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Tööprotsesside modelleerimine Eesti väikeettevõtte näitel

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Workflow Modeling. The Case of an Estonian Small Enterprise

Master Thesis

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Declaration

Hereby I, Konstantin Gussev, declare that this Master Thesis is my personal achievement and a result of an original investigation. It has not been submitted for any academic degree before.

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(Date) *(Signature)*

Contents

List of abbreviations

BPM	Business Process Management
BPMN	Business Process Modeling Notation
IT	Information Technology
GDP	Gross domestic product
EU	European Union
AS	Aktsiaselts (limited company)
HR	Human Resources
PC	Personal Computer
BPD	Business Process Diagrams
MS	Microsoft

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Abstract

Organizations are always under pressure to improve their work processes. In order to improve these processes, knowledge is extremely necessary. To support the improvement of a process, an organization should collect a process data, transform the process data into knowledge and then “insert” this knowledge back into the organization.

The goal of this thesis is to demonstrate the usage of a workflow modeling. Our approach is based on process modeling, and focuses on process models that show the way to improve the enterprise. We also emphasize that such models must be used in a real life.
One of the most popular modeling methods will be applied on a small Estonian enterprise. Using this method work processes can be reorganized.

1 Introduction

The first chapter gives a brief introduction to the theme of the research subject and the background of the problem.

1.1 Background

The World experienced deep economic crisis during few last years [2]. Without doubts, it has changed the world. In particular, one of the main aspects of great changes induced by economic problems is lowering of consumption. According to the statistics during the crisis years in Europe GDP dropped as well as private and public consumption. Unemployment rate increased (see Figure 1). This indicator is directly connected with the consumption that humans has no work, no opportunity to earn money and spend them.

Main features of the Commission forecast

	2008	2009	2010
GDP (% growth)	0.9	-4.0	-0.1
Private consumption (% growth)	0.9	-1.5	-0.4
Public consumption (% growth)	0.9	-1.5	-0.4
Total investment (% growth)	0.1	-10.5	-2.9
Unemployment rate (%)	7.0	9.4	10.9
Inflation (HICP, %)	3.7	0.9	1.3

Source: European Commission Spring Forecast

Figure 1 Consumption and GDP for EU

Consumption dropped so it means that in general case it turned over, profit decreased. An effect of this is especially for enterprises with small and medium size, not so much for big companies like Toyota Motor Corporation and for others famous brands in different areas of business [20]. It is a crucial fact for small European countries like Baltic States. Most of them are small with limited number of workers and resources.

EU Member States traditionally have their own definition of what constitutes an SME, for example the traditional definition in Germany uses a limit of 250 employees, while, for example, in Belgium it is 100. But now the EU has started to standardize the concept. Its current definition in categorizing companies with fewer than 10 employees as "micro", those

with fewer than 50 employees as "small", and those with fewer than 250 as "medium". In contrast, in the United States, when small business is defined by the number of employees, it often refers to those with fewer than 100 employees, while medium-sized business often refers to those with fewer than 500 employees.

Sizes of small and medium enterprises depend on a size of a country. It means that the average number of workers is called “a micro firm”. In the EU (big countries) such “micro” firms include 1-9 employees, but for Baltic States a small firm includes 1-9 employees and a medium size firm - 10-60 employees [3].

The majority of small firms were hit by the financial crisis hard. A few of them could survive, most of them bankrupted or closed. The main reason for this is sizes of enterprises and limited resources; decreasing of sales [4].Processes are essential factors [1], because their good functionality, effectiveness and efficiency are key factors. Workers – an important aspect of high quality production and effectiveness, each worker should be suitable for each place. It means that a right worker at a right place produces more, than a good worker in some place.

1.2 Business processes in small enterprise

Effective and quickly reorganized business process gives a huge possibility for an enterprise to achieve its goals in changeable environment. Achieving goals and increasing effectiveness can be performed by analysing and reworking or reengineering the existed processes. During this procedure considering weak points and bottleneck places which can cause difficulties or serious consequences for an enterprise is extremely important. All main processes and activities should be mapped; this action should be done before analysing and optimizing. The first step in gaining control over an organization is to know and understand the basic processes [24] [25].

Mapped and described processes help to provide quality products and services for customers and accelerate development of an enterprise.
For small firms changes influence quicker than for big ones. In this thesis a small enterprise AS Sign Computers will be viewed as an example.

AS Sign Computers is operating in IT sector. Changes in the IT market are connected with retail business, the result of which is to provide a consumer with products and services. Retail business is based on customer-oriented activities, so it should be flexible to free market conditions and customer orientation. These goals in business are possible to achieve through the process management.

1.3 Overview AS Sign Computers

In this section the structure and functionality of AS Sign Computers is discussed. We will watch processes as a chain of activities which produce values for a client.
AS Sign Computers was founded in 1996. The company's main business area is in Estonia. The main office is located in Tallinn. The Enterprise has one filial in Narva. The number of workers is eight. Main business activities are connected with retail business, support and repairing. Inside the main enterprise there is a sub unit called “Sign Hooldus”. Its functions are basically connected with repairing; fixing customer’s devices and solving any kind of troubles connected with hardware, sometimes with software.

Mission.

- Enterprise mission is to provide our customers complete solutions in the IT field, thereby helping them to grow and develop.

- Providing our employees with a clear motivation, opportunities in development and modern working environment, increase the value of the company.

Vision

- Become the fastest growing IT company (in small sized group) in 2015 year.

Values

- Customer satisfaction.
- High quality services and IT support. Quality and Competence: committed to maintaining the quality and excellence

- Achieving confidence in partnership with partners

AS Sign Computers and filial in Narva operate and manage the business under a single brand through the three areas such as:

- Retail Business - engaged mainly in sales devices to final consumers and assembling of new devices (servers, PC, notebooks).
- Support- engaged with help and consulting customers on different problems. Servers and services administration. Maintenance of users and partner clients.
- Repair and warranty- deals with customers and clients on different requests about repairing.

The 7th figure presents the structure of the enterprise. As it was mentioned above, it is divided into 3 main directions. The head division of the whole firm is a board (a group of people who possess at least one share of the company [26]). An audit committee possesses control functions to check how well and correctly the enterprise works.
The director is a person who's responsible for everyday operations. The bookkeeper (an assistant) is a person who helps to take care of counting and HR.
Retail business includes all people and processes which are connected with sales. Repairing and warranty is a part of the enterprise, responsible for filling of warranty agreements and making some profit by repairing.
The third part is support. The goal of the enterprise is to help or maintain partners, business clients.

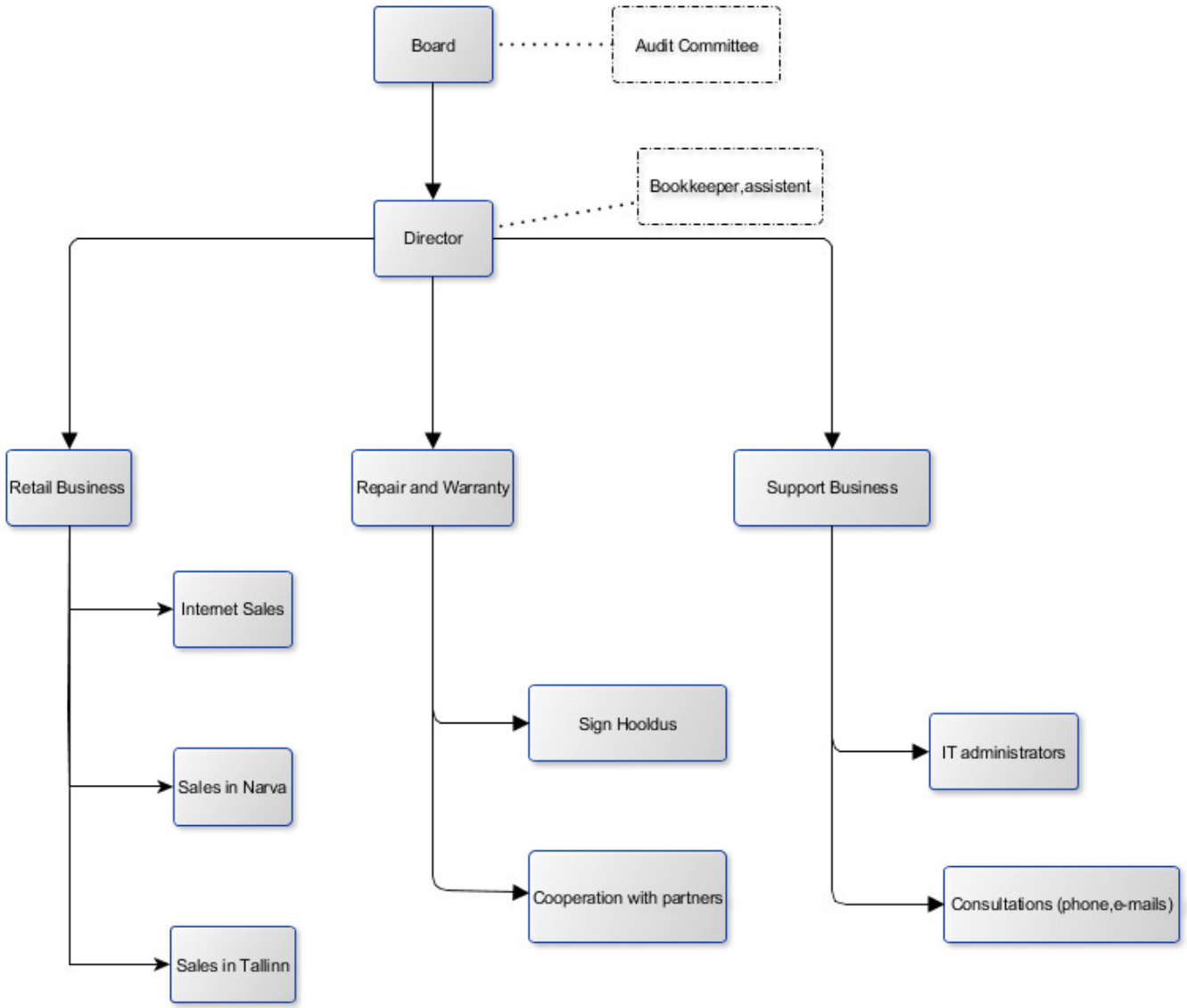


Figure 2 Basic structure of AS Sign Computers

1.4 Motivation and Problem

At the moment the situation in financial area of the firm is stable. During the crisis period it was pointed out that some steps should be taken to improve performance of firm and increase effectiveness and efficiency of processes in the enterprise. As it was described above, the firm has limited resources, so it means that the enterprise should find better ways to solve its problems. Finding the best solution is to focus on processes which bring profit.

1.5 Objective and research questions

The goal of this thesis is to create a business process model for a small company. To achieve the goal, the following steps were fixed:

- Overview business process management.
- Choose the most suitable method for mapping
- Analyze the existing processes
- Apply the chosen method
- Analyze the results

The research questions are discussed according to the goals:

- What is Business process management; what does it give to a small enterprise?
- How business process management is used in AS Sign Computers?
- What are the most useful methods in business process management?
- What method should be applied in a small enterprise for modeling and improving the processes?
- What troubles appeared during the modeling?

1.6 Methodology

To answer the main research questions pointed in this thesis, the methodology is built on the general modelling approach. The approach is analytical, based on mapping and analysis of existing processes. The most suitable software and method for modeling will be found out.

Method will consist of the following subsequent steps (see Figure 3):

1. Define and describe process
2. Create model based on a chosen modeling language
3. Analyze the created model
4. Drawing conclusions.

Figure 3 Methodology way

Some interviews were made with all workers of the firm before defining the processes. The aim of it was to find out some bottle necks and worker's problems which are connected with their duties. Offcial instructions for each worker were also studied. Personal instructions are appendixes for contracts.
A small test was done to find out main trends and moods.

1.7 Thesis Outline

The Thesis structure will consist of the following four sections:

The first chapter gives a brief introduction to the theme of the research subject and the background of the problem. Researching problems, questions and methodology will be formulated here.
The second chapter of this work concentrates on business process management. Mainly based on the analysis of management literature, the chapter examines the relationship between the process management and applications of strategic management. Also the small firm AS Sign Computers will be introduced here, the structure of its business and the workflow will be viewed.

The third chapter reviews the existing methods, modern tendencies of business process modeling, the literature and different internet sites are also presented. The decision will be reached through analyzing different methods. A software solution will be acquired for modeling process in the same part.

The fourth chapter focuses on the chosen method and implementation, in other words, how it should be applied for a small business.

In the 5th chapter a method of results is presented. The survey's results are based on analyzing if the created model is successful or not.

2 Business Processes and their Management

The second chapter gives an overview to the Business Process Management.

2.1 What exactly means Business Process

What is a process? One of the first people who described processes was Adam Smith (Scottish social philosopher and a pioneer of political economy) in his famous (1776) example of a pin factory. Inspired by an article in Diderot's Encyclopédie, Smith described the production of a pin in the following way:

"One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head: to make the head requires two or three distinct operations: to put it on is a particular business, to whiten the pins is another ... and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which in some manufactories are all performed by distinct hands, though in others the same man will sometime perform two or three of them."

In the early 1990s, Davenport (1993) defines a (business) process as:

"a structured, measured set of activities designed to produce a specific output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus's emphasis on what. A process is thus a specific ordering of work activities across time and space, with a beginning and an end, and clearly defined inputs and outputs: a structure for action. ... Taking a process approach implies adopting the

customer's point of view. Processes are the structure by which an organization does what is necessary to produce value for its customers. [6]"

Business processes can be defined according to their goals [9]. Three different categories: production, support, and managerial processes. Managerial processes define and coordinate the other two types, through strategic management. They define goals, preconditions, and constraints for the other types. Support processes ensure that the production processes run smoothly within their environment, e.g. providing technical support or HR processes. Production processes generate business value, usually in the form of services or goods, e.g. manufacturing or sales processes. These objects are sold to customers and, thus, revenue generated by the organization.

Managerial process is responsible for organizing and for solution of problems (more general process). Production process is to produce value for a customer. Support process helps to produce value. Hierarchy direction in this scheme is going from up (managerial process) to down (support).

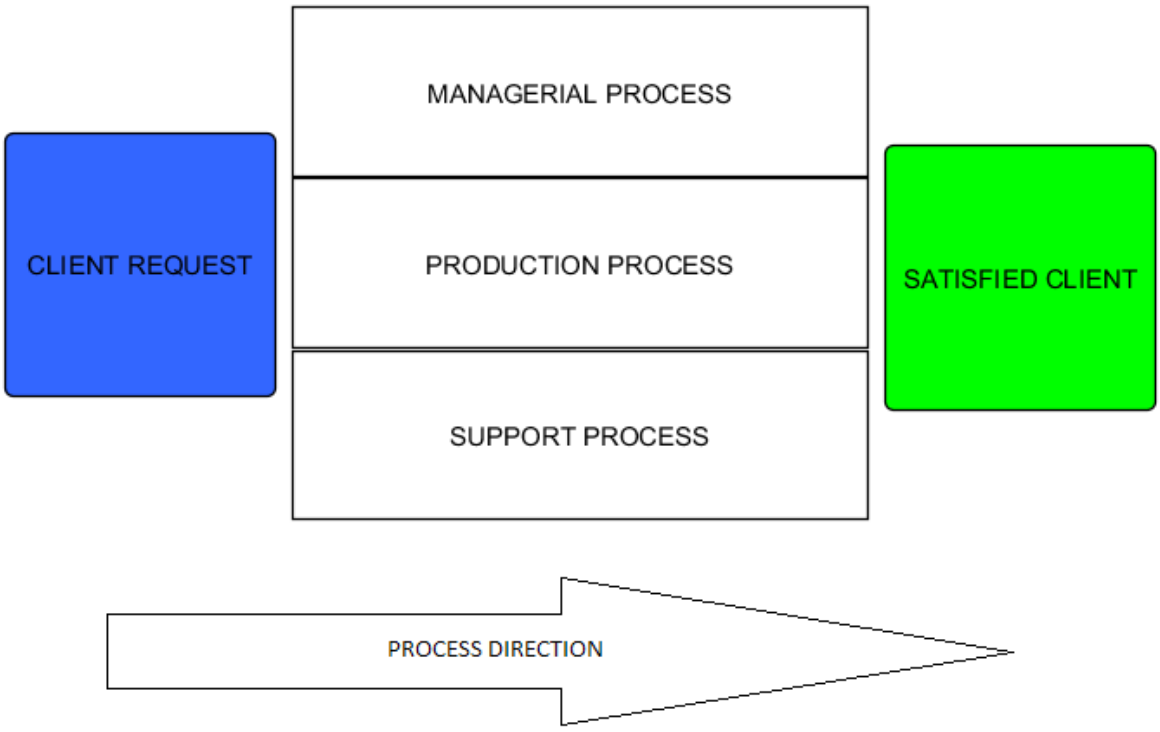


Figure 4 Process direction and hierarchy

Production creates value. It helps the Strategy to complete the goals. Achieving goals or not should be measured by indicators (metrics). Simple process that happens every day; A client makes a request to buy PC with specific system parameters.

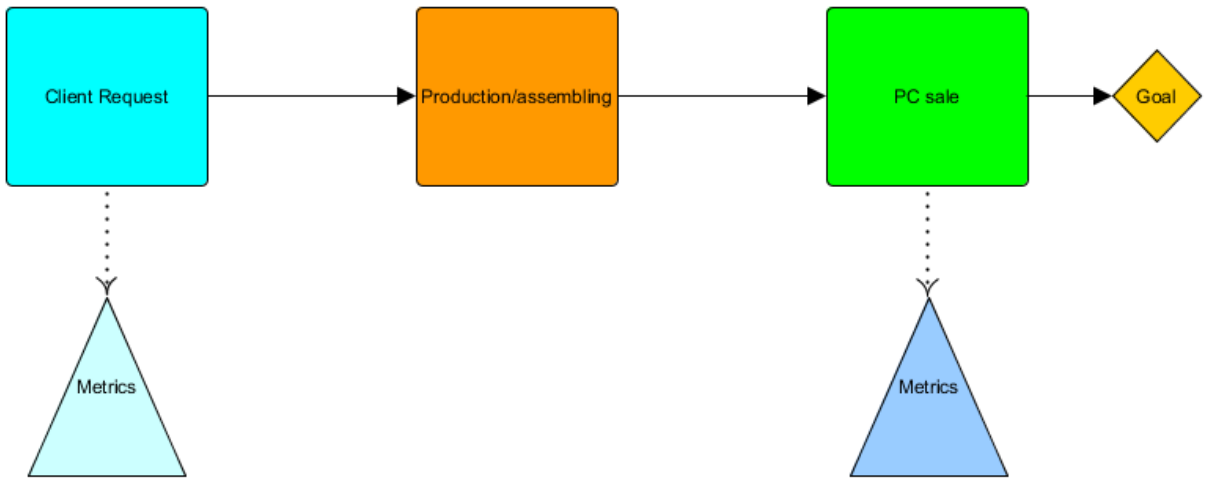


Figure 5 Production process flow (Sale of PC to client)

In order to set goals and metrics for a production process, it should be understood. Process must be mapped and described.

The process is a set of activities, which are the input (s) and output (s) that are affected by the restrictions and will be conducted using a variety of resources. Business processes are processes conducted in a commercial enterprise for creating a value for a customer, in its widest meaning. It includes business processes: fundamental processes that create customer's value directly, as well as management and support processes that are direct and indirect support in creation the customer`s value.

2.2 Business Process Management

Business process management (BPM) is a holistic management approach focused on aligning all aspects of an organization with the wants and needs of clients. It promotes business effectiveness and efficiency while striving for innovation, flexibility, and integration with technology. BPM attempts to improve processes constantly. It can therefore be described as a "process optimization process." It is argued that BPM enables organizations to be more efficient, more effective and more capable of change in compare with a functionally focused,

traditional hierarchical management approach. Like it was mentioned above it is located in third level of strategic management, called functional level [7].

Business process management is implemented in series of activities. It is not something that an organisation adopts or implements instantly, it can take months and occasionally years, depending on the extent of the process and sub-processes, how many people and systems are involved and how much of it needs to be redesigned. BPM requires careful planning and analysis to ensure that it is properly adapted within the organisation's existing system and goal.

"BPM is challenging our fundamental business model."- Gary Ives, SVP Office of Strategic Management, Pulte Mortgage (2007)

BPM Life Cycle

The life cycle is presented to ensure that BPM goals are achieved at each stage of implementation. In this section we will discuss different activities of business process management that are involved in the life circle.

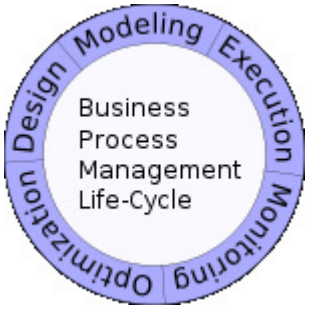


Figure 6 BPMN Life circle

Business Process Life circle consists of the following steps:

Process Definition

In this phase of the process an owner will design, analyze and define business processes that will be the beginning for the flow, information flow, business rules and policies, resources to calculate the performance (Key Performance Indicators / KPIs) such as - length of processing time, a price of all the activities, etc. In some BPM software solution, this step can be done by

modeling and describe the visual process graphically, such as Microsoft Visio, TIBCO Business Studio.
Once modeled, we can even simulate the processes for identifying critical paths and bottlenecks that may occur.

Execution & Process Control
Results from modeling and design processes are conducted by a process manager then passes to the IT. After implementation, employees and the relevant parties will run the process in accordance with the rules that have been defined previously, and supervisors and managers in charge of the process control the process. Something can happen that is not in accordance with the conditions set in the enterprise, such as the processing time delay, the exception, unavailable resources and so on, so correction is required at this phase,

Monitoring & Improvement Process
Business processes that have been implemented are monitored the performance by closely calculating Key Performance Indicators (KPI) and other measures that had been predetermined. Monitoring is being done by using the data in real-time form, so it will fit with the real situation on the ground. From the results of such monitoring the management can view and analyze whether the repairing is necessary to the business process or not.

Life cycle management (life cycle) of the business process is very essential for flexibility of a company and it is extremely useful in the business world today. Support the life cycle can make process and develop the system of business effectively and efficiently and support the business in changing environment.

2.3 Business Process Management as a part of the Strategy

"Activities, then, are the basics of competitive advantage. Overall advantage or disadvantage results from all a company's activities, not only a few' and then went on to say that "The essence of strategy is choosing to perform activities differently than rivals do."

Dr. Michael Porter

Strategy, a word of military, refers to a plan of action designed to achieve a particular goal [27]. In business: "Strategy is the direction and scope of an organisation over the long-term:

which achieves advantage for the organisation through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfil stakeholder expectations"[5].

Strategy can be also explicated like [1]:

1. Strategy as a perspective-based on defining a mission and vision
2. Strategy as a position- enterprise positions itself in a current segment of business
3. Strategy as a plan-define goals and ways and how to reach them
4. Strategy as a pattern of an action-decide how to make it happen, make corrections according to feedbacks

Main factors which have influence on strategy: [1]

1. Global, regional, international considerations- globalization, regional Unions(EU) influence, Baltic & Northern countries partnership, also the preservation of Estonia identity are take into considerations
2. Social and political influence – an enterprise should obey laws and take into consideration not only profits and losses but also public point of view.
3. Attractiveness of the industry and competitive conditions- strategy must be in accordance with the industry and competitive situation.
4. Company resources and competitiveness- determine the real scope
5. Personal ambitions of managers and owners, philosophical and ethical views-very essential points because of personal abilities and nationalities.
6. Culture of management- may have a significant impact on a choice of a strategy, or even be a dominant fact.
7. Ethical factor- ethics has more influence than just obey laws. Some time individual characteristics of a person do not allow doing something which is not against the law but in conflict with human nature or principles.

The strategy can be defined like: long term plan with a purpose to achieve goals. In strategic management there are four levels (Jaak Leimann p. 93):

1. Corporate strategy (answers the questions of "which businesses should we be in?" and "how to create synergy being in this businesses and/or increase competitiveness?")

2. Business strategy (answers question: how can we compete with rivals in long term? refers to the aggregated strategies of a single business firm or a strategic business unit in a diversified corporation. According to Michael Porter (leading authority on company strategy and the competitiveness of nations and regions.), a firm must formulate a business strategy that incorporates either differentiation, or focus to achieve a sustainable competitive advantage and long-term success.)

3. Functional strategy (the main goal of this level is to answer how we support business strategy and in which way. It includes marketing strategies, new product development strategies, human resource strategies, financial strategies, legal strategies, supply-chain strategies, and information technology management strategies. The emphasis - short and medium term plans and limitation of each department's functional responsibility. Each functional department attempts to do its part in work, and strategies are derived by a broad of the enterprise.)

4. Operational (in majority of strategic management books this level is not separated from functional base, but this level should not be underestimated. For example if a worker cannot finish job in time, a project won't be finished in the right time. It is a very essential part and deals with day-to-day operational activities such as scheduling criteria. It must operate with a budget of a firm but not create that budget. Operational level strategies are informed by business level strategies which are informed by corporate level strategies.)

In 1996, Dr. Michael Porter emphasized that "Activities, then, are the basics of competitive advantage. Overall advantage or disadvantage results from all a company's activities, not only a few and then went on to say that "The essence of strategy is choosing to perform activities differently than rivals do." the key word in this sentence is activity, it equals the process of the enterprise in the current context.

The second quote gives us an opportunity to make a statement that business process management is an essential part of the strategy.

Later in 2004 Kaplan and Norton's released a book 'Strategy Maps'. Business processes are presented there and pointed out that organisations must identify and measure performance of their critical business processes in order to create value for their customers and shareholders. They point out that an organisation strategy needs a clear answer to the question 'Which processes must be chosen to satisfy our customers? '

Process management is located in third level of the strategic management. Strategy formulates guidelines for activities. The strategic management is a management process that identifies targets and directs and how to achieve the basic processes. It consists of developing strategy, implementation, control and evaluation. Development of the strategy is usually preceded by an inside and outside corporation analysis. The basic scheme is in drawing below [1]:

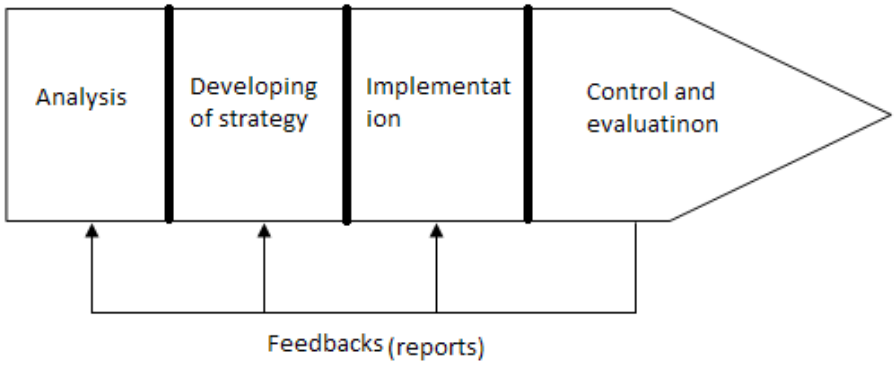


Figure 7 Basic scheme of strategic management

2.4 BPM Today

Today many organizations focus on a process-oriented way to manage their business [21]. This idea of process-oriented way of manage is taken on by the concept of Business Process Management. Organizations attempt to improve their business performance by applying BPM methods. BPM has become an essential way of controlling and governing business processes. For organizations it is generally important to discover, control, and improve their processes to increase their total revenue, their customer satisfaction or to ensure regulatory compliance as in the introductory example. To allow this, the processes under treatment must not only be understood by the business departments but also by IT crew. Today, business processes are run and supported by different kinds of IT systems. Given that, business process models serve as means of communication among the stakeholders from business and IT departments. An

essential part of BPM as a management concept is business process modeling. The modeling of business processes requires an abstraction from real world processes in order to map them into process models. Within modeling it is essential to achieve high quality of the business process models. Only then, the models can best serve their modeling purpose and are useful for the management of business processes [34].

According to a publication of H. James Harrington BPM gives a huge impact on progress in automobile industry as an example. During last years of the 20th century American auto industry was among the best. Later in the beginning of the 21st century Japan and European auto corporations used BPM to redesign and improve processes and activities. It still brings use to them. The result of this is now an American auto is best in world. David Cole, the director of the Office for the Study of Automotive Transportation at the University of Michigan, states: "The Japanese set the benchmark in all details related to execution of the product. They can design, develop, and produce very complex products at very high quality levels quicker and less expensively than anyone."

2.5 Benefits of BPM

One question can be asked: “What is the purpose of BPM? What benefits does it give? ”

According to the publication of Michael Havey [10], there are next benefits:

Formalize existing process and spot needed improvements. Adopting BPM makes business think through and formalize its understanding of current processes. Besides it helps to improve, make new steps to automation or reengineering of a part of a company or the whole flow.

Facilitate automated, efficient process flow. When BPM software drives the process flow, downtime between activities is almost zero, unless the software itself is down. Ever better, BPM supports process parallelism, so that independent sequences of work can be performed concurrently in isolation of each other, with their results merged and synchronized later in the flow. A process can be controlled by some other means – for example, by phone calls, emails, or inter-office mail exchange.

Increase productivity and decrease head count. Get work done faster with fewer people! Actual BPM case studies provide some interesting results: a financial service was able to reduce staff from 613 to 406 while decreasing processing time and increasing customer satisfaction; an insurance company trimmed off 40 % of its staff and increased its rate of claims handling.

Allow people to solve the hard problems. Although BPM is often about removing or decreasing human participation in process, one of its benefits is its flexibility to use people to help fix problem.

Simplify regulations and compliance issues. As the butler group points out, BPM helps businesses build audible processes that help organizations completely with various regulatory requirements:
"Organizations do not really have much control over compliance. The smarter business will therefore look to offset the cost of compliance with the benefits of closer process control and management"

2.5 Two approaches of BPM

According to Manuel Laguna and Johan Marklund there are two complementary BPM approaches [28]:

1. Continuous Process Improvement (CPI)
    - Changes that make processes more useful and successful
    - Does not question the fundamental assumptions and rules that define the current process

In simple words improvement is happening permanently, all the way during the existence of the process. It should be applied to existing processes.

2. Business Process Re-Engineering (BPR)
    - Questions existing assumptions and rules

- Requires new perspectives to generate innovative solutions with potential for breakthrough improvements

BPR can be explained as a radical rebuilding of the process. It is not so important if a process exists or not because BPR can be used in both cases.

On the figure below comparison of continuous improvement is presented (incremental improvement) versus BPR (radical improvement) in time [28].

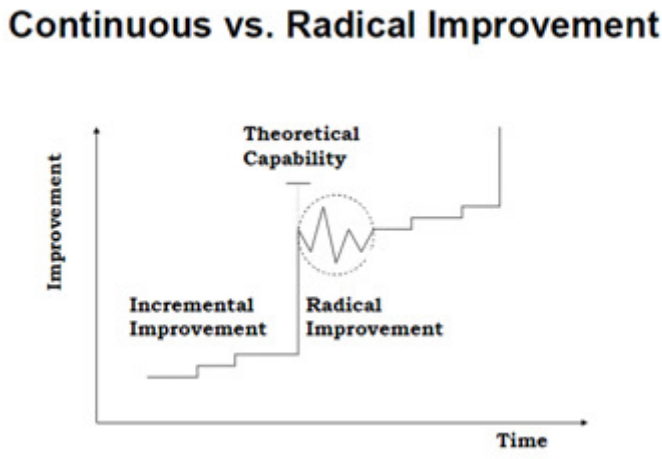


Figure 8 Comparison CPI VS BPR in time

3 Business process modeling methods

In this part about business process modeling will be discussed, what is a model and methods of business process modeling will be described.

What is a model?

A model is an abstract representation of the real world, excluding elements with low influence.

"The purpose of a model is to reduce the complexity of understanding or interacting with a phenomenon by eliminating the detail that does not influence its relevant behavior" [11].

The definition of a business process according to Hammer & Champy's [29] A definition can be considered as a subset of Davenport's. They define a process as:" a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer."

Business Process Modeling is the representation of current ("as is") and proposed ("to be") enterprise processes, so that they may be compared and contrasted. By comparing and contrasting current and proposed enterprise processes business analysts and managers can identify specific process transformations that can result in quantifiable improvements to their businesses [12].

As in physics, in business process management there are specified properties for creating a model: mapping, an abstraction, a purpose. Mapping is a process which is responsible for reflecting real world or artificial parts in a model. The level of abstraction is responsible for including all the processes which have influence on model or value produced. Purpose gives a clear vision of model; what for it was made.

3.1 Business process description methods

There are two types to describe methods: in graphics (diagrams, schemes), in text documents.
A text document presents clearly defined actions, procedures and methods. A text can be presented without pictures or schemes. There are basic instructions, how to act or what should or shouldn't be done in most cases. For a human reading these documents can cause some problems in imagining and understanding flows of the activities. For example it was widely used in "Eesti Energia" [22].
All the time of existing the AS Sign Computers all processes were described as text documents. Most of them were just working instructions for workers. Commands were directly written down into contracts. Also regulations were presented what should do or how to act in a particular situation.

Graphical description is more visual for a human. This method helps to get a full picture of processes, how they interact, easier to get overview of the whole organization and functions. Schemes help a person, a worker, or a manager to recognise and define areas of responsibilities.
Graphical method's result is drawing (based on described processes). In the literature there are several graphical methods for the description of processes, some of them are standardized and regulated by recognized organizations.

Business Processes describes the simplest method – graphical method -activities, beginning and end of the process. In this thesis a graphical method is used but this does not mean that text documentation is a poor or unusable method; it is just a question of choice.

"A Single Picture Is Worth a Thousand Words [13]" –this phrase exactly characterizes why a graphical method is more reliable, effective and is used more often.

3.2 Description of methods variations

In this section the most popular methods of modelling will be described. At the end of the description of the each method, there is a view of process which was constructed using one of methods [16].Briefly process includes the following:

Example Process: "Process Returned Goods" Food Products Manufacturer
Objectives:
(1) To process returns in a timely manner
(2) To ensure the amount of refunds is appropriate

The example diagrams were taken from article "Business process modeling approaches in the context of process level audit risk assessment: the analysis and the comparison" by Carla Carnaghan.

3.2.1 System flowcharts

System flowcharts are one of the oldest forms of diagrams used in information systems. A flowchart is a graphical representation of the definition, analysis, or solution of a problem in which symbols are used to represent operations, data, flow, equipment, etc.
Flowcharting is a tool originally developed in the computer industry, for showing the steps involved in a process. Flowcharting is probably the oldest method of diagrammatically representing system processes (or sequence of activities). A flow chart is a pictorial description of how accounting transactions flow through a system. Flowcharts clearly and graphically convey work processes, process controls, decision flows, time flows and paper

flows. A flowchart is a diagram made up of boxes, diamonds and other shapes, connected by arrows - each shape represents a step in the process, and the arrows show the order in which they occur. They are frequently used to visually document how a job is being done and compare it to how it should be done. Because there is no better way to illustrate a process, flowcharts are no longer the domain of engineers and auditors. Flowcharts are to managers and business owners what spreadsheets are to accountants [14].

The advantages of using a flowchart in document are as following:

1. Flowcharts are easier and take less time to understand.
2. Flowcharts make it easier to represent flow of transactions using standardized symbols.
3. Flowcharts are easier to update.

In the 9th picture a flowchart system with basic elements is represented. In this thesis we won't describe this method in details but as it was mentioned above it is used for describing computer industry in common.

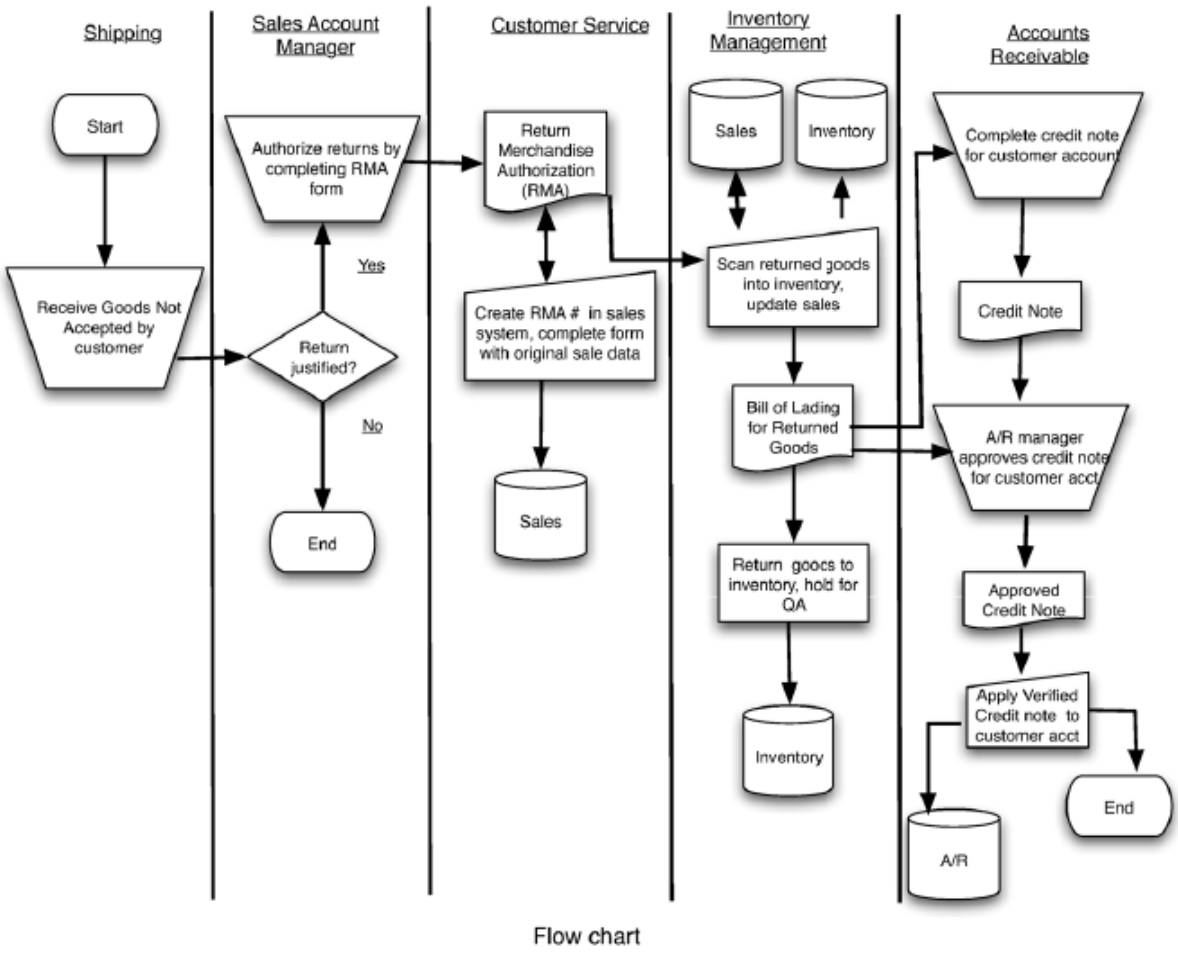


Figure 9 Example of System flowchart [16]

3.2.2 IDEFØ

IDEFØ is part of a larger system modeling methodology developed by the U.S. Airforce known as Integrated Computer Aided Manufacturing Definition (IDEF) [15].
The website http://www.idef.com provides a brief description of IDEF conventions, along with a link to the IDEFØ standard released by the American National Institute of Standards and Technology (NIST). The following description is largely based on these sources.

IDEFØ is a method designed to model the decisions, actions, and activities of an organization or system. IDEFØ was derived from a well-established graphical language, the Structured Analysis and Design Technique (SADT). The United States Air Force commissioned the developers of SADT to develop a function modeling method for analyzing and communicating the functional perspective of a system. Effective IDEFØ models help to organize the analysis of a system and to promote good communication between the analyst and the customer. IDEFØ is useful in establishing the scope of an analysis, especially for a functional analysis. As a communication tool, IDEFØ enhances domain expert involvement and consensus decision-making through simplified graphical devices. As an analysis tool, IDEFØ assists the modeler in identifying what functions are performed, what is needed to perform those functions, what the current system does right, and what the current system does wrong. Thus, IDEFØ models are often created as one of the first tasks of a system development effort.
The basic IDEFØ concepts include the following. The "box and arrow" graphics of an IDEFØ diagram show the function as a box and the interfaces to or from the function as arrows entering or leaving the box. To express functions, boxes operate simultaneously with other boxes, with the interface arrows "constraining" when and how operations are triggered and controlled. The basic syntax for an IDEFØ model is shown in the figure below.

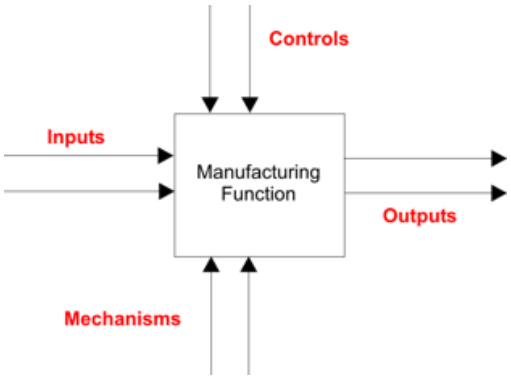


Figure 10 IDEFØ Box and Arrow Graphics

Methodology: Step-by-step procedures are provided for modeling, review, and integration tasks. Formal training courses for transferring the methodology are available.

IDEF0 is used to model processes and constituent activities and their transformation of inputs into outputs, along with the controls governing the transformation and the resources (referred to as mechanisms in IDEF0) required for the process. Inputs and outputs can be materials or information. Controls can be any type of information that starts, regulates, or synchronizes the process. Arrows indicate the direction of flow of information or materials between processes, and thus indicate interdependencies among the processes. Functional decomposition is used with IDEF0, with a context model at the top level showing the process as one activity with all inputs and outputs, and then subsequent levels decomposing the process into multiple activities. Every process must also have a stated purpose [16].
Example of IDEF0 is presented below on figure 11.

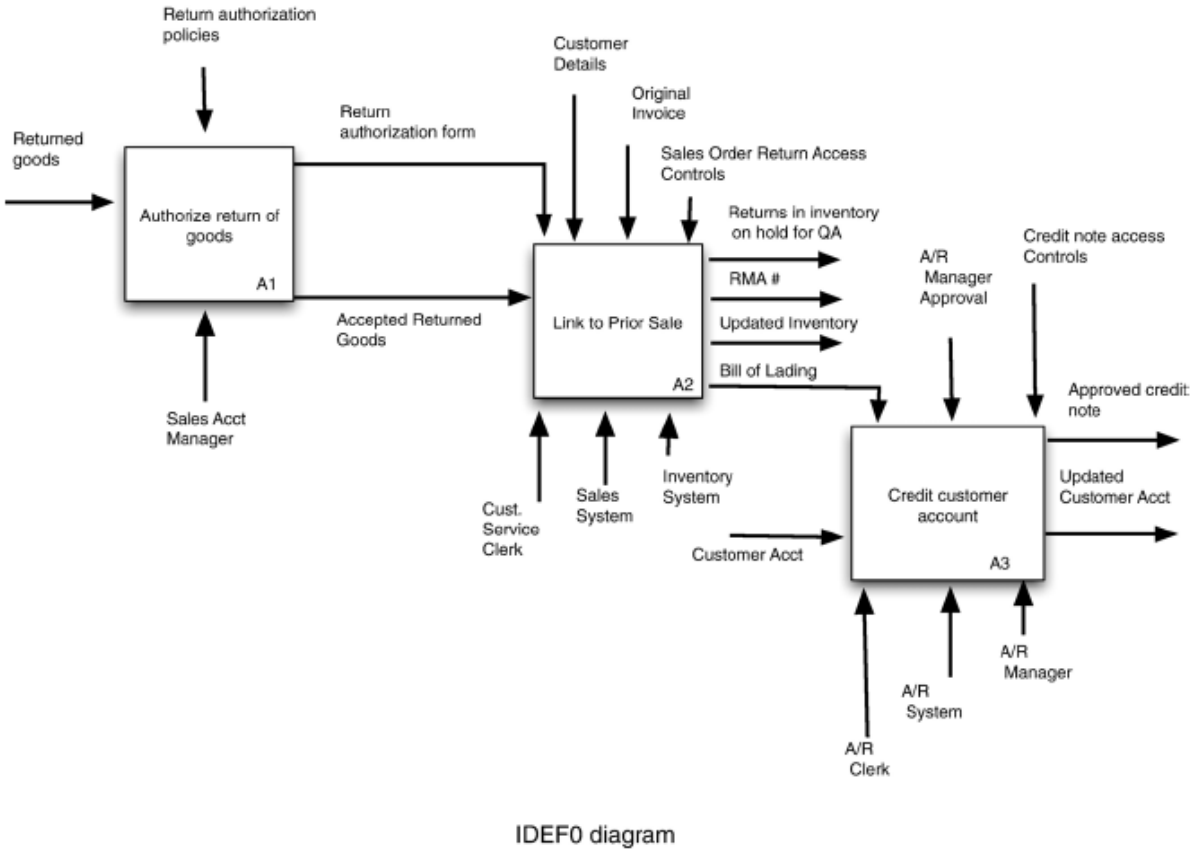


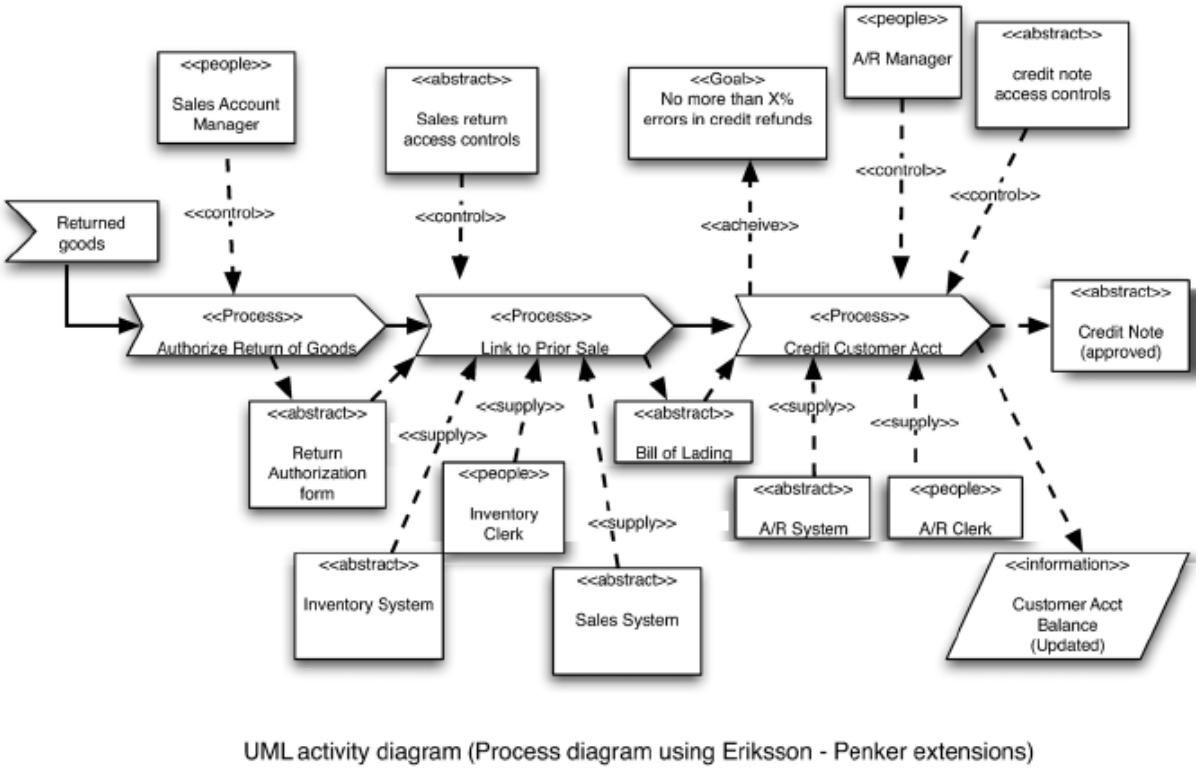
Figure 11 Example diagram IDEF0 [16]

3.2.3 Unified Modeling language (UML)

UML is one of the most widely used modeling languages [30]. It is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group. UML consist of different types of diagrams, but specially was made activity diagram for BPM.

The activity diagram has been developed for use as a business process modeling convention by Eriksson and Penker (2000), and Jackowski (2003), among others [16].

Activity diagrams capture both the activities comprising a business process and the flow of control among the activities. Activities are linked together to form a complete process. Usually, each activity starts when the activity preceding it in the sequence completes. Guard conditions can be used to indicate delays before another activity starts by providing conditions that must be satisfied before another activity can be performed. Decision points provide the primary means of indicating flow of control, determining which of a set of potential activities will occur depending on which of a set of specified conditions exists. Activities can also be shown as happening in parallel. Swimlanes can be used to partition an activity diagram to show the organizational units that contribute to each activity, as well as location. Inputs to and outputs from activities are either material or information. The use of resources by processes is not modeled. Like many of the other conventions, while controls can be shown as activities or in the form of data, there is no explicit construct to model a control that is distinct from that of a regular activity or data.
Strength of activity diagrams is the small number of symbols that must be mastered to read or create a diagram, although this may also lead to confusion when a particular symbol is "overloaded" with multiple interpretations.
A problem with activity diagrams (and UML more generally) is that they are intended to provide a modeling convention by providing a set of symbols that are loosely mapped to particular concepts such as activities and decision points, but the precise meaning (semantics) of many of the concepts is not well defined. [16].
Example of Activity diagram is pictured on figure 12.



UML activity diagram (Process diagram using Eriksson - Penker extensions)

Figure 12 Example UML (Activity diagram) [16]

3.2.4 Extended event-driven process chain diagrams (EPC)

An Event-driven Process Chain (EPC) is a type of flowchart used for business process modeling. EPC's can be used for configuring an enterprise resource planning (ERP) implementation and for business process improvement.

EPC diagrams are a component of the Architecture of Integrated Information Systems (ARIS) framework developed by Scheer (1992). It is used by many companies for modeling, analyzing, and redesigning business processes. As such it forms the core technique for modeling in ARIS, which serves to link the different views in the so-called control view, which will be elaborated in section of ARIS Business Process Modeling.

In general, an EPC diagram must start with an event and end with an event. The event may initiate more activities, and activities may result in multiple events. Connection lines represent the logical relationships between the graphical symbols of the descriptive process. The

process describes the sequence of the chain and the influence on data, operations, applications, organization structure and products [17].

EPC method highlights easy comprehensibility and ease of use for business. Example of EPC diagram presented below.

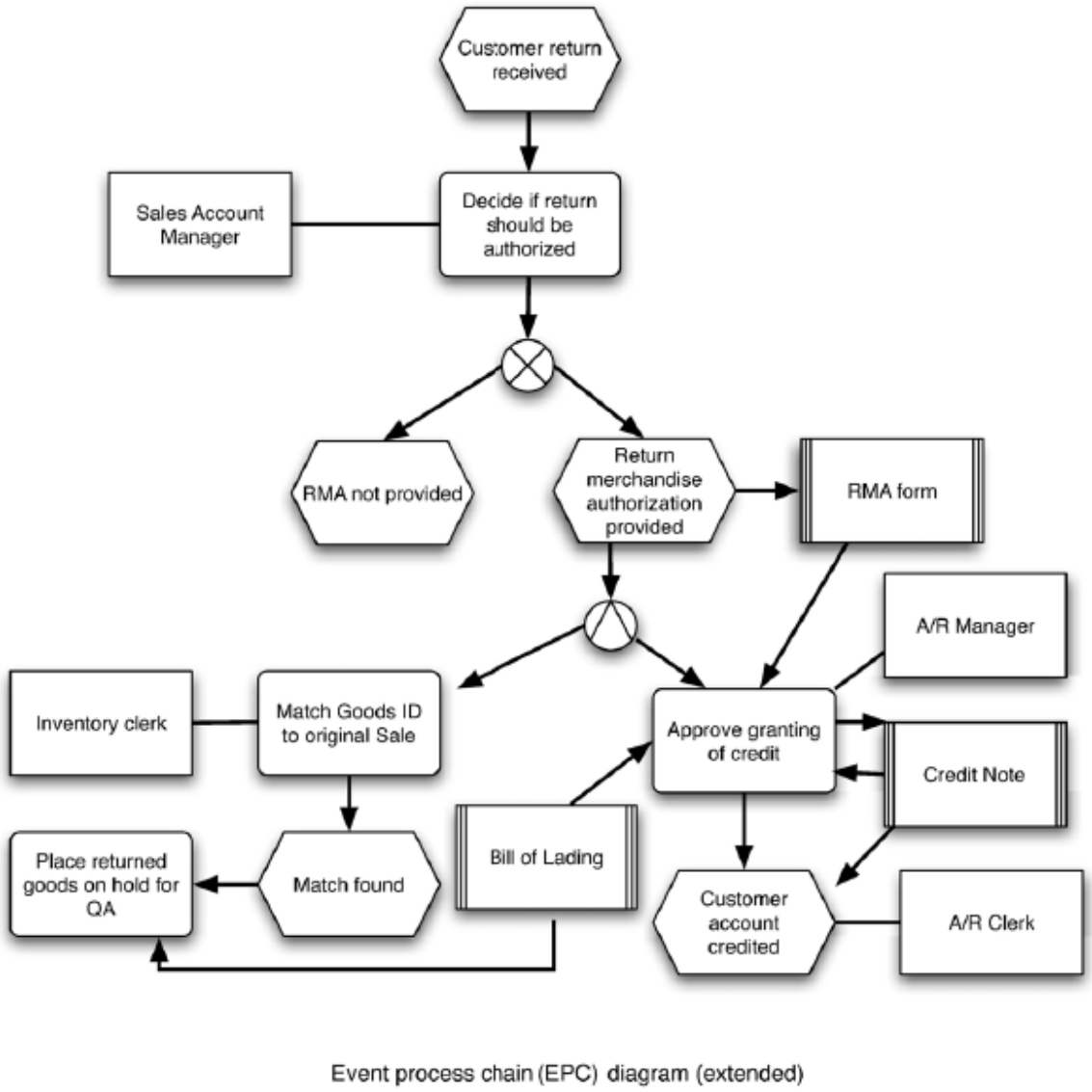


Figure 13 Example of EPC chart [16]

3.2.5 Business process diagram (Business Process Modeling Notation)

The Business Process Modeling Notation (BPMN) is a graphical notation that depicts the steps in a business process. BPMN depicts the end to end flow of a business process. The notation has been specifically designed to coordinate the sequence of processes and the messages that flow between different process participants in a related set of activities.

BPMN was developed by Business Process Management Initiative (BPMI), and is currently maintained by the Object Management Group since the two organizations merged in 2005. As of March 2011, the current version of BPMN is 2.0.

This method tries to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes [18]. Feature is very useful; it can be applied for the small business enterprise to secure understanding of business model on different levels from managers to workers. The example is figure 14.

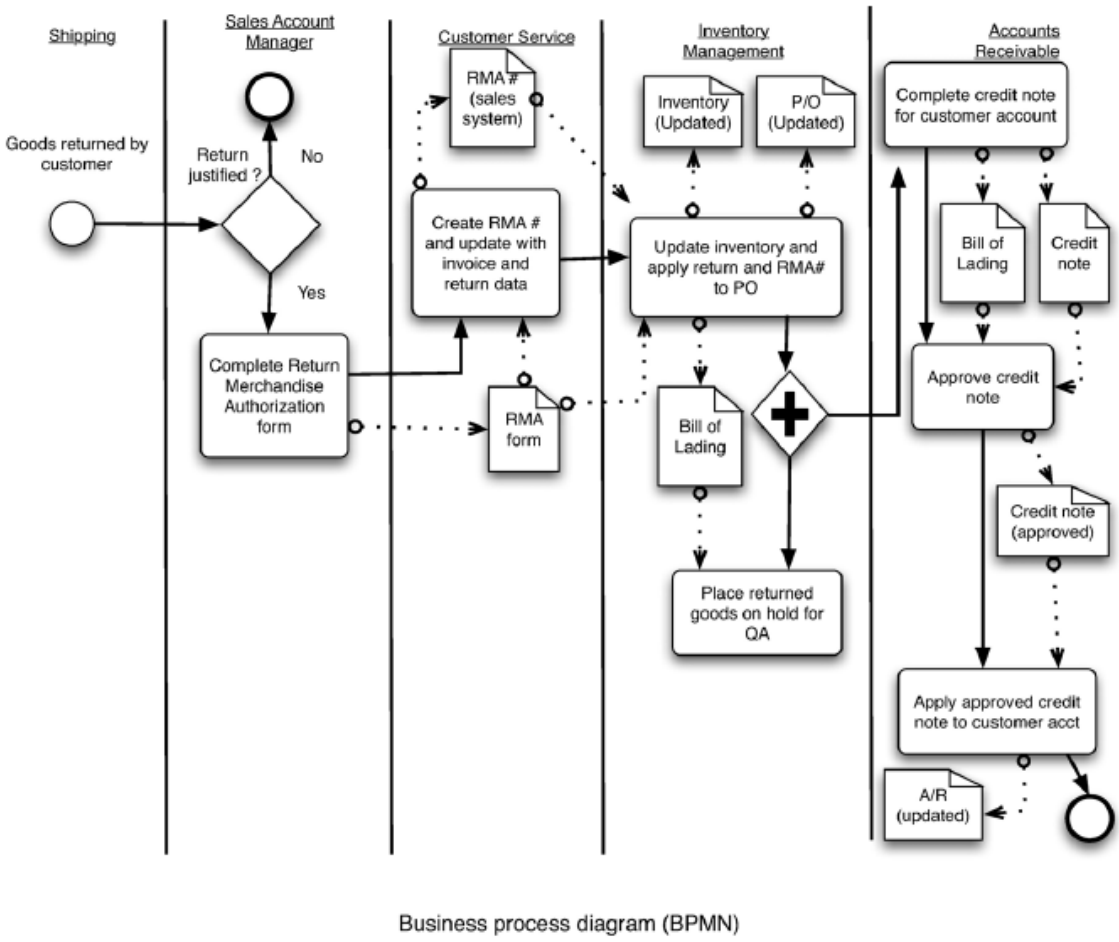


Figure 14 Example BPMN diagram [16]

3.3 Business process modeling choice of method and software

In this section a chosen method and software are described. The decision is based on available materials.

The choice of methods was limited with software choice.

Software for modeling should be responded to the following requirements:

1. Freeware
2. Easy to use and popular among users
3. Similar to someone on a firm

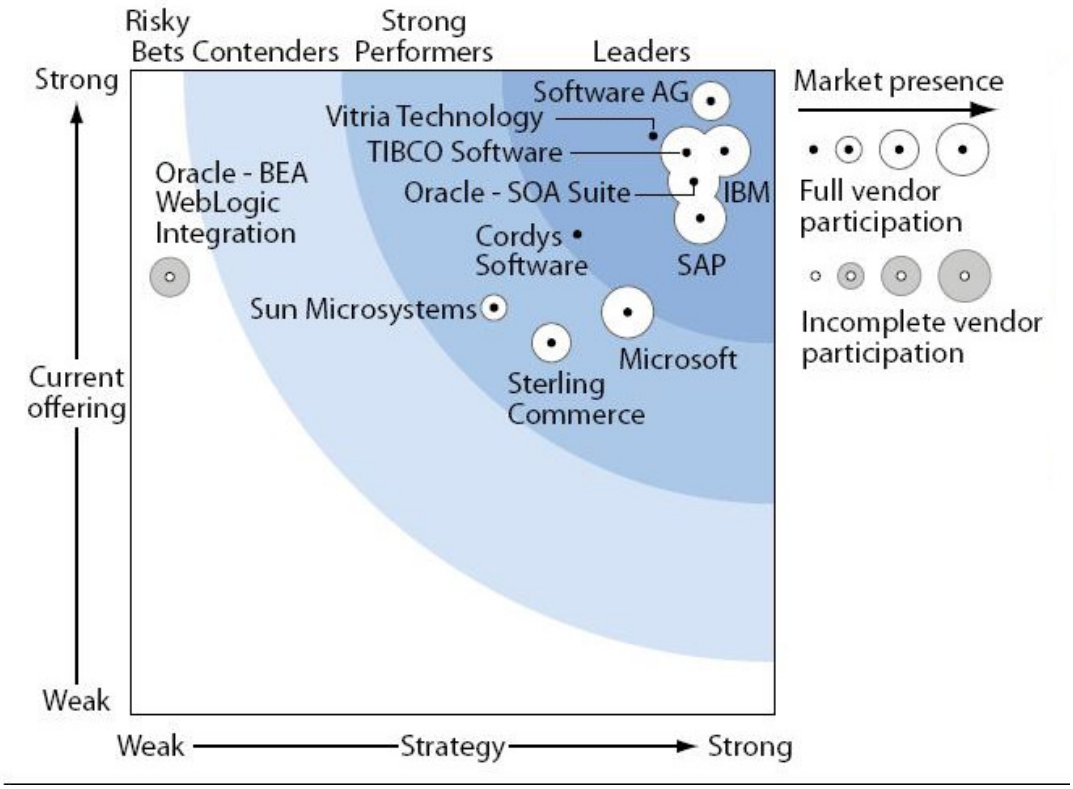


Figure 15 Chart of modeling software developers (Forrester Research Inc 2009)

The 15th figure shows the rating of software developers and software which is presented by them. In group of leaders we can see IBM, TIBCO Software, Software AG.

The choice was made from popular following methods: UML, EPC, BPMN; Flow chart and IDEF0 were not taken into consideration because of usability for end users.

IBM has a freeware product (IBM Rational Modeler) for UML. TIBCO possesses freeware tool (TIBCO modeling studio) for BPMN, Software AG produces (ARIS Express) also for BMPN, EPC and it's free.

A key strength of EPC diagrams is that they are easy to understand, but the absence of a clear semantics to aid in the interpretation of an EPC is a problem in their use [31], as is true for many of the modeling approaches described here other than REA (Resource-event-agent modeling). Identification of the appropriate events to be modeled (e.g. those which trigger activities) can also be challenging [32]. In addition, EPC diagrams also do not have an explicit construct to model controls, although the activity construct may be used to represent controls such as authorization or verification, and examination of the organizational units involved may provide some sense of segregation of duties. There is no representation for the resources required for a particular activity beyond that of the organizational unit performing the activity [16].

UML is modeling language orientated on software development modeling. So in our case it is not suite. A strength of activity diagrams is the small number of symbols that must be mastered to read or create a diagram, although this may also lead to confusion when a particular symbol is "overloaded" with multiple interpretations. A problem with activity diagrams (and UML more generally) is that they are intended to provide a modeling convention by providing a set of symbols that are loosely mapped to particular concepts such as activities and decision points, but the precise meaning (semantics) of many of the concepts is not well defined [16].

BPMN is it was mentioned in its section; it is understandable for all workers from manager to workers. Owen and Raj [33] suggest that strength of the BPD is that it is closer than many other conventions in depicting how business analysts think of processes. They also note that BPD can be mapped to executable business languages, so that an automated analysis of business processes could be supported. The BPD is focused primarily on the portrayal of activities; data inputs and outputs are optional, but the sequence of activities comprising a process must be shown. The resources required by a particular activity can be shown as data objects, but do not have their own distinct construct. Controls can be modeled as activities, data, or decision points, but there is no separate control construct. However, specialized versions of the event symbols are defined that show the triggering of business rules that cause an event to occur. The range of attributes available for each of the elements in BPMN suggests that performance measures could also be captured in text form [16].

During the comparison we can see that obviously BPMN is more suitable for Business process modeling from the position of an analyst. One of our aims is to analyze existing process.

So it is a question of preferences now. TIBCO or Software AG? According to the 15th figure Software AG products are widely presented on market, this point is acceptable, an IT manager works just fine with Aris and it's easy to use and apply.
The choice is Aris Express.

4 Modeling and analyzing of existed processes

The existing processes their modeling will be discussed and analyzed in this chapter. We will view basics principles and apply BPMN method for modeling which was chosen in chapter 3

In previous sections the structure of an example firm AS Sign Computers was described in details. In following sub-sections existing processes and mapping will be discussed

4.1 BPMN basics

Every graphical modeling method consists of basic elements, so Business Process Management Notation is one of them.

BPMN defines a Business Process Diagram (BPD), which is based on a flowcharting technique tailored for creating graphical models of business process operations. A Business Process Model, then, is a network of graphical objects, which are activities (i.e., work) and the flow controls that define their order of performance [18].

A BPD is made up of a set of graphical elements. These elements enable the easy development of simple diagrams that will look familiar to most business analysts (e.g., a flowchart diagram). The elements were chosen to be distinguishable from each other and to utilize shapes that are familiar to most modelers. For example, activities are rectangles and

decisions are diamonds. It should be emphasized that one of the drivers for the development of BPMN is to create a simple mechanism for creating business process models, while at the same time being able to handle the complexity inherent to business processes. The approach taken to handle these two conflicting requirements was to organize the graphical aspects of the notation into specific categories. This provides a small set of notation categories so that the reader of a BPD can easily recognize the basic types of elements and understand the diagram. Within the basic categories of elements, additional variation and information can be added to support the requirements for complexity without dramatically changing the basic look-and-feel of the diagram. The four basic categories of elements are [18]:

- Flow Objects
- Connecting Objects
- Swimlanes
- Artifacts

Flow Objects is a small set of three core elements: Event, Gateway, and Activity.

4.1.1 Event

According to publication (White Stephen A; 2004):

An *Event* is represented by a circle and is something that "happens" during the course of a business process. These Events affect the flow of the process and usually have a cause (trigger) or an impact (result). Events are circles with open centers to allow internal markers to differentiate different triggers or results. There are three types of Events, based on when they affect the flow:
Start, *Intermediate*, and *End* (see the figures to the right, respectively).

In diagrams Event is presented by the symbols: 

4.1.2 Task or Activity

In publication of White Stephen:

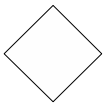
An *Activity* is represented by a rounded-corner rectangle (see the figure to the right) and is a generic term for work that company performs. An Activity can be atomic or non- atomic (compound). The types of Activities are: *Task* and *Sub-Process*. The Sub-Process is distinguished by a small plus sign in the bottom center of the shape.

Symbol: 

4.1.3 Gateway

White:

A *Gateway* is represented by the familiar diamond shape (see the figure to the right) and is used to control the divergence and convergence of Sequence Flow. Thus, it will determine traditional decisions, as well as the forking, merging, and joining of paths. Internal Markers will indicate the type of behavior control.

Symbol: 

4.1.4 Connecting Objects

According to White:

The Flow Objects are connected together in a diagram to create the basic skeletal structure of a business process. There are three Connecting Objects that provide this function. These connectors are:

A *Sequence Flow* is represented by a solid line with a solid arrowhead (see the figure to the right) and is used to show the order (the sequence) that activities will be performed in a Process. Note that the term "control flow" is generally not used in BPMN.

Symbol

A *Message Flow* is represented by a dashed line with an open arrowhead (see the figure to the right) and is used to show the flow of messages between two separate Process Participants (business entities or business roles) that send and receive them. In BPMN, two separate Pools in the Diagram will represent the two Participants.

Symbol

An *Association* is represented by a dotted line with a line arrowhead (see the figure to the right) and is used to associate data, text, and other Artifacts with flow objects. Associations are used to show the inputs and outputs of activities.

Symbol

4.1.5 Swimlanes & Pool

Many process modeling methodologies utilizes the concept of *swimlanes* as a mechanism to organize activities into separate visual categories in order to illustrate different functional capabilities or responsibilities. BPMN supports swimlanes with two main constructs. The two types of BPD swimlane objects are [18]:

A *Pool* represents a Participant in a Process. It is also acts as a graphical container for partitioning a set of activities from other Pools (see the figure to the right), usually in the context of B2B situations.

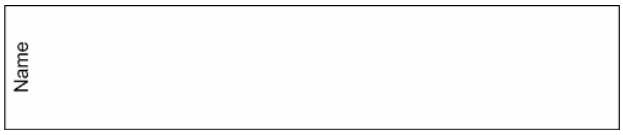


Figure 16 Pool

A *Lane* is a sub-partition within a Pool and will extend the entire length of the Pool, either vertically or horizontally (see the figure to the right). Lanes are used to organize and categorize activities.

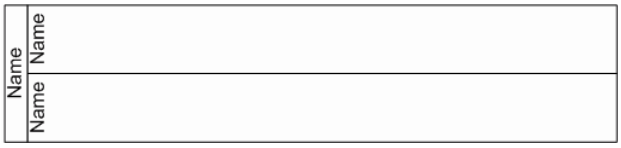


Figure 17 Lanes

Pools are used when the diagram involves two separate business entities or participants (see Figure16) and are physically separated in the diagram. The activities within separate Pools are considered self-contained Processes. Thus, the Sequence Flow may not cross the boundary of a Pool. Message Flow is defined as being the mechanism to show the communication between two participants, and, thus, must connect between two Pools (or the objects within the Pools) [18].

Lanes are more closely related to the traditional swim lane process modeling methodologies. Lanes are often used to separate the activities associated with a specific company function or role .Sequence Flow may cross the boundaries of Lanes within a Pool, but Message Flow may not be used between Flow Objects in Lanes of the same Pool.

4.1.6 Artifacts

BPMN was designed to allow modelers and modeling tools some flexibility in extending the

basic notation and in providing the ability to additional context appropriate to a specific modeling situation, such as for a vertical market (e.g., insurance or banking). Any number of *Artifacts* can be added to a diagram as appropriate for the context of the business processes being modeled. The current version of the BPMN specification pre-defines only three types of BPD Artifacts, which are [18]:

Data Objects are a mechanism to show how data is required or produced by activities. They are connected to activities through Associations.

Figure 18 Data object symbol

A *Group* is represented by a rounded corner rectangle drawn with a dashed line (see the figure to the right). The grouping can be used for documentation or analysis purposes, but does not affect the Sequence Flow.

Figure 19 Group symbol

Annotations are a mechanism for a modeler to provide additional text information for the reader of a BPMN Diagram (see the figure 20).

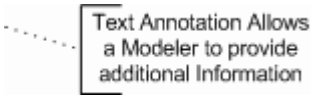


Figure 20 Annotation

4.2 Uses of BPMN

Business process modeling is used to communicate a wide variety of information to different audiences. BPMN is designed to cover many types of modeling and allows the creation of process segments as well as end-to-end business processes, at different levels of fidelity. Within the varietyof process modeling objectives, there are two basic types of models that can be created with a BPD:

- Collaborative (Public) B2B Processes
- Internal (Private) Business Processes

In simple words Collaborative describes processes which take place between business organizations or between an external person and an organization.

Internal describes processes that happen in organization itself.

5 Modeling of existing processes

In this section we will construct BPMN model for existing process.

All existing processes correspond directly with a structure of the firm. 3 basic activities are presented and divided into directions: the first direction is “Retail business”. This activity is responsible for sale of devices, software and details.
The second is “Repair and warranty”. This part of the enterprise generates value over repairing and helps to maintain warranty for client during warranty period.
The third process is responsible for support clients and inside an enterprise IT structure. Within this activity the enterprise creates value; in comparison with retail business value, this value is lower. For modeling we should make a choice, pick one of the existing processes. Parameters in choosing the process are value that generates process. According to last accountant’s reports the most profitable activity of the enterprise is Retail business. This criteria is very important for a firm because it produces value for customer and enterprise.

We will design and rework process according to time of the process. Reducing time of the process gives an opportunity to make more activities in a definite period of time.

5.1 Retail business process (sales)

According to the structure we can see 3: Internet sales, Narva's sales (sales that happen in the filial which is situated in Narva), Sales in Tallinn (the same process like in Narva but location is other). Basically there are two types of sales – in network or "in person" then a person; a buyer attends shop to buy specified device, software or service. An internet sale is almost the same process but it happens in network, exactly on the webpage (web shop).

We try to map process that happens in shops (Narva, Tallinn). Cause of this is more value according to internal report [19] and operates more active than in a web shop. four parts take par in this process: an accountant, a client, retail business and suppliers. Retail business is divided into two departments: sales and production. Sales department is basically a person who sales devices, software to clients.

An event that begins the process of sale is a request, a desire or a wish to buy something. A person or an organization calls over phone, e-mail or in person expresses his or her desire to buy for example a device (it can be whatever software, hardware or service). Sales manager considers epy request and generates an offer for the client. The client gives a response; it can be positive or negative in case of negative answer the process ends. The positive response advances process to a production phase. In the 21st figure an existing process of retail business is presented. This process is described above.

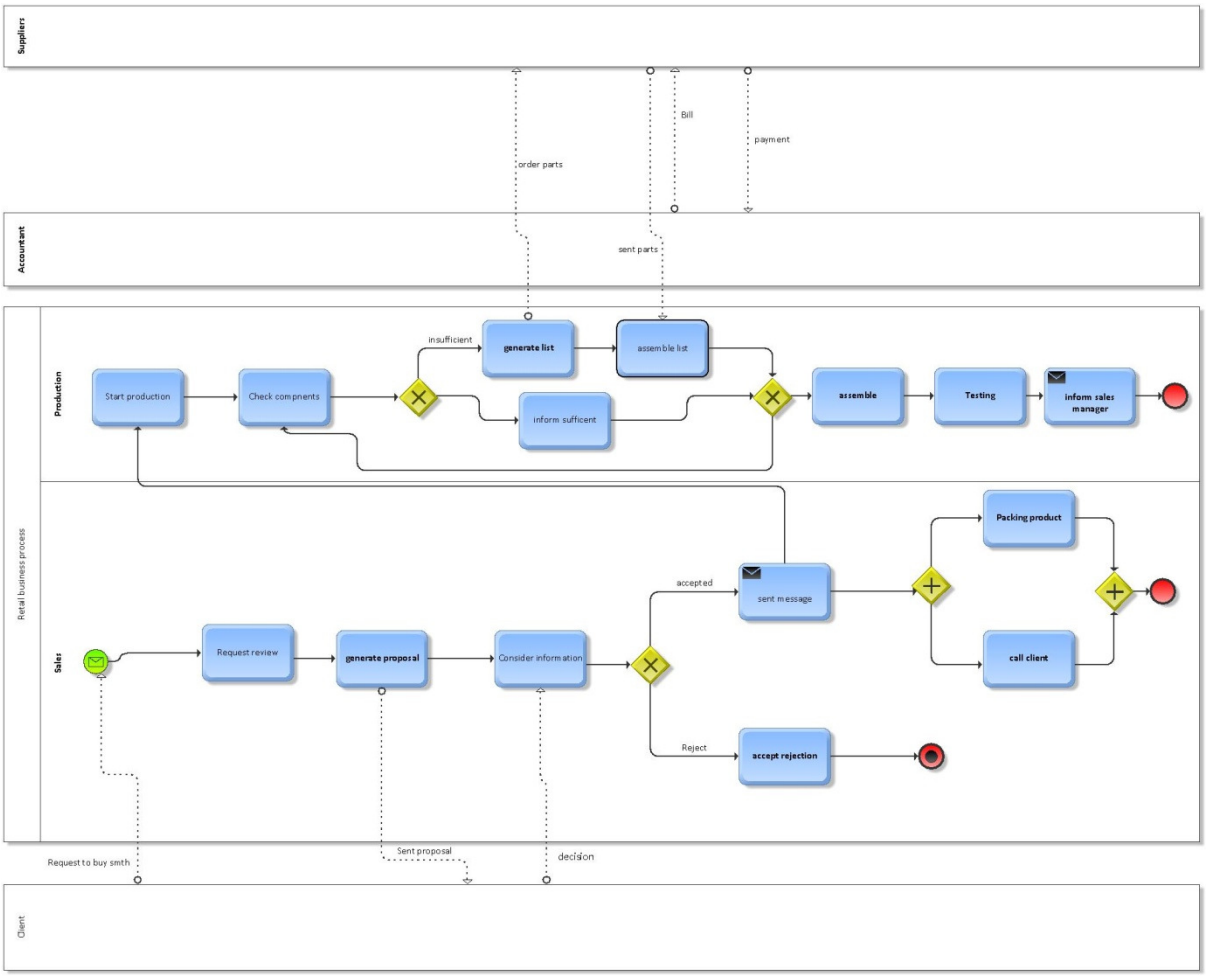


Figure 21 BPMN diagram of an existing "in person" sale process

During the production a worker who does this activity should check availability of all requested details (software, hardware) and completion of production. After all a worker assembles and tests the device, then he sends info (call, email) to a sales department.
Process ends while packing the device and informing the user.
The process is mapped for better understanding the process in retail business.

5.2 Redesign of existing processes

After mapping the existing sale process it was found out that during the production a worker who participates in assembling of the device or installing software usually deals with an activity which should not be done by him. This activity takes time so a worker can't concentrate on production. According to the diagram this activities are to check components, generate a list of components, and check sufficiency. This part of the process should be improved. One of the possibilities is process time improvement.

According to Laguna & Marklund: Cycle Time Analysis the task of calculating the average cycle time for an entire process or process segment. Assumes that the average activity times for all involved activities are available (activity time = waiting time + processing time). In the simplest case a process consists of a sequence of activities on a single path. In the 21st figure a basic scheme of process was mapped. It is not possible to count the time but it is clear that processes of production and sale are not happening in parallel way. According to this moment we can state that this part of process should be redesigned in way to reduce number of activities.

Ways of reducing cycle times through process redesign [19]:

1. Eliminate activities
2. Reduce waiting and processing time
3. Eliminate rework
4. Perform activities in parallel
5. Move processing time to activities not on the critical path

According to these simple steps the process can be redesigned. Activity, the activity of a production worker, directly depends on a sales manager activity. Actions of the sales manager are to create a list of details in a database with help of scripts. The scripts generate the list of sufficient and insufficient details. It compares prices and time of delivery and sends request to specified suppliers. This way of organizing a work flow is to save time and make the process simple.

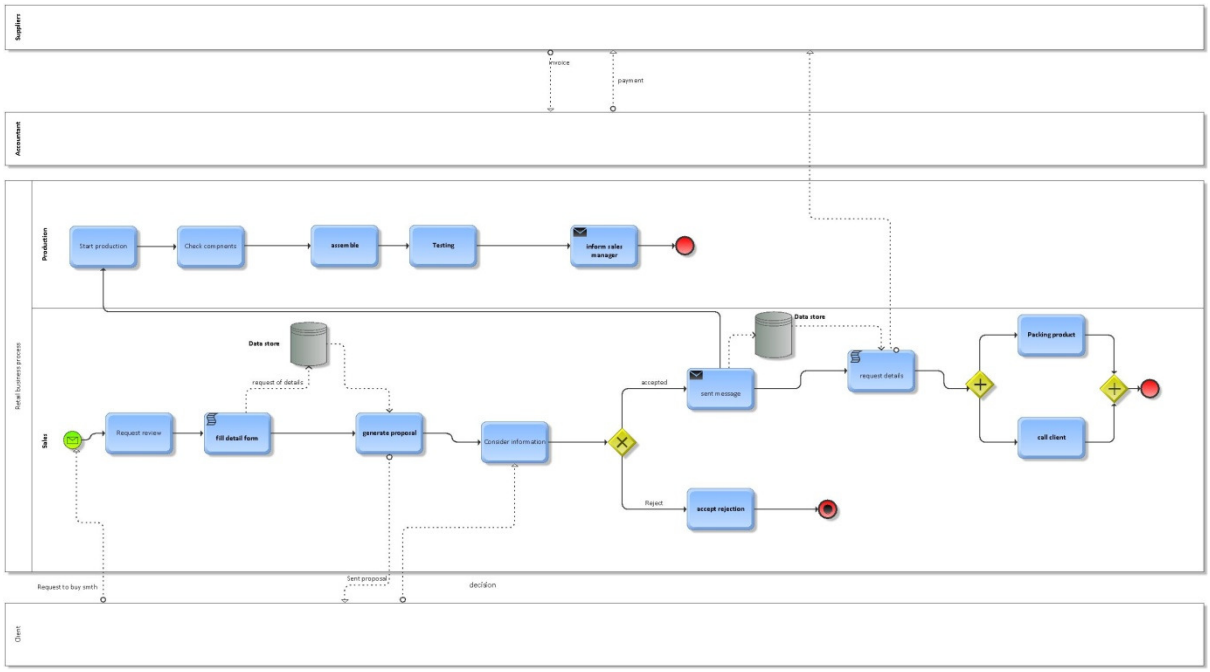


Figure 22 rebuilt process of figure 21

The 22d figure presents the redesigned process. The main difference from the 21st figure is the Data store. It can be a database, based on all activities of sale (incoming, outgoing). Some sort of scripts could help to generate the list of useful details or devices.

In general the Data store case is located in the Internet. It can be located on a server and every worker should have a possibility to access it whether he is in a local network or not. The data store is a database. A simple base can be done with help of MS Access for example. A salesman gets a request and then he just inputs the required information. Existing scripts in the database control availability in details check a price then generate a proposal.
According to these principles, which were published in work of Manuel Laguna and Johan Marklund: elimination of activities gives boosts to process. Human's activity eliminates with scripts in the database. It saves time.

5.3 Results

As a result we have received a redesigned model. Business process was reworked using criteria of reducing time. Processes can be reworked in different ways but a designer should always know and define criteria before reworking.

The model has been created in the previous part. It reduces time for production and sale. Two simple steps for improving the process were used there: elimination of activity with help of a database with scripts and a parallel process flow was used at the end of it.
The result of redesigning is a reworked process of reducing time for useless activities. Using this model gives more opportunity to execute more processes in a particular period of time. The redesigned model was not tested in real life; it is hard to calculate the exact economy of time. But we can approximately compare time in the original model and in the redesigned model. The first one was excluded from production of a worker and creating a list of details by him. In the redesigned model this activity is performed by a sale's manager with a help of scripts and the database. Comparing and generating actions automatically takes less time. This is the worst case, but in general case the result will be much better. Sales manager fulfills a form in the database than pushes a button and in seconds t list of details will be generated. It depends on different factors and the main of them is functionality of the database, hardware that is used for the database store and speed of a worker's PC-s. We can firmly state that manually comparing and fulfilling of a form takes more time. At the end of the process a parallel process was used that makes the process faster (see figure 22).So approximately we can state that redesigned process reduce time of process at least by 2.

The redesigned process gives an opportunity to produce more actions as for a sales manager and for a worker. Quantity of activities increases so this means that it produces values for users and the enterprise grows. This example can be a good signal to analyze and rework all the process on the firm. It can help in hard times to survive and in good times to be profitable and to grow.
Also in some cases it helps to solve some problems with duties that should do or not each person in the firm. It helps to rewrite duties in contracts to the state ones that will satisfy all requirements. Reworking of the process is not a useless task – it is the work for the future.

This model can be applied in a real life. Before using the modified model in general case every enterprise should analyze such aspects as – value, pluses against loses, what it cause and the cost of the project. But this part is for further researches.

6 Conclusion

The goal of this thesis is to demonstrate the usage of the workflow modeling, to give an overview of the existing process. The work is mainly focused on AS Sign Computers retail business process.

Business processes have been studied here as a creative approach to customers value and successful management. We had a look at the relationship between management, strategic management process that set specific goals and provide guidelines for the establishment of business operations.

Business process has been studied to describe the most common methods of modeling processes. Master's thesis were compared with an overview of the graphic modeling, such as the IDEF-0, UML, EPC, flowchart System, BPMN uses.

Existing processes were established and described according to the selected method. A modified model was created according to the basic principles in reworking the process. The purpose of the redesigned model was to reduce time and makes process simpler.

Kokkuvõte

Magistritöö eesmärk oli optimeerida äriprotsesse nende modelleerimise abil ettevõtte AS Sign Computers näitel. Töös realiseeriti see jaeäri valdkonnas, kuna see on ettevõtte tegevusvaldkondadest suurima käibega.

Äriprotsesse terviklikult käsitleva lahenduse väljatöötamiseks uuriti protsessijuhtimist kui kliendile väärtust loovat lähenemisviisi. Vaadeldi protsessijuhtimise seoseid strateegilise juhtimisega, mis seab ettevõttele konkreetsed eesmärgid ja annab suunised äritegevuse teostamiseks.

Äriprotsesside kirjeldamiseks uuriti enimlevinud protsesside modelleerimise meetodeid. Magistritöös anti ülevaade ning võrreldi järgmiste graafiliste modelleerimismeetodite, nagu IDEF-0, UML, EPC, Flowchart diagram, BPMN kasutusvõimalusi. Lähtudes kirjanduse põhjal kogutud infost, firma vajadustest ja töötajate oskustest valiti äriprotsesside kirjeldamiseks meetod BPMN ja vastav diagrammide koostamise tarkvara.

Töös koostati ettevõtte müügiprotsessi mudel ning selle mudeli analüüsi tulemusena koostati uus mudel. Uue mudeli loomisel lähtuti protsessi ümberkujundamise printsiibist, st uues mudelis säilitati ennast seni õigustanud alamprotsesse kujutavad mudeliosad. Kuigi uue mudeli kohaselt seisab ettevõtte müügiprotsesside ümberkujundamine alles ees, võib juba praegu hinnata müügile kuluva aja vähemalt kahekordset kokkuhoidu.

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