Platform will also support creation of business process model in EPC or BPMN. It will cost its owner around 2 000 euro.

Correspondingly the choice of business process modeling will lead to a choice of business process modeling tool. Therefore future amount of investments is determined by a selected methodology. It is also obvious that mistake in prediction of appropriate methodology can't be easily fixed by purchasing of the next tool and will lead to inconveniences.