

KAUNAS UNIVERSITY OF TECHNOLOGY

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BUSINESS PROCESS MODELING

Educational Book

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FOREWORD

This book is intended for the international students that study the Business Process Management in Lithuania. The aim of this book is to explain how to develop the manufacturing enterprise's business model including the main managerial processes.

Reading this book the students can understand the main principles of business process management. The software of business process schemes drawing is presented. The main stages of business model are characterized and the practical example of business model development process is given.

The students can select the appropriate type of Lithuanian enterprise, plan the necessary human resources, calculate the labour costs including the social insurance payments. The production process planning and organizing is described which must be implemented in cooperation with experienced engineers. The main taxes are defined that must be considered modeling the business enterprise. The cost-price calculation process and the setting of a product's price principles are given. The enterprise's financing decisions are explained, the example of activity start balance-sheet creation is given. Using this book the students will be able to calculate the income and costs of their business models, to plan the cash flows and to estimate the project's efficiency. Also the clients servicing system's development and its efficiency assessment are explained. The analysis of business environment and risks is also very important modeling the enterprise's activity, so the main sources of Lithuanian statistics related to macroeconomics and business indicators are presented.

The author of this book expects to improve the students' skills of business modeling that further can be applied in real life realizing the business ideas successfully. The foreign students will understand the main peculiarities of Lithuanian business enterprises and will be able to start their own businesses.

1. BUSINESS PROCESS MODELING CONCEPT



The tasks of this chapter:

- To explain the concept of business process modeling.
- To present the business process modeling software.

1.1. Literature review

A business process is defined as a set of logically related tasks performed to achieve a defined business outcome (Budiono, Loice, 2012). Business process management (BPM) is defined as the organizational management practice, which is focused on the identification, definition, analysis, continuous improvement, execution, measurement, monitoring and analysis of internal and external organizational business processes. BPM requires the management understanding and involvement, process-aware information systems, well-defined accountability and a culture receptive to business processes. BPM is based on a process architecture, which captures the interrelationships between the key business processes and the enabling support processes and their alignment with the strategies, goals and policies of an organization (Draghici, Draghici, Olariu, Canda, 2012). Business process management plays a central role at operational, organizational and technological levels of enterprises. The business process modeling produces abstract descriptions of business processes that are a central asset to the organization as they enable its specification, documentation, analysis and engineering through multiple paradigms, languages and techniques (Caetano, Pereira, Sousa, 2012).

Every company is composed of many different business processes. The business processes are defined by ISO as a set of interrelated or interacting

activities which transform inputs into output. A business process is a collection of related tasks that lead to a specified goal. Many modeling notations are available to capture business processes, including Event-driven Process Chains (EPC), UML Activity Diagrams and the Business Process Modeling Notation (BPMN) (Tka, Ghannouchi, 2012). BPMN is a graphical standard language to model business processes. BPMN provides coverage for more specific properties than any other existing business process modeling standard (Ferreira, Martinho, Domingos, 2014).

A business process can also be defined as a set of connected actions which consumes (inputs) and produces (outputs) tangible or intangible artefacts, is performed by people, contributes to achieve goals, takes place in a specific location and occurs during a period of time. A business process can be functionally decomposed in as many levels of detail as required (Figure 1.1.1). Modeling methods usually prescribe various levels of decomposition and use different naming conventions for each level (e.g. process, activity, task) (Caetano, Pereira, Sousa, 2012).

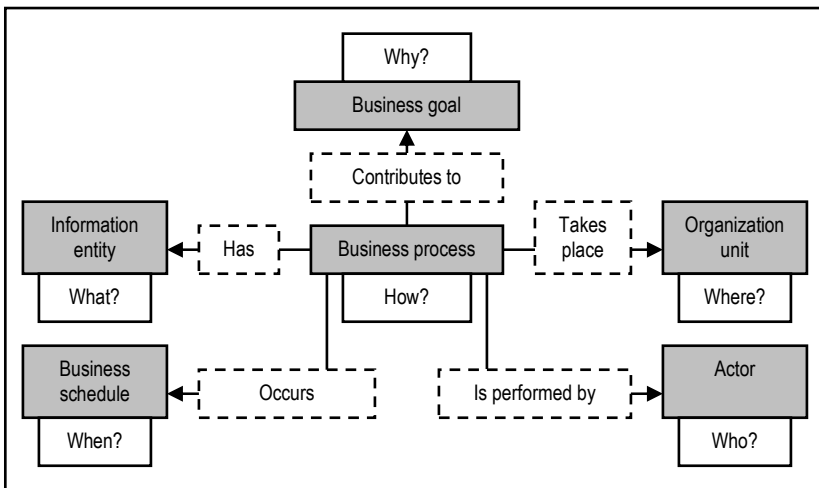


Figure 1.1.1. The conceptual business process model (Caetano, Pereira, Sousa, 2012)

A business process model is a collection of business processes documented using a standardized method. Business processes can also be defined as the specific ordering of work activities across time and place, including clearly identified inputs and outputs. The typical purposes of documenting business processes are:

- To document the relationship between business processes and IT.
- To have a common reference for change and process improvement.

- To ensure consistent quality in process execution (Svensson, Hvolby, 2012).

In such a scenario, a suitable architecture has to support the exchange of information and triggers between different processes as well as a management platform that is capable of monitoring a process and service landscape, also generating interactions with users in different roles (Schlegel, Vidačković, Dusch, Seiger, 2012).

In large and complex supply chains, there are a considerable number of business entities that are involved in the business processes, such as:

- Manufacturing.
- Sales.
- Stock.
- Logistic.
- Accounting and other.

The determination of these participants is crucial for establishing the boundaries of sub-processes and discovering key interactions between enterprises (cross-functional) or departments (inter-departmental), hereinafter business nodes (Figure 1.1.2). Hence, it is required to gather the relevant properties that are part of the structure of the processes and activities, i.e. inputs and outputs, payloads, resources, costs, etc. Likewise, it is important to give especial emphasis on the input, outputs and payloads of processes and activities, as this information will be essential for establishing the link between inter-related processes (Vera-Baquero, Colomo-Palacios, Molloy, 2014).

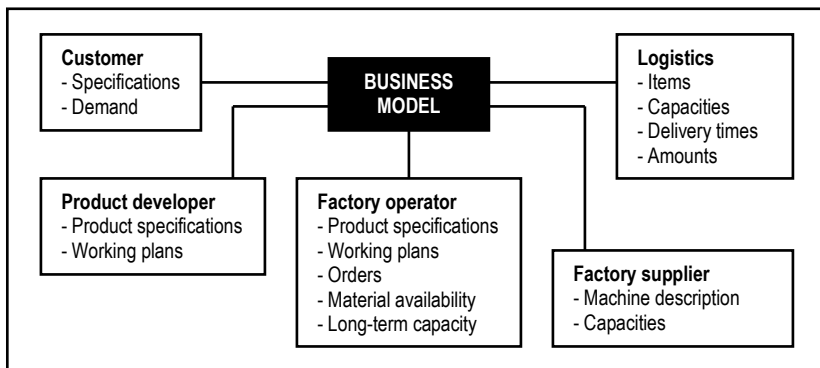


Figure 1.1.2. The concept of business model (Rudtsch, Gausemeier, Gesing, Mittag, Peter, 2014)

In business practice the Enterprise Resource Planning (ERP) systems are used to manage the business processes as the enterprise-wide on-line interactive

systems that support cross-functional processes using a common database. ERP systems are designed to provide the seamless integration of processes across functional areas with improved workflow, standardization of various business practices, and access to real-time up-to-date data. The commercially available software packages promise seamless integration of all information flows in the company:

- Financial and accounting information.
- Human resource information.
- Supply chain information.
- Customer information.

A company represents an open, dynamic and goal-oriented system that constantly interacts with its internal and external environment. Constantly changing environment significantly affects the overall efficiency and so also the competitiveness of enterprises. One of the conditions to maintain the competitiveness and performance of the company is the ability to work properly and timely with information not only about past and present but also especially about the future. ERP information system is a powerful tool that influences awareness, flexibility and performance of the company (Rajnoha, Kadarova, Sujova, Kadar, 2014).

In the traditional view, a business process is an organizational tool meant to provide a product or service through a number of activities (or tasks) that are performed on the basis of predefined precedence rules. This approach is called activity-centric and its main representative is the BPMN notation. Tasks may be divided into:

- Human tasks.
- Automatic tasks.

The human tasks are carried out by persons playing specific roles, e.g. customers and account managers, and the automatic tasks are performed by software components. The precedence rules form the control flow of the process and are based on the completion events of tasks. The implementation of tasks is outside the scope of the process, which acts as an manager of activities: the process elements representing tasks are placeholders of external activities and are intended to pass them input parameters and to receive results. Input parameters and results are mapped to process variables (Bruno, 2014).

So, BPM can be defined as a structured approach to analyze and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company's operations (Akkoyun, Erkan, 2014). BPM as being a system which supports business processes using methods, techniques, and software to design, enact, control and analyze operational processes involving humans, organization, applications, documents and other sources of information (Dragan, Ivana, Arba, 2014). These roles are equipped with the permissions to

perform their respective tasks. Human users and other active entities (subjects) are assigned to roles according to their work profile. A process-related role based access control model enables the definition of permissions and entailment constraints for the tasks that are included in business processes (Hummer, Gaubatz, Strembeck, Zdun, Dustdar, 2013).

To increase the flexibility and controllability of the management of organizations, business processes are used to describe the services that an organization provides and the internal processes that implement those services. As a result, it is common to see collections of hundreds or even thousands of business process models (Yan, Dijkman, Grefen, 2012). In environments involving business collaborations, business processes are increasingly complex and integrated both within internal corporate business functions (e.g., manufacturing, design engineering, sales and marketing, and enterprise services) and across the external supply chain (Papazoglou, Kratz, 2007). Manufacturing company's challenges are driven by increasing flexibility, agility, efficiency and quality of their processes (Prades, Romero, Estruch, Garcia-Dominguez, Serrano, 2013).

Business process management is a management approach that describes how companies can achieve efficiencies by integrating and improving their business processes and by aligning those business processes with corporate strategies and goals. Companies that routinely practice BPM are able to consistently improve on the results obtained from existing processes (Nikolova-Alexieva, 2012).

Traditional way of business performance comes out from evaluation of achieved financial indicators: profit, turnover, market share. A modern way of performance evaluation is based on measurement of business processes performance and it is known as performance management. Process performance management is a systematic identification, visualization, measurement, evaluation and permanent improvement of company processes using methods and principles based on process approach. Main features of process management are process orientation, horizontal management, considering the enterprise as a system of processes and activities. Increasing process performance with aim to increase an added value for customers belong among basic strategic goals in modern enterprises (Sujova, Rajnoha, Merkova, 2014).

Besides the trend towards BPM, business process reengineering (BPR), which is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed. Nowadays, organizations are faced with a steady increase of both business processes complexity and regulations. Business processes need to follow regulations, which by their nature change very often. Thus, BPM and BPR are being forced more and more to react to and consider these regulatory requirements when business processes are managed or when processes must be redesigned fundamentally (Becker, Delfmann, Eggert, Schwittay, 2012). Current business environments evolve increasingly fast due to

new markets, changing government rules and emerging technologies. As a result, organizations have to adjust their business processes along with the changing environment in order to maintain a competitive advantage. Furthermore, business processes may not perform as desired according to various measures, and have to be redesigned consequently. The causes of these performance issues should be identified in order to propose suitable redesign goals that may solve the performance issues of the business process. Additionally, the appropriate indicators should be formulated, in order to be able to verify whether the initial goals were met and determine the success of the redesign (Maruster, van Beest, 2009).

According to Mates, Rychly & Hruška (2014) the execution of business processes can be controlled by two types of business process management systems:

- Rule-based management systems.
- Case-based management systems.

The rule-based systems manage business processes by predefined rules describing how to react in particular situations (e.g., in a case of a new production order). These systems are based on best practices and supported by many well-established approaches, e.g., for monitoring of the rule-based managed processes in the measurement phase. However, the rule-based systems are not very suitable for dynamic modifications of the processes at runtime according to context changes which cannot be described by the predefined rules. Existing approaches focus mostly on updating of a process to its new version during its runtime, which could take days or even years without possibility to stop the process for the update.

The case-based systems manage business processes on the basis of previous experiences in the form of cases describing the process variants. These systems are very flexible, because the process definition is fully-specified in all its variants of individual cases and it is always possible to introduce a new case according to the current needs. However, there may be a problem with monitoring and controlling of the process performance in the measurement phase which may be very different in each case. This can lead to breaking business rules, problems with performance evaluation, and unpredictable quality because of too much freedom in the processes (Mates, Rychly, Hruška, 2014).

In somewhat simplified terms, the classical BPM process approach involves a business analyst constructing a model of a process system using one of the multiple standards. These standards have developed into modern ones, such as ARIS and BPMN. The shortcomings of such an approach are well known, including the models' inherent lag from the practice, unsuitability for dynamically changing and multi-version processes, a gap between the company's IT services and managers and employees, and, hence, a failure to account for the fact that processes in the company may often run in a way that is completely different from what is reflected in the analyst's model. Current business services are becoming increasingly dynamic

and knowledge-intensive. Therefore, it is quite natural that alternative approaches to process business process modeling are being researched. Such approaches should be based on process automation and suitability for dynamically changing and multi-version processes, projects, separate usage scenarios and even episodes, as well as for adaptive conduct of business: a single group user action to achieve the goal without a previously made plan, and assignment of responsibilities (Stavenko, Kazantsev, Gromoff, 2013).

A process model, be it compact or compound, is accompanied by an information model that shows the entity types involved in the process, their relationships and attributes (Bruno, 2014). Business process management is becoming popular in business, and the business process modelling is a way of representing an organization to enable its analysis and improvement. A business-friendly modelling is very helpful for business people, and also can act as a communication tool between them and technical IT people. A good data modeling technique can assist BPM, thus improve the organisation operations.

A business process graph is a graph representation of a business process model (Yan, Dijkman, Grefen, 2012). The development of a database needs to go through the process of data modeling. There are a few conventional data modeling techniques, and one of the popular techniques is the entity relationship diagram (ERD). The relational database management system (RDBMS) has become a dominant data processing software these days. ERD, on the other hand, is a popular high level conceptual data model. This model and its variations are frequently used in the conceptual design of database applications. The model describes data as entities, relations and attributes. Relational database is used in most integrated accounting information system (AIS), where the relational database system is the most popular type of database used in transactional processing (Mohamed, Noordin, 2013). The Event-driven Process Chains (EPCs) is a popular business process modeling language. EPCs offer function type elements to represent these activities, event type elements describing pre- and post-conditions of functions, and three kinds of connector types including AND, OR, and XOR. Control flow arcs are used to link these elements (Tka, Ghannouchi, 2012). Considering the intense usage of business process modeling in all types of business contexts, the relevance of process models has become obvious. Business process models are an important means to design, analyze, implement, and control business processes. As with every type of conceptual model, a business process model has to meet certain syntactic, semantic, and pragmatic quality requirements to be of value (Pinggera, Soffer, Fahland, Weidlich, Zugal, Weber, Reijers, Mendling, 2013).

Business process simulation could be split into two parts based on its purpose:

- Simulation for long-term planning.
- Simulation for short-term planning.

First type is used in steady state analysis for long periods of time, focusing on assisting long-term strategic planning. Simulation for short-term planning is mostly suitable for operation decision support in concrete situations. It was less used in practice due to the difficulty of obtaining real-time objective data and lack of techniques to automatically create precise process models (Khodyrev, Popova, 2014).

Successful business models encompass three aspects: accordance with corporate objectives and business strategy, internal consistency of the aspects and robustness against competitors (Rudtsch, Gausemeier, Gesing, Mittag, Peter, 2014). Mostly organizations operate in a process-driven way, so specifying and developing business processes it became crucial for organization development, in particular to establish agile enterprises. Business process specifications have to be tailored by participating parties to the specific situation.

The models include:

- The subjects involved in a process.
- The interactions they are part of.
- The data they send or receive through each interaction.
- The behaviour of each subject (Fleischmann, Stary, 2012).

The requirement for the modeling tool to support inter-organizational process flow adjustment can be described as follows:

- Each employee can recognize and accept the process flow of the main business processes: the process of the part of the business for which they are responsible, and the process of other sections are connected by a detailed process layer. By these functions employees (end users) and information system staff can communicate easily and help the adjustment process effectively.
- Process components (hierarchical groups) can be easily seen: this function helps to maintain business process efficiency and also helps in standardizing business processes.
- The effect and influence of business process change can be seen by sections (from the management view and the employees' view): by this function, relocation of human resources can be optimized from the viewpoint of overall process optimization (Iizuka, Iizuka, Suematsu, 2013).

However, it is sometimes difficult to maintain business processes effectively because they are not usually managed as structured components, and this causes difficulty in standardization of the business process. Some companies have used widely spread business flowcharts (not containing hierarchical layers) for drawing up their business processes. For some companies, it is difficult to think about top-down layered business processes, and this situation sometimes makes it difficult to develop business process modeling schemes (Iizuka, Iizuka, Suematsu, 2013).

According to Abreu, Martins, Fernandes & Zacarias (2013), the business process improvement (BPI) is a challenge to organizations trying to continually improve the quality of their services and to keep up their competitiveness. The organizations in many different areas, aware of workflow optimization benefits on time and cost control, have adopted strategies and methodologies for process improvement. Today it can be found a broad range of process improvement approaches, distinct from each other, either on its principles and techniques, or on the target area on which the improvements are focused.

The definition of maintenance is based on the combination of all technical, administrative and management activities of the life cycle of an asset, in order to keep it or return it to a state where it can perform its required function, where the required function is the function or combination of functions of an asset considered as necessary to provide a certain service. In a general overview, there are three major types of maintenance: preventive, corrective and improvement. In theoretical terms they are defined as:

- Preventive maintenance is the maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item.
- Corrective maintenance is the maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function.
- Improvement maintenance is intended to improve the performance of an asset in its context, considered as an improvement over the conditioned maintenance, where identification of the change that can improve the asset's functioning is the key (Abreu, Martins, Fernandes, Zacarias, 2013).

Approaches to the business process improvement can generally be divided into two categories: improvement of the operational properties of BP and improvement of the structural properties of BP. While the first approach is oriented on dynamic parameters of BP, the approach based on structural analysis deals with the static properties of BP (Modrak, 2013).

The business process of modern manufacturing enterprises refers to a group of correlative activities that create value for customers together. Business process integrates with knowledge. Every business process shall be related to business processes around it instead of being separated. The reengineering of business process (BPR) refers to intensive application of knowledge scattering in different individuals or organizations (Shu, Liu, Li, 2013). BPR can be described as follows: a continuous analysis of business processes and reengineering within and between organizations in order to improve quality and time management and to save costs (Alas, Zernand-Vilson, Vadi, 2012). BPR derives its existence from different disciplines, and four major areas can be identified as being subjected to change in BPR:

- Organization.
- Technology.
- Strategy.
- People.

The process view is used as common framework for considering these dimensions is shown in Figure 1.1.3 (Budiono, Loice, 2012).

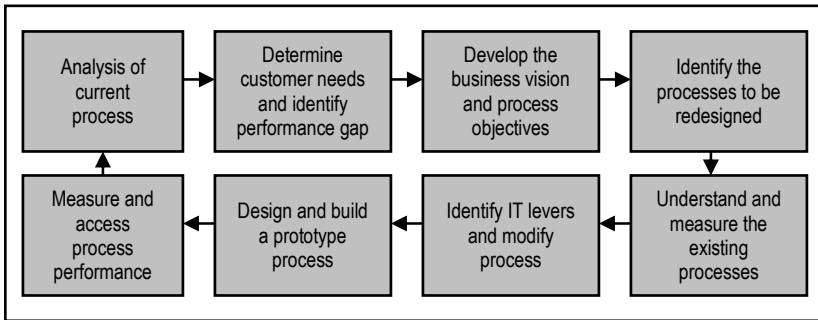


Figure 1.1.3. The cycle of process improvement (Budiono, Loice, 2012)

The changing customer requirements, unrelenting financial reporting requirements, and competitive cost pressures require firms to rapidly adjust, redesign, and adapt their processes and capabilities. In today's volatile business environment, ability to sense, shape, and respond to dynamic customer needs, emerging business opportunities, and unprecedented threats are considered a critical business capability. In addition, dealing with challenges associated with the exponential growth of data volumes, organizational realignments that include mergers, acquisitions, spin-offs, and outsourcing decisions require continuous unbundling and re-bundling of business processes. Thus, agility defined as the ease and speed with which firms can reconfigure, redesign, and realign their processes to respond to these needs, threats, and opportunities, has become an essential capability for business organizations today (Seethamraju, Sundar, 2013). In addition, fast moving markets and decreasing product life cycles of built-in units (e.g. telecommunication, lighting technology) require decreasing reaction times (Sivri, Krallmann, 2015).

Improving the operational effectiveness and efficiency of processes is a fundamental task of business process management. Organizations should consider three topics before starting a process improvement:

- Is the business process substantially relevant to the organization, e.g., with regard to the output produced or the cost volume incurred?

- May the organization assume that there are improvement potentials in the process, for example, when considering existing problem reports or benchmarks?
- Are there particular circumstances that require analyzing the process such as intentions to replace the underlying processes? (Lohrmann, Reichert, 2014).

The traditional management and business process modeling methods worked well and proved their effectiveness. However, the environment that companies are facing has changed drastically. For example, a decrease in sales due to shrinking of the domestic market requires companies to make efforts to reduce costs in order to maintain profits. Some companies have to transfer production overseas in order to reduce labor costs. Because of this change in the environment, companies have to adapt in ways such as the following:

- Change business processes to realize enhancement in cost efficiency.
- Change business processes to realize integrated business processes corresponding to corporate marriage or enterprise integration within domestic or global.
- Improve information system operation efficiency (using packaged software is one option).
- Improve system maintenance efficiency.
- Enhance information systems to enable analysis of business data to support management decision-making.
- Show agility in responding to environmental changes (Iizuka, Iizuka, Suematsu, 2013).

In other words, basis of philosophy is focused on creating activities that bring value to the customer, system identification and elimination of waste and continuous improvement of the production environment in order to increase productivity. Primary focus is on the activities that create value to the customer, while elimination of waste and constant improvement are a result of these activities (Stojkic, Majstorovic, Visekruna, Zelenika, 2014). Business process value added analysis is concentrated on surveying the costs of the entire value chain, i.e. since receiving production orders to sending the output to customers, and it strictly differentiates between costs incurred to generate added value and costs of non-productive, i.e. value-not-added activities and processes. While economic value added (EVA) is concentrated primarily on the costs of capital employed, added value of business processes is focused on the cost of complex value chain continuous time. Philosophy of EVA indicator management is to quantify current and future real achievable economic outputs based on the maximization of economic profit (Figure 1.1.4). It is thus obvious that the core is to find the optimal ratio between revenues and economic costs of the best alternative possible for selected production

processes which are the real creators of economic value added (Rajnoha, Sujova, Dobrovič, 2012).

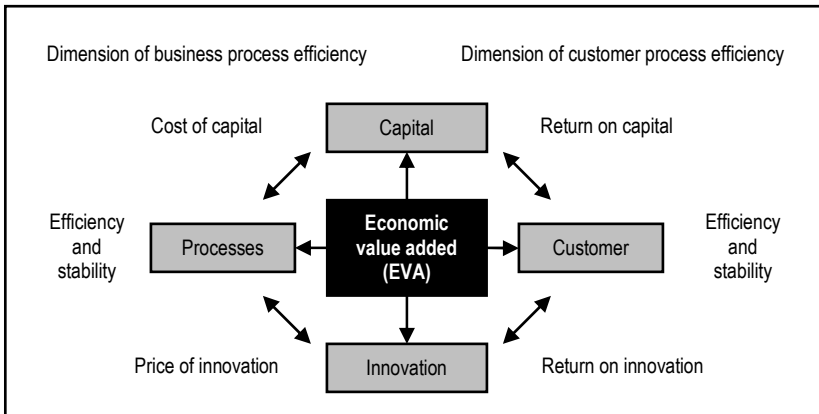


Figure 1.1.4. Two related dimensions of quantifying the value added in business (Rajnoha, Sujova, Dobrovič, 2012)

That is why there was another aggregation after the qualitative evaluation so that six business model elements could be identified as essential: value proposition, technologies, competencies and key resources, channels and customer relations, value chains and processes, network and partner and revenues (Seidenstricker, Scheuerle, Linder, 2014). The business model framework is given in Figure 1.1.5.

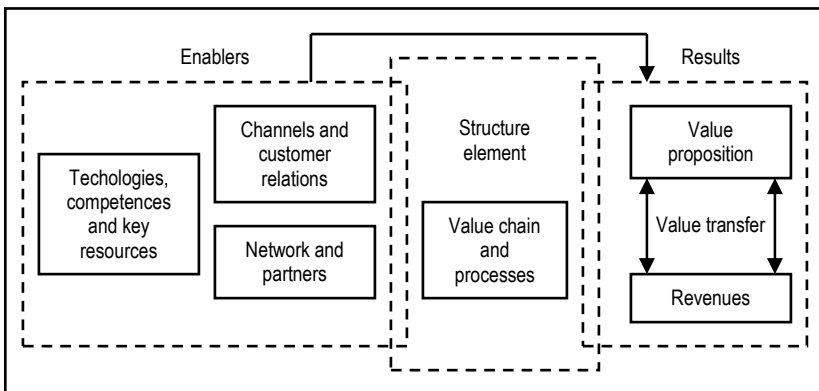


Figure 1.1.5. The business model framework (Seidenstricker, Scheuerle, Linder, 2014)

Enterprise systems seek to model and realize the best practice processes. It is believed that the processes embedded in the models and implemented in many case study organizations are truly the best practices and implementing them and discarding the existing imperfect practices is expected to contribute to improved performance.

1.2. Business process modeling software

The free business process modeling software is „ARIS Express“ (Figure 1.2.1).

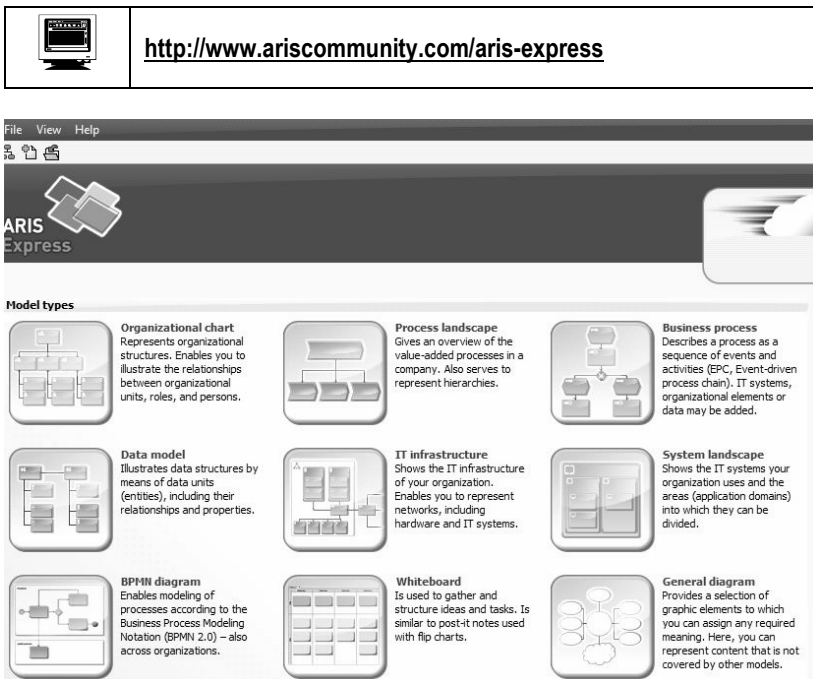


Figure 1.2.1. The main window of „ARIS Express“ software

The buttons *Business process* or *BPMN diagram* must be selected to develop the business process schemes. The main nodes of business process diagrams are shown in Figure 1.2.2.

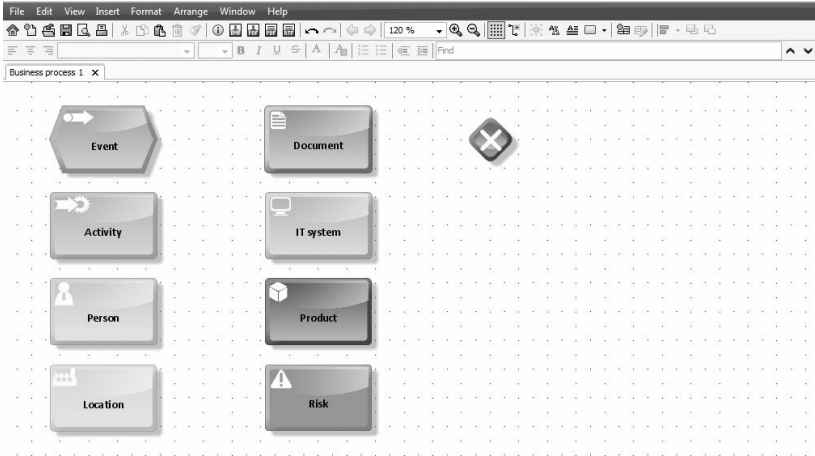


Figure 1.2.2. The main nodes of business process models in „ARIS Express“

The example of connected nodes is given in Figure 1.2.3.

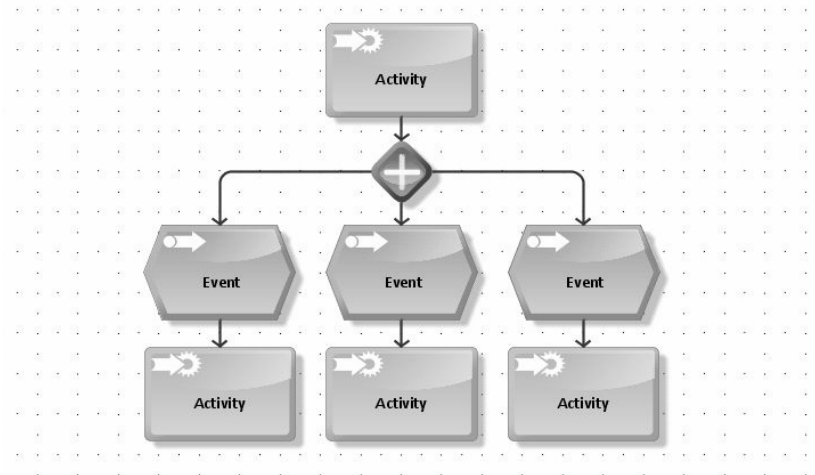


Figure 1.2.3. The example of connected nodes in „ARIS Express“

2. THE MAIN BUSINESS PROCESSES



The aim of this chapter is to understand the main processes of enterprises.

The main processes of enterprises are shown in Figure 2.1.

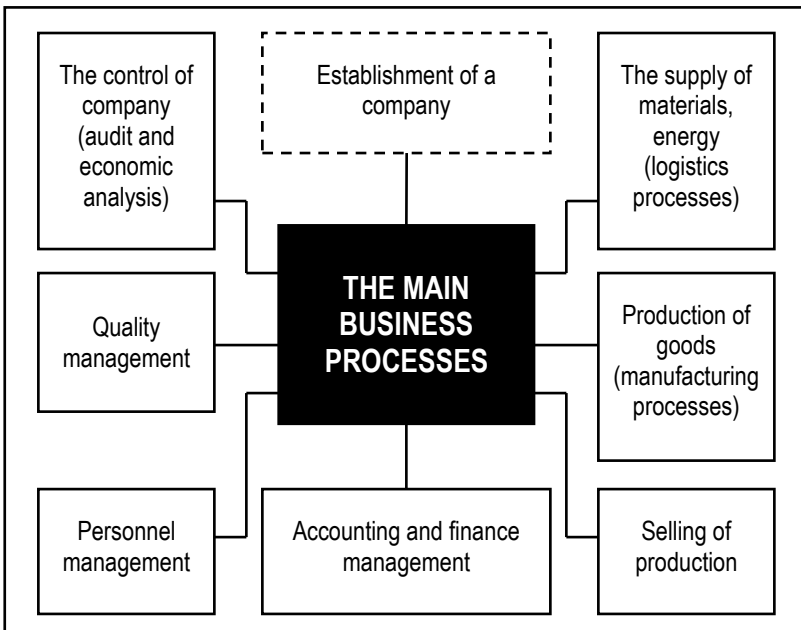


Figure 2.1. The main processes of enterprises

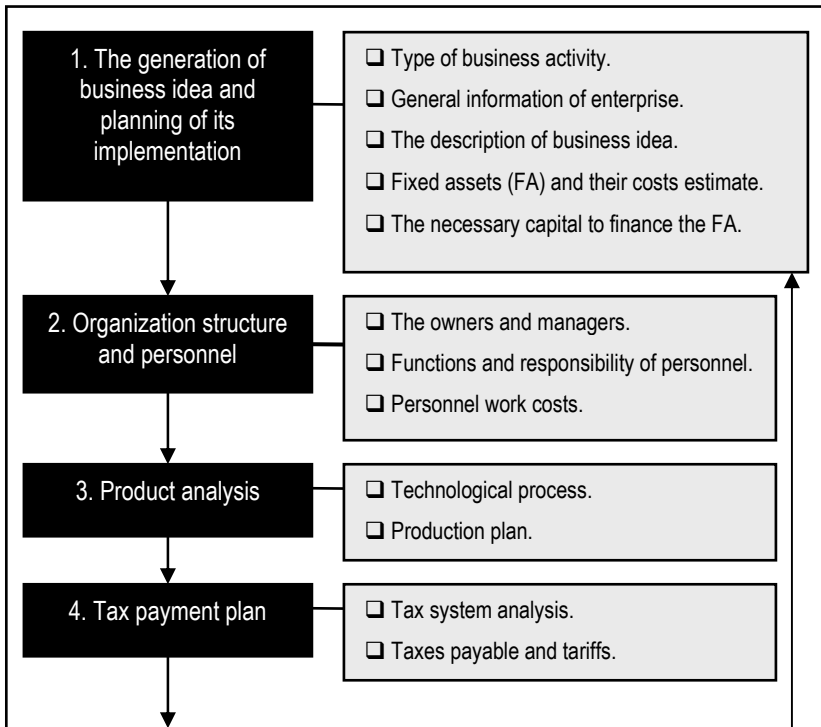
Managing the business processes the knowledge of their essence is necessary. Planning the new company's activity it is necessary to be able to model all business processes.

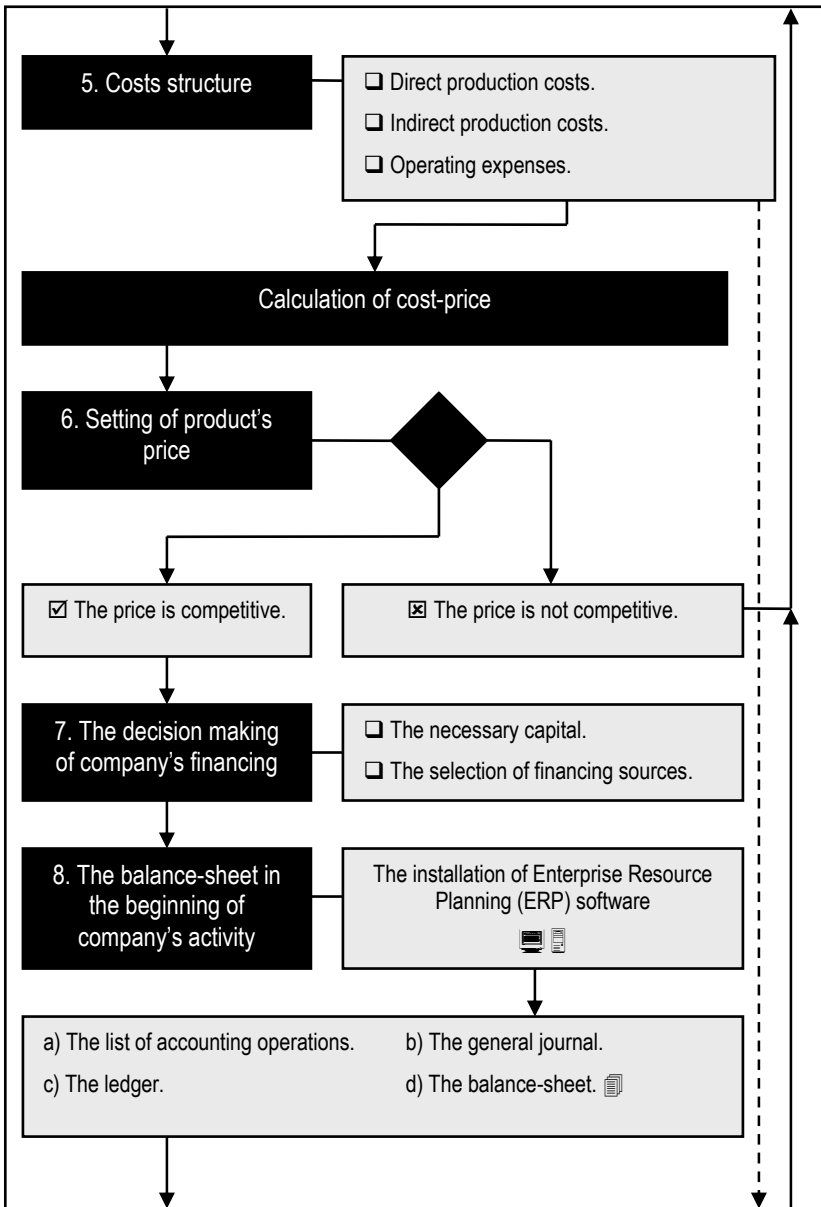
3. BUSINESS MODEL DEVELOPMENT SCHEME

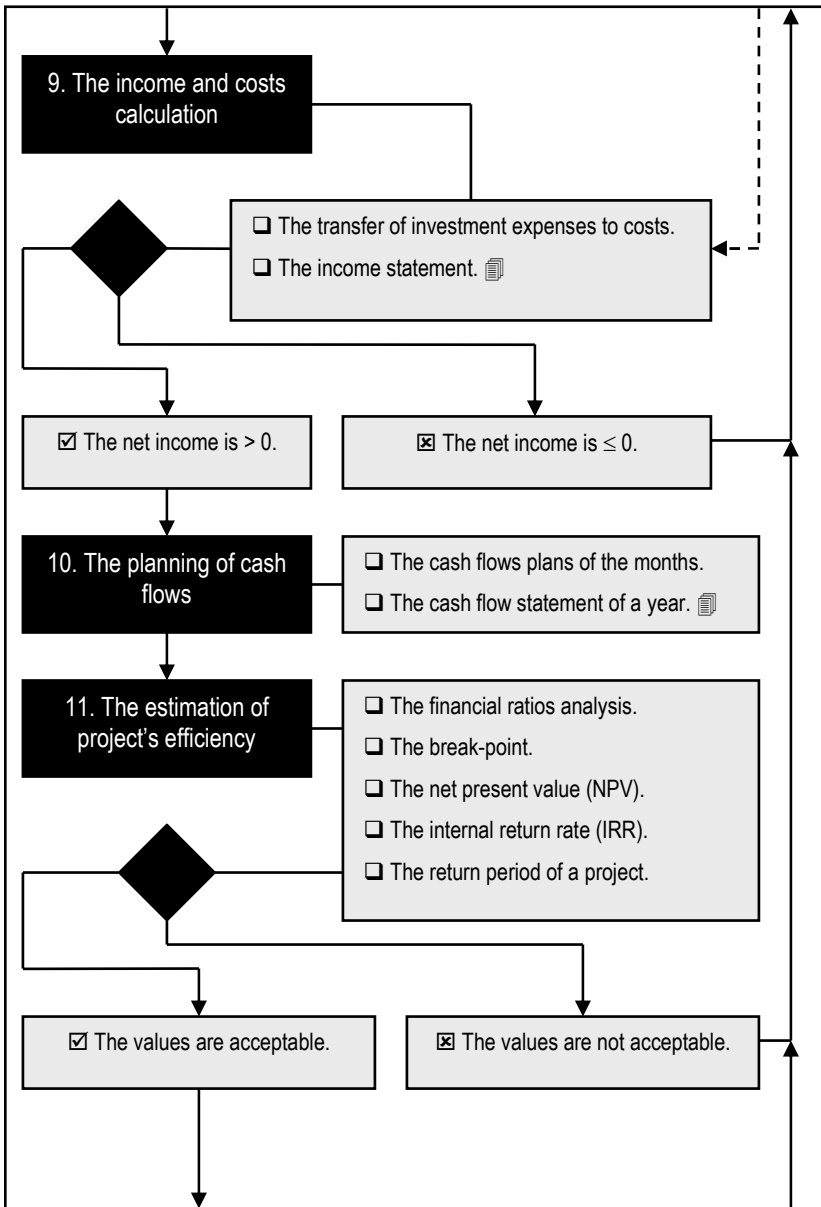


This chapter aims to visualize the main stages of business process system's development. The conceptual scheme is typical for main business activities.

The business model development scheme consists of 16 stages. The typical operations of business model development process is visualized in Figure 3.1.







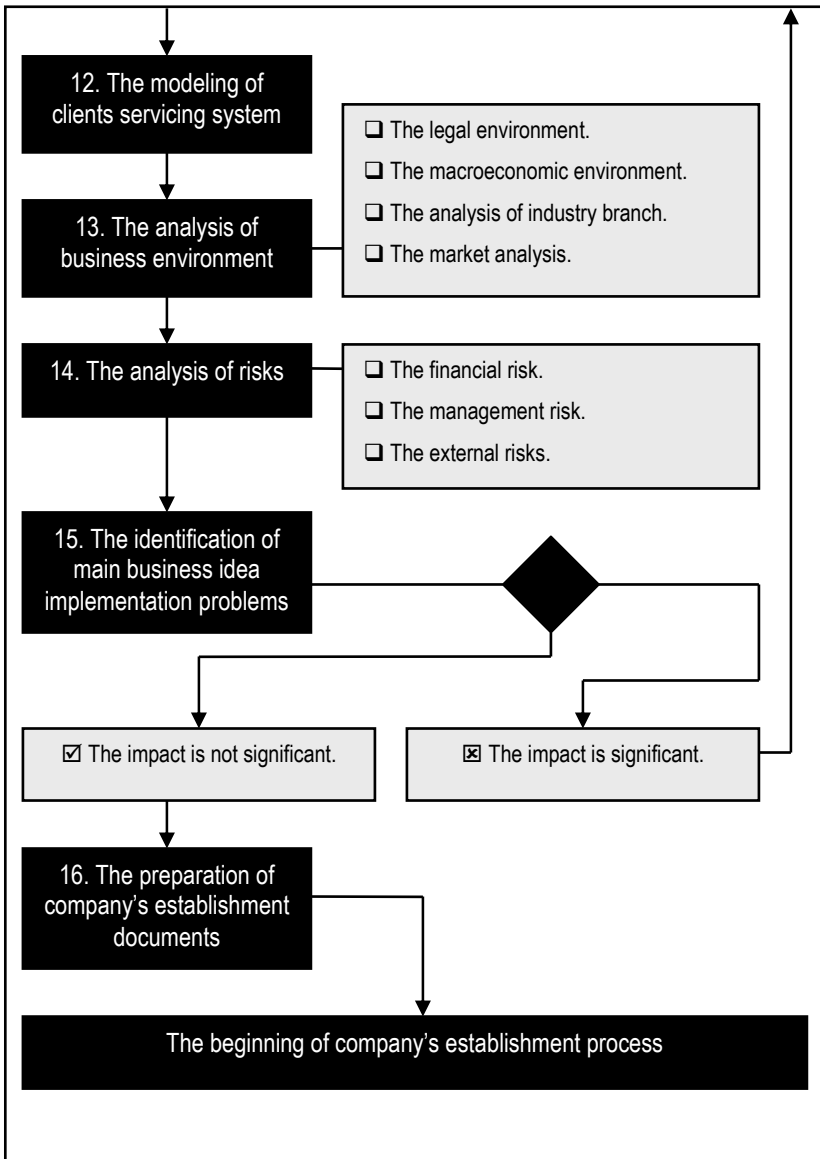


Figure 3.1. The conceptual scheme of business model development process

4. THE BEGINNING OF ENTERPRISE'S MODELING



The tasks of this chapter:

- To present the main types of Lithuanian enterprises.
- To explain the limited and unlimited responsibility.
- To start the modeling of business enterprise.

4.1. The main types of Lithuanian enterprises

The Lithuanian business structure according to the enterprises type in the beginning of 2015 is given in Figure 4.1.1.

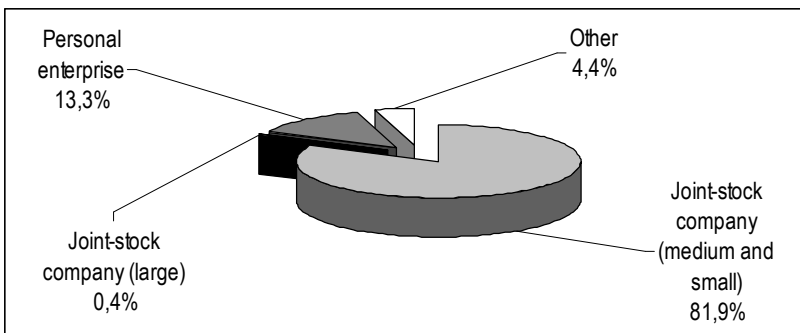


Figure 4.1.1. The distribution of Lithuanian enterprises (Statistics Lithuania, 2015)

The numbers of main Lithuanian enterprises' types in the beginning of 2015 are given in Figure 4.1.2.

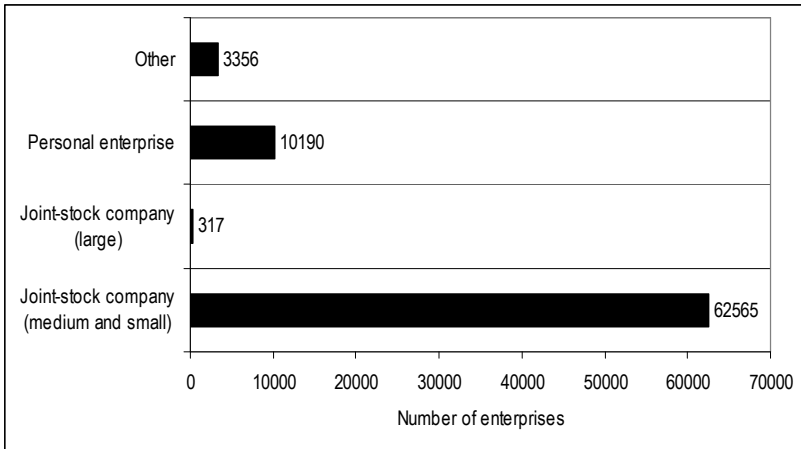


Figure 4.1.2. The number of Lithuanian enterprises (Statistics Lithuania, 2015)

According to the data of Statistics Lithuania the main types of enterprises in this country are:

- Joint-stock company (82,3%).
- Personal enterprise (13,3%).

JOINT-STOCK COMPANY	
Owners' responsibility:	Limited

The peculiarities of joint-stock company (large):

- Minimal shareholders' capital – **40 000 EUR**.
- Maximum number of shareholders – **unlimited**.
- Possibility to be listed in stock market – **YES**.

The peculiarities of joint-stock company (medium and small):

- Minimal shareholders' capital – **2 500 EUR**.
- Maximum number of shareholders – **250**.
- Possibility to be listed in stock market – **NO**.

The strengths of joint-stock companies compared to personal enterprises:

- The limited responsibility of the owners.
- The owners can be the natural persons or juridical persons.
- It is more easy to attract the capital issuing the shares or getting credits.

- The equity of owners in the decision making process because one share ensures one vote in shareholders' assembly. The more shares has the shareholder, the more votes he has making the strategic decisions of enterprise.

The weaknesses of joint-stock companies compared to personal enterprises:

- The minimal capital is required for the enterprise's establishment.
- The more complex accounting (preparation of financial reports). The company must have the accountant or it can buy the accounting services from other accounting services providers.
- The owners cannot withdraw the money from the company's account until the end of the financial year. If the company was profitable the shareholders can get the dividends in the beginning of next financial year.
- Joint-stock companies usually have less tax exemptions.
- The more complex enterprise's establishment process and the higher establishment expenditures.

PERSONAL ENTERPRISE	
Owners' responsibility:	Unlimited

The strengths of personal enterprises compared to joint-stock companies:

- The minimal capital is not required so the enterprise can be established when the owner has not much capital.
- The owner is one and he makes all decisions in the enterprise.
- The owner can work alone. If necessary he can employ more workers.
- The accounting is simple. The accountant is not necessary.
- The owner can withdraw the money from the enterprise's account or other assets in the financial year.
- All profit belongs to one owner.
- Small personal enterprises usually have more tax exemptions.
- The lesser enterprise's establishment expenditures.

The weaknesses of personal enterprises compared to joint-stock companies:

- The owner can be only one person and he cannot have more than one personal enterprise.
- Unlimited responsibility. There is high risk for the owner to lose the personal property in case of enterprises bankruptcy.
- It is impossible to attract the other investors' capital for the enterprise's expansion.

The rest part (4,4%) of Lithuanian business structure consists of other types of enterprises:

- Small partnership.
- Personal partnership.
- State enterprise (municipal enterprise).
- Agriculture company.
- Cooperative.
- European economic interests group.
- European company.
- European cooperative.

SMALL PARTNERSHIP

Owners' responsibility:	Limited
-------------------------	---------

The owners of small partnership can be no more than 10 natural persons. The minimal capital is not required. This company must prepare the financial reports of every financial year.

PERSONAL PARTNERSHIP

Owners' responsibility:	Unlimited
-------------------------	-----------

The owners of personal partnership can be from 2 to 20 natural and juridical persons. The minimal capital is not required.

There are two types of personal partnerships:

- Real partnership.
- Commandite partnership.

In real partnership all owners have the personal financial responsibility in case of company's insolvency or bankruptcy. The owners in commandite partnership are real and commanditors. The real owners' personal responsibility is unlimited while the commanditors' responsibility is limited.

STATE ENTERPRISE (MUNICIPAL) ENTERPRISE

Owners' responsibility:	Limited
-------------------------	---------

The owner of state enterprise is the government of the country. The owner of municipal enterprise is the municipality. The aim of these enterprises is to satisfy the public interests. Mostly these companies are the natural monopolies in energetics, transportation (railways, seaports, airports), etc. The state (municipal) enterprises cannot be the shareholders of other companies.

AGRICULTURE COMPANY

Owners' responsibility:	Limited
-------------------------	---------

The owners of agriculture company can be 2 or more natural or juridical persons. The minimal capital is not required. The year's revenue from agriculture activity must be more than 50%.

COOPERATIVE

Owners' responsibility:	Limited
-------------------------	---------

The owners of cooperative can be 5 or more natural or juridical persons. The minimal capital is not required. The dividends of a year cannot exceed 10% of net income.

EUROPEAN ECONOMIC INTERESTS GROUP

Owners' responsibility:	Limited
-------------------------	---------

The aim of European economic interests group is to help to achieve the better activity results for the separate companies that are established in 2 or more EU countries. This group is similar to the association because the group by itself does not seek to earn profit. It supplements the performance of different enterprises. The owners can be the natural and juridical persons from different EU countries.

EUROPEAN COMPANY

Owners' responsibility:	Limited
-------------------------	---------

This is large company that performs in 2 or more EU countries. The minimal capital required to establish the European company is 120 000 EUR. Establishing the European company the different joint-stock companies can be joined. Also the joint-stock or other juridical form company can be reorganized into the European company if it performs in 2 or more EU countries for more than 2 years.

EUROPEAN COOPERATIVE

Owners' responsibility:	Limited
-------------------------	---------

The owners of European cooperative can be 5 or more natural persons from 2 or more EU countries. The minimal capital required is 30 000 EUR. The abbreviation of this company is SCE (*societas cooperativa europaea*).

4.2. The limited and unlimited responsibility

The main difference between the limited and unlimited responsibility enterprises is shown in Figure 4.2.1. In case of company's insolvency or bankruptcy there is high risk to lose the personal property for the owners of unlimited personal responsibility enterprises. In companies of limited responsibility the creditors cannot require to repay debts for the owners if the enterprise is insolvent.

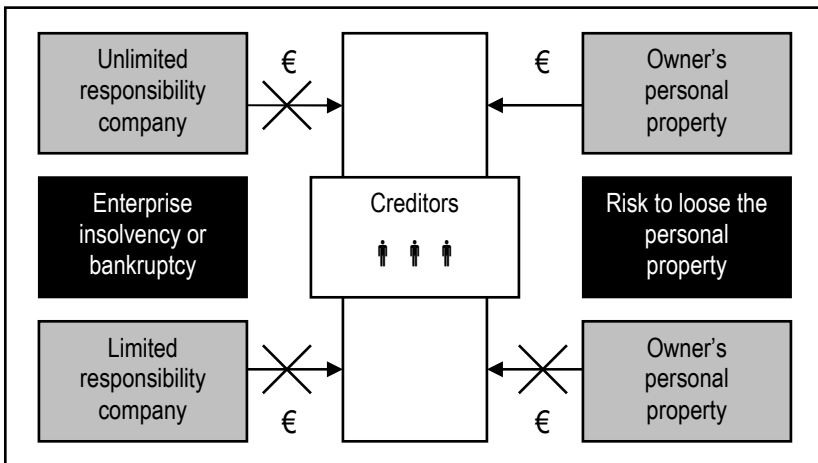


Figure 4.2.1. The difference between limited and unlimited responsibility enterprises

4.3. The business process model: Part 1

Type of business activity

The production of bread.

General information of enterprise

- The date of establishment – January, 2, 2016.
- The juridical form of a company: Joint-stock company (JSC).
- The name of a company – „Nemunus Bread“.
- Registration place – Nemuno str. 500, Panevėžys, Lithuania.

Description of business idea

JSC „Nemunus Bread“ will produce the wholemeal bread. The wholemeal bread contains higher concentrations of minerals and vitamins than white bread as it retains the bran and germ of the wheat. It is an excellent source of dietary fibre, containing twice that of white bread and more than multigrain breads.

Fixed assets and their costs estimate

Table 4.3.1

The company's fixed assets

Fixed assets	Price (EUR)
Building	130 000
Car	30 000
Production equipment	70 000
Assets of administrative room	7 000
Software for computer	3 000
Total:	240 000

Necessary capital to finance the fixed assets

Table 4.3.2

The necessary capital

	EUR
Capital	240 000

5. MODELING OF HUMAN RESOURCES



The tasks of this chapter:

- To present the labour costs calculation process.
- To present the labour taxes and social insurance payments.
- To calculate the costs of labour in business model.

5.1. Labour costs calculation process

The main stages of labour costs calculation process modeling the enterprise are shown in Figure 5.1.1.

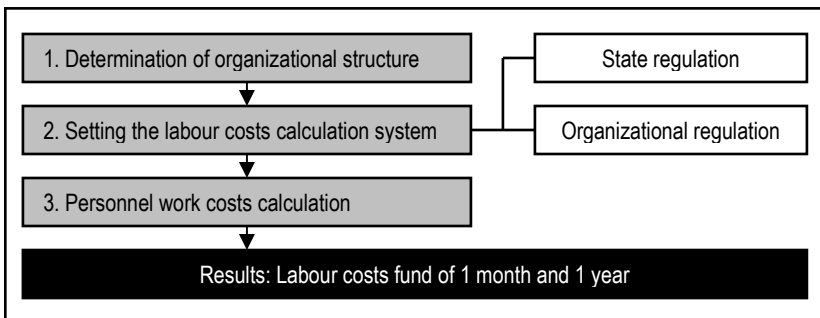


Figure 5.1.1. Labour costs calculation process in business model

State regulation

The government determines the compensation conditions of employees and their social insurance system. The compensation of **1 work-hour** and **month salary** cannot be lesser than minimal.

In Lithuania (year 2015):

- The minimum salary of month (before taxes) – **300 EUR**.
- The minimum salary of 1 hour – **1,82 EUR**.
- The average salary before taxes (year 2014) – **696,7 EUR**.
- The average salary after taxes (year 2014) – **541,1 EUR**.

Organizational regulation

A company can select the type of salaries calculation that is compatible with state regulation (law).

The types of salaries calculation:

1. Unit calculation.
2. Time calculation.

!	Unit calculation schemes – the salary depends on production quantity.
!	Time calculation schemes – the salary depends on time worked.

UNIT CALCULATION SCHEMES

These schemes can be applied when it is possible to measure the production or services quantity (Figure 5.1.2).

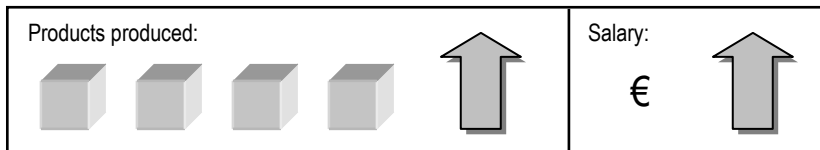


Figure 5.1.2. The main factor of salary's growth in unit calculation scheme

Unit calculation schemes (I classification):

- Progressive.
- Regressive.
- Fixed.

Progressive unit calculation scheme:

- The necessary quantity of production – fixed salary.
- The extra quantity of production – higher salary (Figure 5.1.3.).

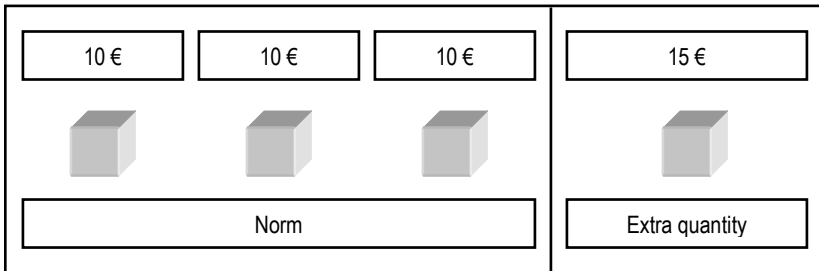


Figure 5.1.3. Progressive unit calculation scheme

Regressive unit calculation scheme:

- The necessary quantity of production – fixed salary.
- The extra quantity of production – lesser salary (Figure 5.1.4.).

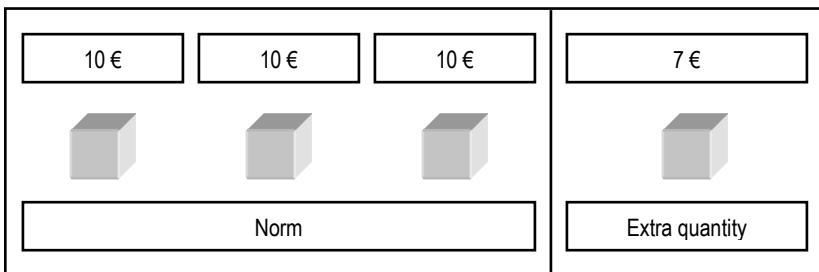


Figure 5.1.4. Regressive unit calculation scheme

Fixed unit calculation scheme:

- The necessary quantity of production – fixed salary.
- The extra quantity of production – fixed salary (Figure 5.1.5.).

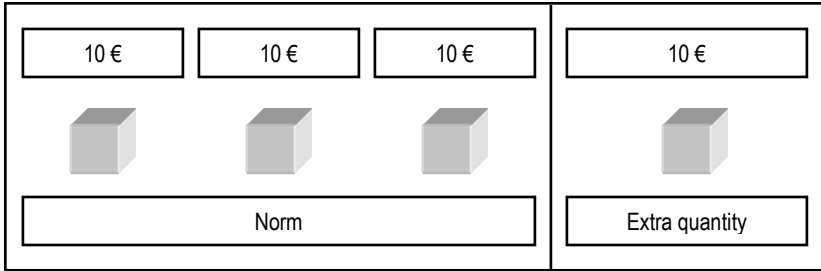


Figure 5.1.5. Fixed unit calculation scheme

Unit calculation schemes (II classification):

- Individual.
- Collective.

Individual unit calculation scheme is based on individual work results (Figure 5.1.6).

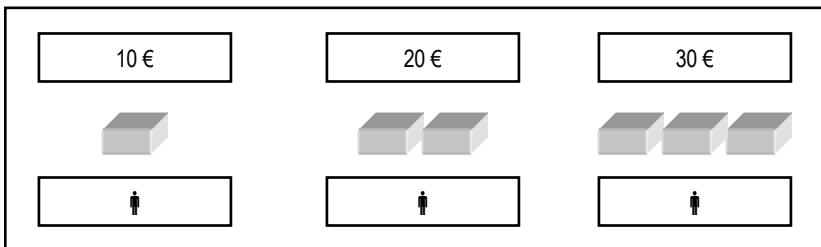


Figure 5.1.6. Individual unit calculation scheme

Collective unit calculation scheme is based on team work results (Figure 5.1.7).

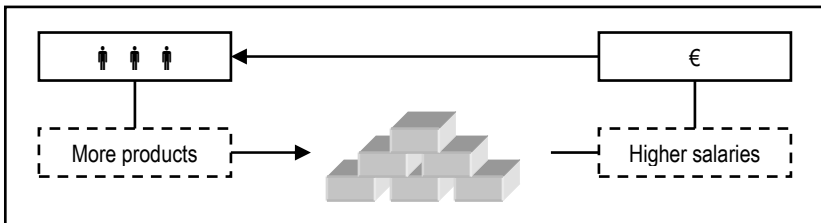


Figure 5.1.7. Collective unit calculation scheme

Unit calculation schemes (III classification):

- Direct.
- Indirect.

Direct unit calculation scheme is based on the worker's own work results. It is similar to the individual unit calculation scheme (Figure 5.1.6).

Indirect unit calculation scheme: The salary of auxiliary workers is based on the main worker's work results (Figure 5.1.8).

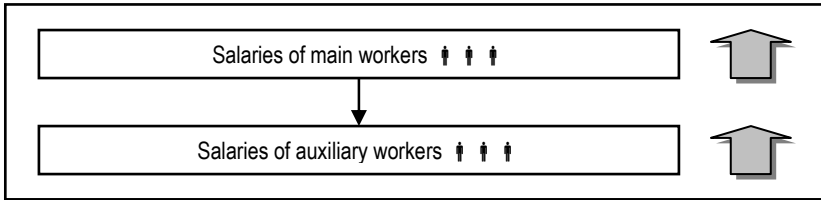


Figure 5.1.8. Indirect unit calculation scheme

TIME CALCULATION SCHEMES

These schemes are being applied when it is impossible to measure the production or services quantity. The measure of work results is working time.

The calculation of salary (I classification):

- Hour calculation.
- Month calculation (Figure 5.1.9).

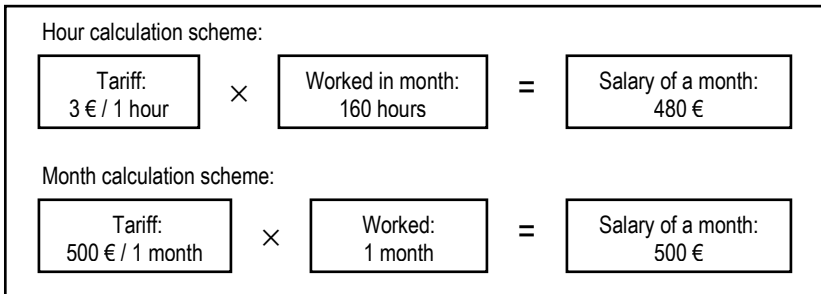


Figure 5.1.9. Hour and month salary calculation schemes

If a worker did not work full month the salary is reduced in proportion to non-worked time.

Example:

- Working days in month – 22 days.
- The company calculates salaries according to the month calculation scheme.
- The salary of full month's work – 500 EUR.
- A worker worked 20 days.

The salary of month:

$$S = \frac{500 \text{ EUR}}{22 \text{ days}} \times 20 \text{ days} = 454,55 \text{ EUR} \quad (5.1.1)$$

The calculation of salary (II classification):

- Simple calculation.
- Premium calculation.

Simple calculation scheme: The salary always has fixed tariff. No premium.

Premium calculation scheme: The salary always has fixed tariff. The premium is possible if work results are excellent. The premium is used to motivate the workers.

Example:

- The usual salary of full month's work – 500 EUR.
- The premium for the excellent work results – 100 EUR.
- The salary of a month: 500 EUR + 100 EUR = 600 EUR.



5.2. Labour taxes and social insurance payments

The labour taxes and social insurance payments:

1. Paid by employees.
2. Paid by company (employer).

The labour taxes and social insurance payments paid by employees

Salary after taxes (SAT):

$$SAT = SBT - (EIT + ESIP) \tag{5.2.1}$$

SBT – the salary before taxes;

EIT – the employees' income tax;

ESIP – the employees' social insurance payment.

15% The employees' income tax (EIT) tariff in Lithuania is 15%.

Not all salary before taxes is taxed. The non-taxable income must be calculated for every employee (Figure 5.2.1).

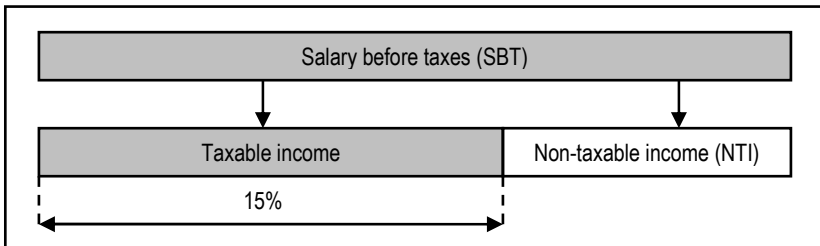


Figure 5.2.1. The taxable and non-taxable income of employees

The non-taxable income is calculated:

$$NTI = 166 - 0,26 \times (SBT - 290) \tag{5.2.2}$$

9% The employees' social insurance payment (ESIP) tariff is 9%.

The labour taxes and social insurance payments paid by employer

30,8% The employer's social insurance payment (CP) is 30,8%.



The accidents at work payment depends on the company's risk group.

The risk groups of companies and the tariffs of accidents at work payments:

- Group I – 0,18%.
- Group II – 0,37%.
- Group III – 0,9%.
- Group IV – 1,8%.

New companies are classified into Group I.

0,2%

The Guarantee Fund payments tariff is 0,2%.

The Guarantee Fund compensates the salary for employees in case of company's bankruptcy.

Example

In January (2015) the calculated salary of employee before taxes – **500 EUR**.

The company belongs to the 1st group of enterprises according to the statistics of accidents at work (no accidents at this company).

The labour taxes and social insurance payments paid by employee

Non-taxable income (NTI):

$$\text{NTI} = 166 - 0,26 \times (500 - 290) = 111,40 \text{ EUR} \quad (5.2.3)$$

Employee's income tax (EIT):

$$\text{EIT} = (500 - 111,40) \times 0,15 = 58,29 \text{ EUR} \quad (5.2.4)$$

Employee's social insurance payment (ESIP):

$$\text{ESIP} = 500 \times 0,09 = 45 \text{ EUR} \quad (5.2.5)$$

Salary after taxes (SAT):

$$\text{SAT} = 500 - (58,29 + 45) = 396,71 \text{ EUR} \quad (5.2.6)$$

The labour taxes and social insurance payments paid by employer

The employer's social insurance payment (CP):

$$\text{CP} = 500 \times 0,308 = 154 \text{ EUR} \quad (5.2.7)$$

The accidents at work payment (AW):

$$\text{AW} = 500 \times 0,0018 = 0,9 \text{ EUR} \quad (5.2.8)$$

The Guarantee Fund payment (GF):

$$\text{GF} = 500 \times 0,002 = 1 \text{ EUR} \quad (5.2.9)$$

The total cost of employee's work calculation process is shown in Figure 5.2.2.

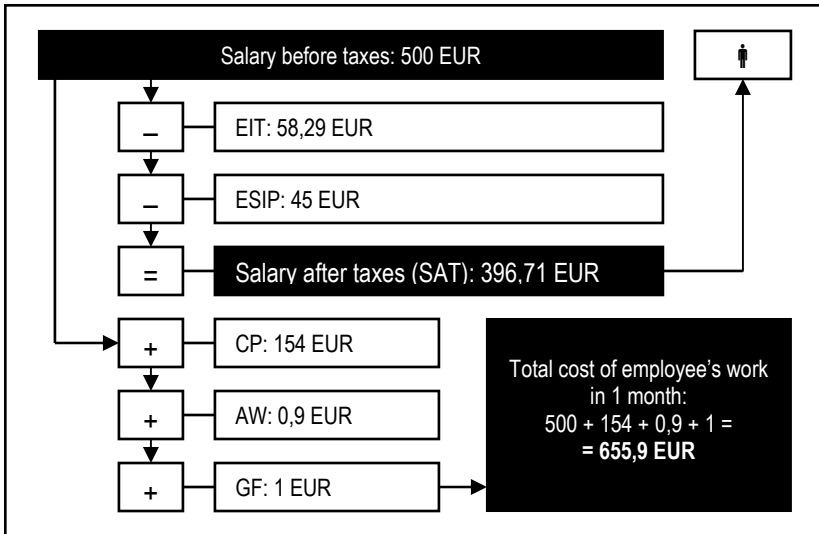


Figure 5.2.2. The total cost of employee's work calculation process

5.3. The business process model: Part 2

The owners and managers

Table 5.3.1

The owners of company and their capital formation

Owners of company	Contribution to the shareholders' capital (EUR)
Student A	60 000
Student B	50 000
Student C	50 000
Student D	50 000
Total	210 000

The director of company – student A. Education – master of management sciences at Kaunas University of Technology. Working experience – manager at company „X“ (2010 – 2014).

Personnel functions and responsibility

Personnel functions and responsibility:

1. Director – makes decisions of company's management, employs personnel, formulates the working schemes, signs company's documents, etc.
2. Secretary – assists the director, manages the enterprise's documents, etc.
3. Accountant – performs the operations of recording transactions in books of accounts, prepares the financial reports, prepares the statistical and financial data.
4. Trading agent – deals with clients, sells products.
5. Technologist – manages the production process.
6. Production workers – work in production process.
7. Auxiliary worker – helps for the main workers in production process.
8. Storekeeper – manages the warehouse of enterprise.
9. Driver – transports the production and other loads.
10. Guard – secures the enterprise.

The organizational structure of company is given in Figure 5.3.1.

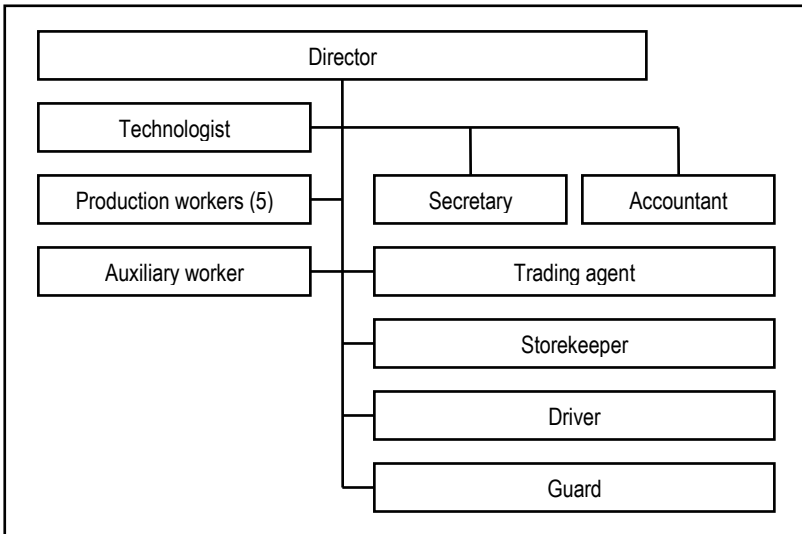


Figure 5.3.1. The organizational structure of company

Personnel work costs

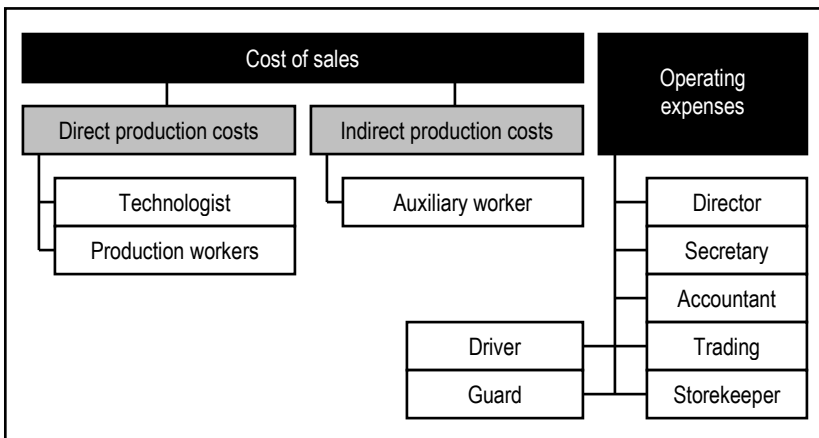


Figure 5.3.2. The classification of personnel work costs

Table 5.3.2

The calculation of employees' taxes and salaries (EUR)

Employee	SBT	NTI	EIT (15%)	ESIP (9%)	SAT
Director	868,86	15,50	128,00	78,20	662,66
Accountant	724,05	53,15	100,64	65,16	558,25
Secretary	300,00	163,40	20,49	27,00	252,51
Trading agent	463,39	120,92	51,37	41,71	370,32
Technologist	724,05	53,15	100,64	65,16	558,25
Production worker (1)	347,54	151,04	29,48	31,28	286,79
Production worker (2)	347,54	151,04	29,48	31,28	286,79
Production worker (3)	347,54	151,04	29,48	31,28	286,79
Production worker (4)	347,54	151,04	29,48	31,28	286,79
Production worker (5)	347,54	151,04	29,48	31,28	286,79
Auxiliary worker	300,00	163,40	20,49	27,00	252,51
Storekeeper	300,00	163,40	20,49	27,00	252,51
Driver	300,00	163,40	20,49	27,00	252,51
Guard	300,00	163,40	20,49	27,00	252,51
Total:	6 018,07	1 814,90	630,48	541,63	4 845,97

Table 5.3.3

The calculation of employers' taxes (EUR)

Employee	SBT	CP (30,8%)	AW (0,18%)	GF (0,2%)	Cost
Director	868,86	267,61	1,56	1,74	1 139,77
Accountant	724,05	223,01	1,30	1,45	949,81
Secretary	300,00	92,40	0,54	0,60	393,54
Trading agent	463,39	142,72	0,83	0,93	607,88
Technologist	724,05	223,01	1,30	1,45	949,81
Production worker (1)	347,54	107,04	0,63	0,70	455,90
Production worker (2)	347,54	107,04	0,63	0,70	455,90
Production worker (3)	347,54	107,04	0,63	0,70	455,90
Production worker (4)	347,54	107,04	0,63	0,70	455,90
Production worker (5)	347,54	107,04	0,63	0,70	455,90
Auxiliary worker	300,00	92,40	0,54	0,60	393,54
Storekeeper	300,00	92,40	0,54	0,60	393,54
Driver	300,00	92,40	0,54	0,60	393,54
Guard	300,00	92,40	0,54	0,60	393,54
Total:	6 018,07	1 853,56	10,83	12,04	7 894,48

Table 5.3.4

The salaries fund of 1 month (EUR)

Employee	Fund	Income statement entry	Production costs
Director	1 139,77	Operating expenses	-
Accountant	949,81	Operating expenses	-
Secretary	393,54	Operating expenses	-
Trading agent	607,88	Operating expenses	-
Technologist	949,81	Cost of sales	Direct
Production worker (1)	455,90	Cost of sales	Direct
Production worker (2)	455,90	Cost of sales	Direct
Production worker (3)	455,90	Cost of sales	Direct
Production worker (4)	455,90	Cost of sales	Direct
Production worker (5)	455,90	Cost of sales	Direct
Auxiliary worker	393,54	Cost of sales	Indirect
Storekeeper	393,54	Operating expenses	-
Driver	393,54	Operating expenses	-
Guard	393,54	Operating expenses	-
Total:	7 894,48	-	-

Table 5.3.5

The salaries fund of 1 year (EUR)

Employee	Fund	Income statement entry	Production costs
Director	13 677,25	Operating expenses	-
Accountant	11 397,71	Operating expenses	-
Secretary	4 722,48	Operating expenses	-
Trading agent	7 294,50	Operating expenses	-
Technologist	11 397,71	Cost of sales	Direct
Production worker (1)	5 470,84	Cost of sales	Direct
Production worker (2)	5 470,84	Cost of sales	Direct
Production worker (3)	5 470,84	Cost of sales	Direct
Production worker (4)	5 470,84	Cost of sales	Direct
Production worker (5)	5 470,84	Cost of sales	Direct
Auxiliary worker	4 722,48	Cost of sales	Indirect
Storekeeper	4 722,48	Operating expenses	-
Driver	4 722,48	Operating expenses	-
Guard	4 722,48	Operating expenses	-
Total:	94 733,74	-	-

Personnel employment process

The personnel employment process is shown in Figure 5.3.3.

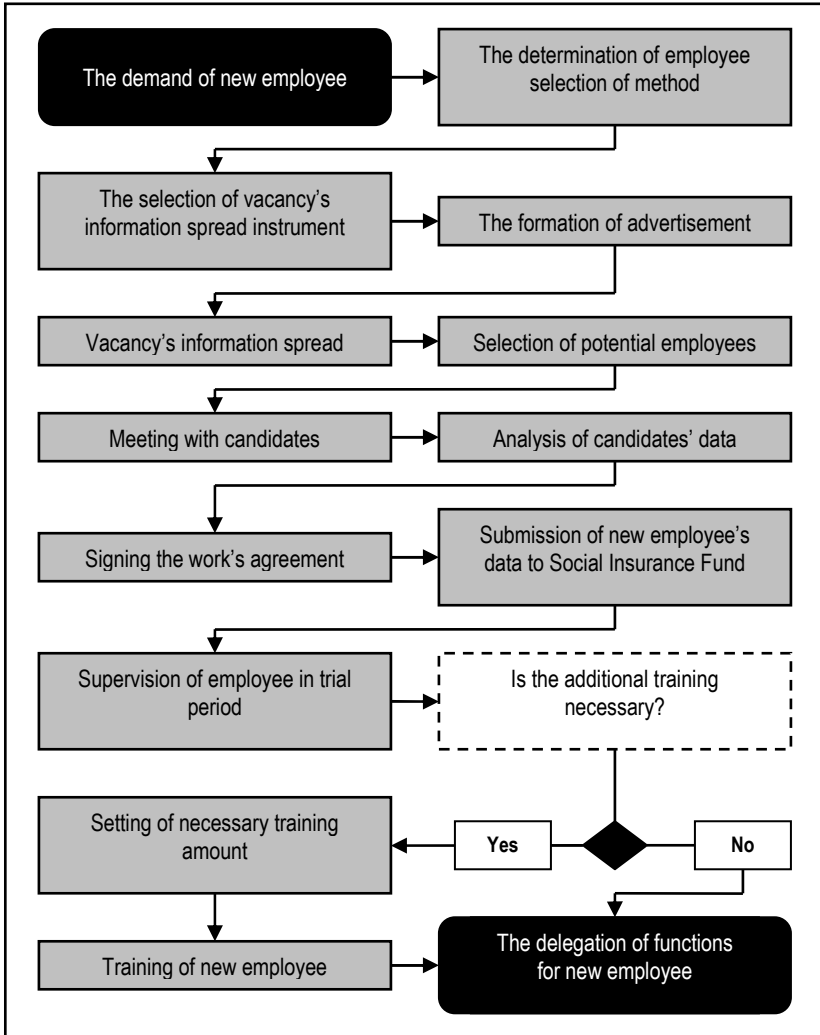


Figure 5.3.3. The personnel employment process

6. MODELING OF MANUFACTURING PROCESS



The tasks of this chapter:

- To present the principles of manufacturing process modeling.
- To develop the model of technological process.
- To determine the production plan in business model.

6.1. The manufacturing process modeling principles



Manufacturing process management (MPM) is a collection of technologies and methods used to define how products must be manufactured.

Production process planning

All decisions that affect the producing process should be made during the planning phase.

The planning of manufacturing process should generate the following:

- A statement of the production goals (product's characteristics).
- A descriptive process model.
- A list of process inputs and outputs.
- A description of tasks and responsibilities in producing process.

The main stages of production process planning are shown in Figure 6.1.1.

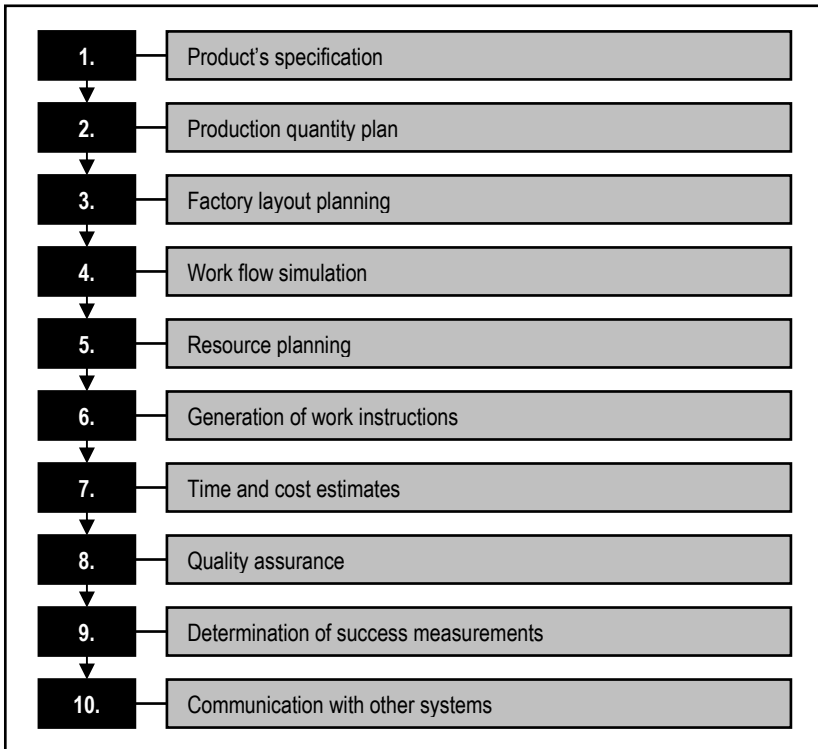


Figure 6.1.1. The main stages of production process planning

Stage 1

The structure of product's specification:

- Descriptive title, number, identifier of the specification.
- Terminology, definitions and abbreviations to clarify the meanings of the specification.
- Test methods for measuring all specified characteristics, targets and tolerances.
- Material requirements of a product: mechanical, electrical, physical, chemical, etc.
- Technical illustrations, drawings and photographs.

- Certifications required.
- Safety considerations and requirements.
- Environmental considerations and requirements.
- Quality control requirements, acceptance sampling, inspections, acceptance criteria.

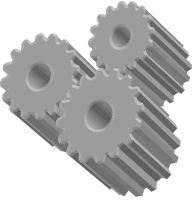
Company name	PRODUCT SPECIFICATION		
DESCRIPTIVE TITLE			
<p>1. SCOPE:</p> <p>This Product Specification covers the performance requirements of Product X.</p>			
<p>2. PRODUCT DESCRIPTION:</p>			
<p>2.1. PRODUCT NAME AND SERIES NUMBER</p>			
<p>Product name: Product X</p>	<p>Part number: 75849-98465</p>		
<p>2.2. DIMENSIONS, MATERIALS AND MARKINGS</p> <p>See Drawings AA.-75849-98465 for information on dimensions, materials and markings.</p>			
			
Revision: 2	Title: Product X		Sheet No.: 1 of 8
Document number: AA-75849-001	Created / revised by: Name (2015-02-10)	Checked by: Name (2015-02-11)	Approved by: Name (2015-02-12)

Figure 6.1.2. The simplified example of product specification

Stage 2

Planning the production quantity the demand influencing factors must be considered (Figure 6.1.3).

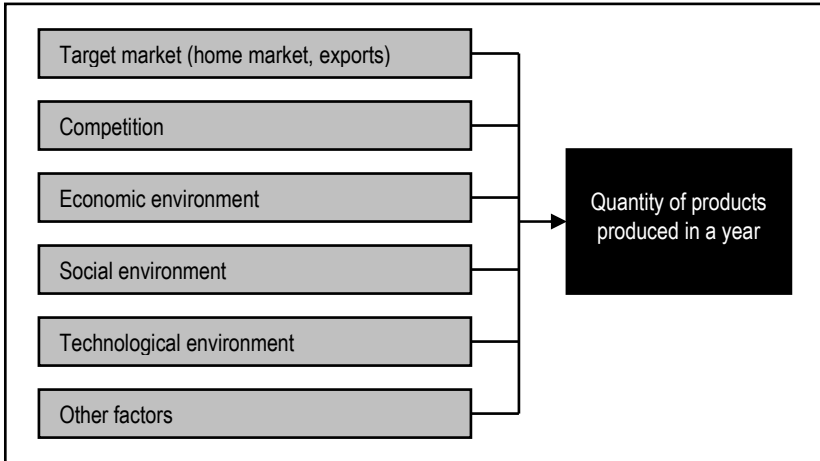


Figure 6.1.3. Factors of production amount

Stage 3

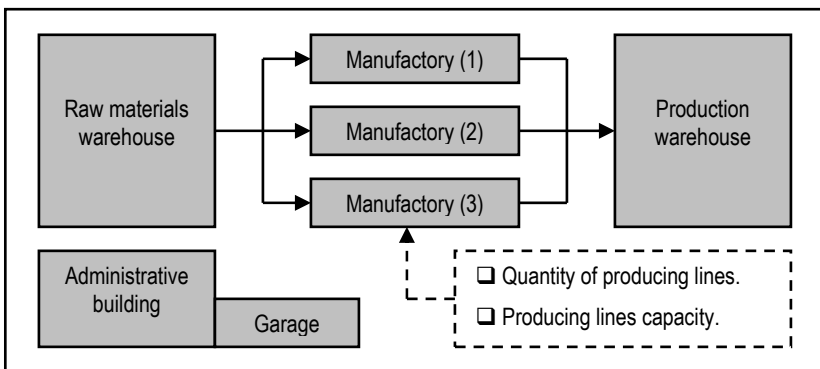


Figure 6.1.4. The simplified factory layout

Stage 4

Work flow simulation consists of:

- Process simulation (modeling the manufacturing lines).
- Plant design optimization.

The example of production process simulation is given in Figure 6.1.5.

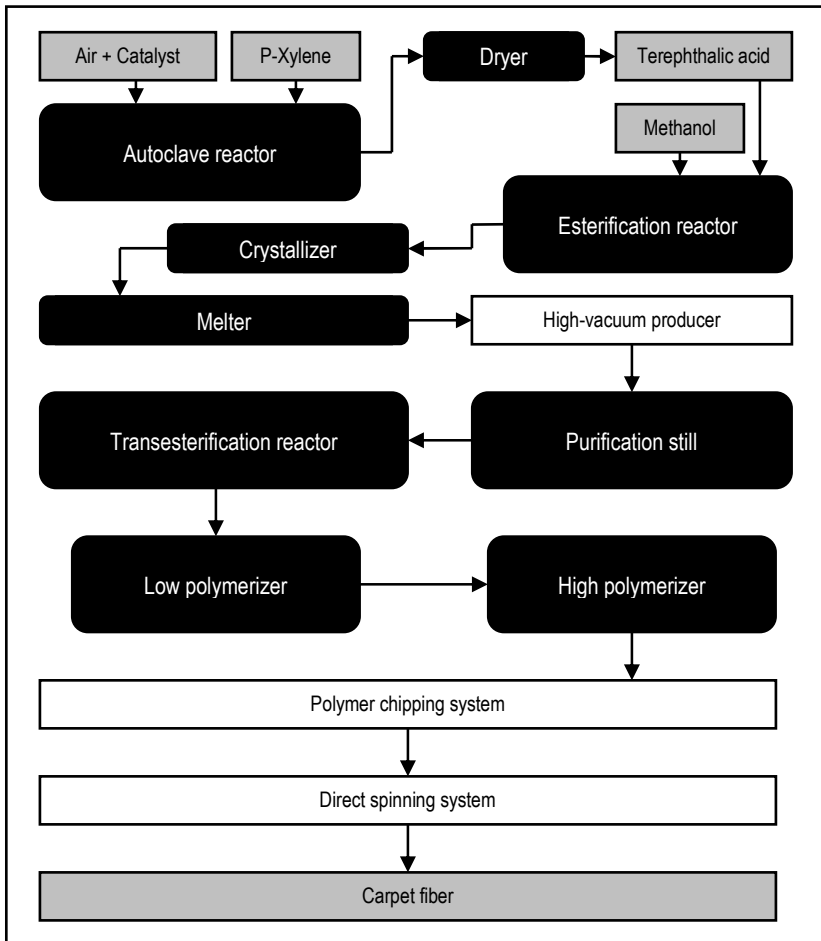


Figure 6.1.5. The simplified example of production process simulation

Stage 5

The resource planning consists of:

- Equipment planning and estimation of its effectiveness.
- Raw materials planning and modeling of supply control system (Fig. 6.1.6).
- Energy sources and infrastructure planning.
- Planning of personnel in manufacturing process.

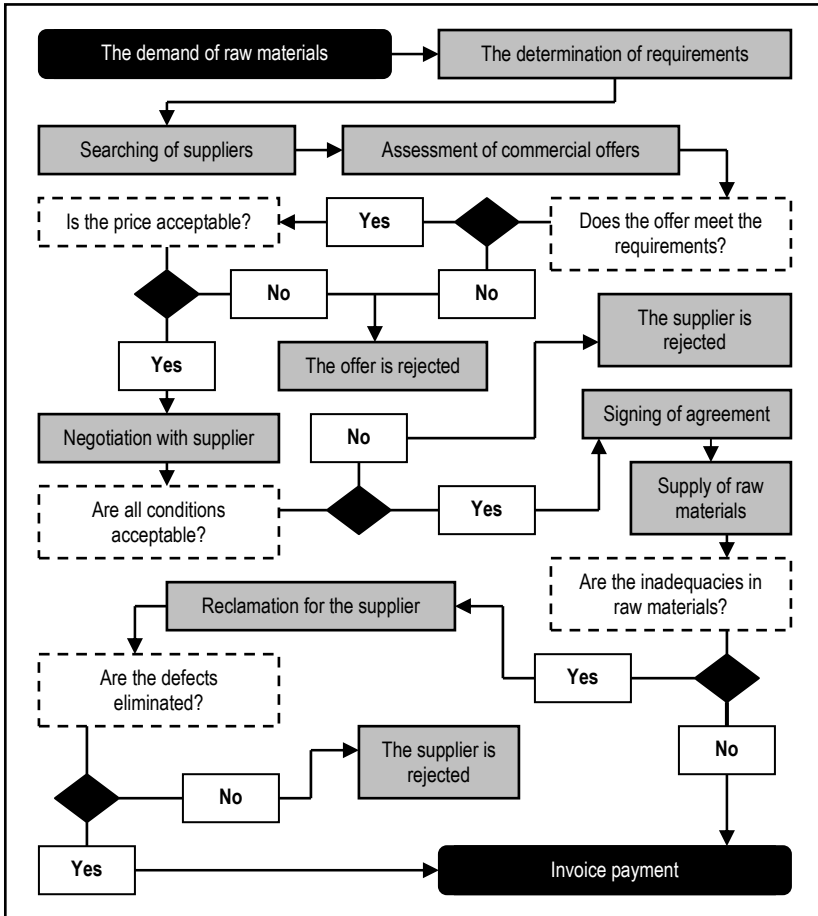


Figure 6.1.6. The raw materials supply process

Stage 6

The generation of work instructions includes the detailed description of every worker's functions in the production process.

Stage 7

The time and cost estimates include the time setting for every producing operations and calculating the costs of these operations.

Stage 8

The quality assurance includes:

- Real time process monitoring and control.
- Statistical process control.

Stage 9

Example of success measurement – 99,9% of good products produced .

Stage 10

The communication with other systems can be ensured using the Enterprise Resource Planning (ERP) software which connects all enterprise's departments and processes (Figure 6.1.7).

Enterprise resource planning is the business process management software that allows the companies to use a system of integrated applications to manage the business and automate many office functions related to accounting, finance, production, services, human resources, product planning, manufacturing, sales, marketing, logistics, inventory management, etc.

Benefits of ERP software for enterprises:

- Integration across all business processes.
- Increase in company's productivity by automating of business processes when ERP makes them more efficient, less prone to errors and faster.
- Performance analysis tools enable to produce the financial and other processes reports, as well as to conduct analysis on the performance of enterprise.
- Integrates the enterprise across the entire supply chain with suppliers and customers to ensure the full visibility and efficiency across the supply chain.

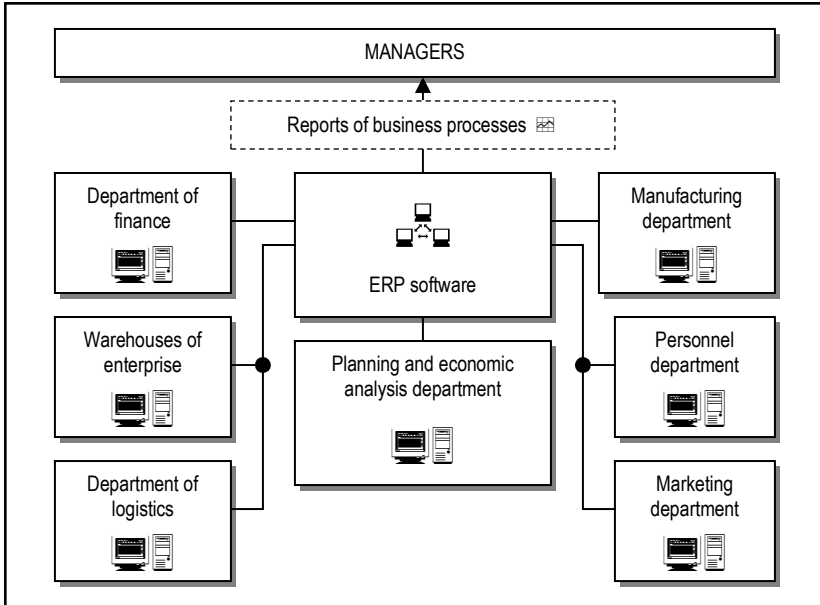


Figure 6.1.7. The aim of ERP software

Production process characterization

Process characterization is an activity in which the company:

- Identifies the key inputs and outputs of a process.
- Collects data on the behaviour over the entire operating range.
- Builds models describing the parameter relationships across the operating range.

The process characterization is also an integral part of any continuous manufacturing process improvement program.

The possible problems identification

Modeling the manufacturing process it is necessary to know how to graphically and quantitatively build models of the relationships between the factors and responses. These graphical tools can help to ensure the manufacturing process stability when the possible problems are clarified in advance.

The visualization of factors and responses includes:

- The identification of all important factors and responses in production process.
- Modeling the relationships of identified factors and responses. These relationships can be easily documented with fishbone diagrams.
- Documentation of relationships and sensitivities between the inputs and outputs. It is recommended to document this kind of information in a table with all of the inputs and outputs listed.

The cause and effect (fishbone) diagrams can be drawn using STATISTICA software. The data example is shown in Figure 6.1.8.

1	2	3
MACHINE	MATERIAL	MEASUREMENT
Calibration	Quality	Accuracy
Environment	Supplier	Sampling
Maintenance	Lack	Skills

Figure 6.1.8. The data example for cause and effect diagram

The commands are: Statistics → Industrial Statistics & Six Sigma → Process Analysis.

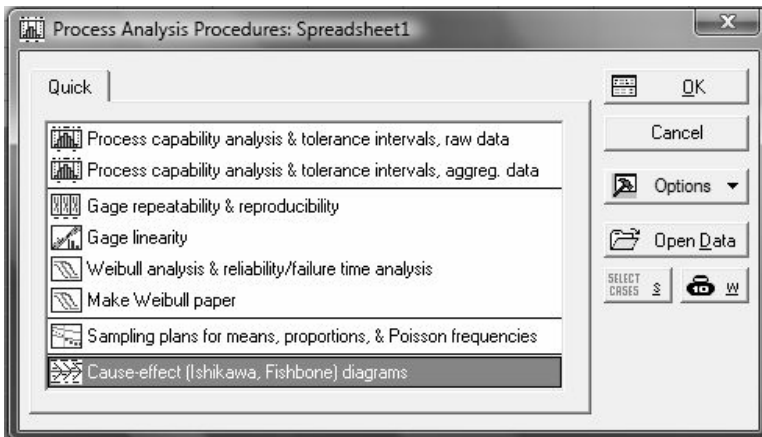


Figure 6.1.9. The process analysis command selection window

In the Process Analysis Procedures window (Figure 6.1.9) the command Cause-effect (Ishikawa, Fishbone) diagrams must be selected. Then the variables of above and below center arrow must be set (Figure 6.1.10).

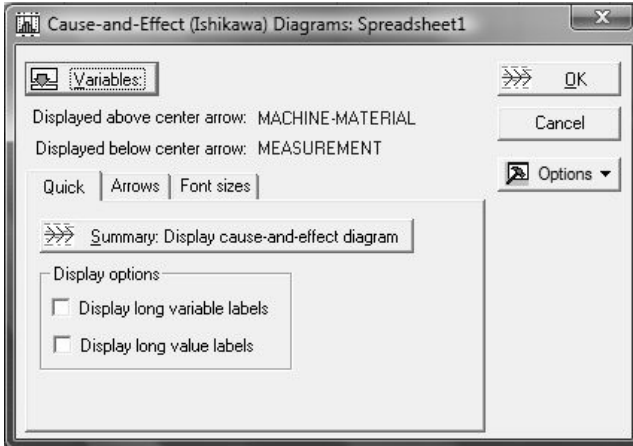


Figure 6.1.10. The selection of variables

The cause and effect diagram is shown in Figure 6.1.11.

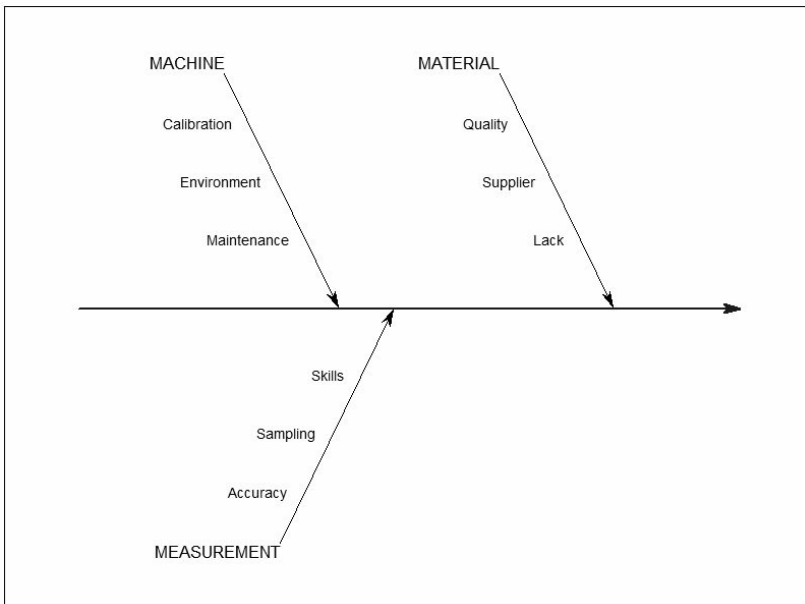


Figure 6.1.11. The cause and effect diagram

The example of table for the documentation of relationships and sensitivities between the inputs and outputs is shown in Table 6.1.1.

Table 6.1.1

The sensitivity of a product to different factors

Input / Output	Result 1	Result 2	...	Result n
Temperature > 260°C				
Pressure > 5 BAR				
...				

Quality control

Manufacturing process control and quality assurance are elements of a quality management system, which is the set of policies, procedures, and processes used to ensure the quality of product or service.

There are three main points when inspection is performed:

- When raw materials are received prior to entering production.
- While products are going through the production process.
- When products are finished - inspection or testing takes place before products are dispatched to customers.

<p>ISO 9000 ISO 9001</p>	<p>The International Organization for Standardization (ISO) has outlined the main quality principles and the procedures for implementing a quality management system in ISO 9000:2000, ISO 9001:2000 and other documents.</p> <p>These documents have become the standards of best practices for ensuring the quality in production process.</p> <p>ISO 9000 and ISO 9001 guidelines provide a comprehensive model for quality management systems that can make any company competitive.</p>
------------------------------	--

The important element of quality management is the collection and analysis of data that measure the quality of the raw materials, components, products and processes. The statisticians can help companies comply with ISO 9000 and ISO 9001 standards by developing data collection and analysis methods during the product's design, development and production stages.

The statistical quality control process:

1. Acceptance sampling.
2. Statistical process control (SPC).
3. Troubleshooting studies.

Stage 1

Acceptance sampling is conducted to decide whether a batch of products (supplier's components or produced units) is of acceptable quality. Usually, rather than testing 100% of the batch, a random sample of the batch is tested, and a decision about the entire batch is made from the sample analysis results.

The main problem in this stage is to determine an appropriate sampling plan.

Stage 2

Statistical process control (SPC) is the effective method of monitoring the production process of company through the use of control charts. By collecting the real-time in-process data or random samples of the output at various stages of the production process it is possible to detect variations or trends in the quality of the materials or processes that may affect the quality of the end product. Because data for analysis are gathered during the production process, the problems can be detected and prevented much earlier than methods that only look at the quality of the end product. Early detection of problems through SPC can reduce wasted time and resources and may detect defects that other quality control methods are not able (Figure 6.1.12).

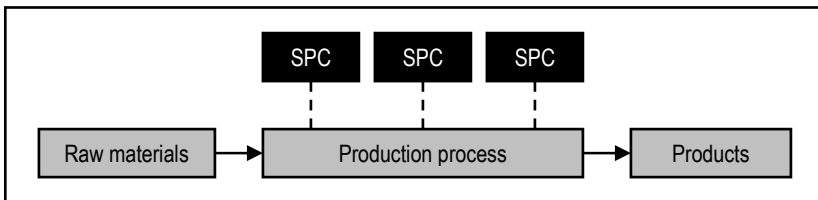


Figure 6.1.12. The statistical process control moments

Stage 3

If a quality inadequacy is identified in the end of production process, a troubleshooting study can be conducted to determine whether changes in certain inputs (raw materials or process characteristics) are associated with the unsatisfactory output variables.

The statistical regression or classification methods can detect associations between raw materials or process attributes and the final product outcomes. Although these observational studies cannot definitively prove the existence of a cause and effect relations, results of troubleshooting analysis may suggest potential targets for corrective actions in producing process, as well as off-line experiments or further measurements and analyses to confirm the root cause of the manufacturing problem (Figure 6.1.13).

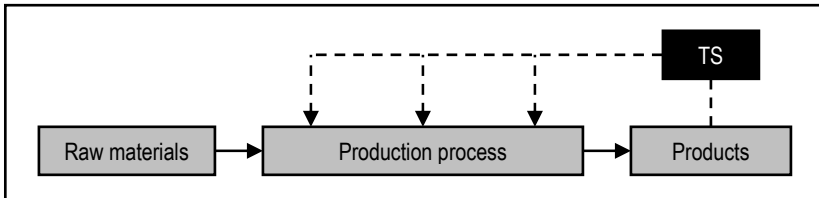


Figure 6.1.13. The troubleshooting studies (TS) moment

Assessing process stability

The manufacturing process cannot be released to practice until it has been proven to be stable. The production process is stable when all of the response parameters have the constant means and variances over time, and also have a constant distribution. This situation is called the **controlled variation**.

Assessing process capability

The process capability analysis entails comparing the performance of a process against its specifications. The production process is capable if all of the possible variable values fall within the specification limits (Figure 6.1.14).

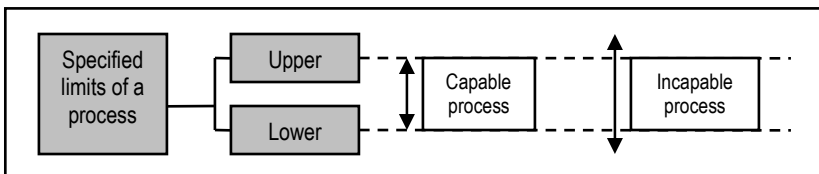


Figure 6.1.14. The process capability

6.2. The business process model: Part 3

Technological process

The technological process of bread making is shown in Figure 6.2.1.

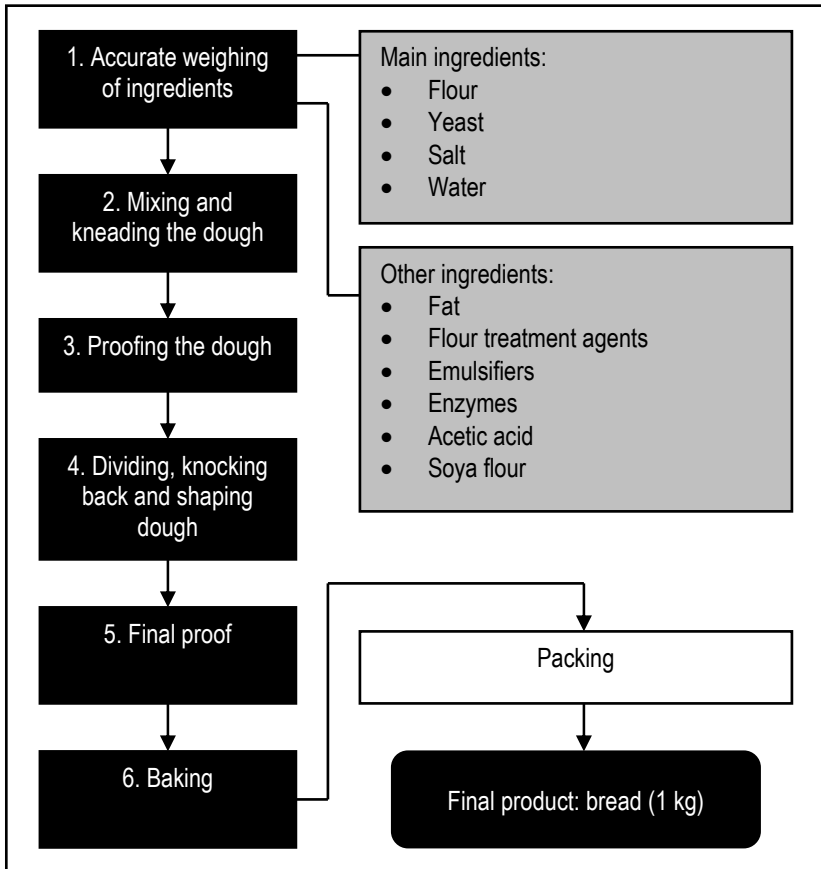


Figure 6.2.1. The technological process of bread production in business model

Production plan

The demand of bread has not the seasonality. The production quantity will be the same in all months (Table 6.2.1).

Table 6.2.1

Production plan

Month	Production quantity (kg)
January	20 000
February	20 000
March	20 000
April	20 000
May	20 000
June	20 000
July	20 000
August	20 000
September	20 000
October	20 000
November	20 000
December	20 000
Total	240 000

7. PLANNING THE TAX PAYMENTS



The tasks of this chapter:

- To determine the tax payment process.
- To present the Lithuanian tax system.
- To plan the tax payments in business model.

7.1. Tax payment process

The tax payment process is shown in Figure 7.1.1.

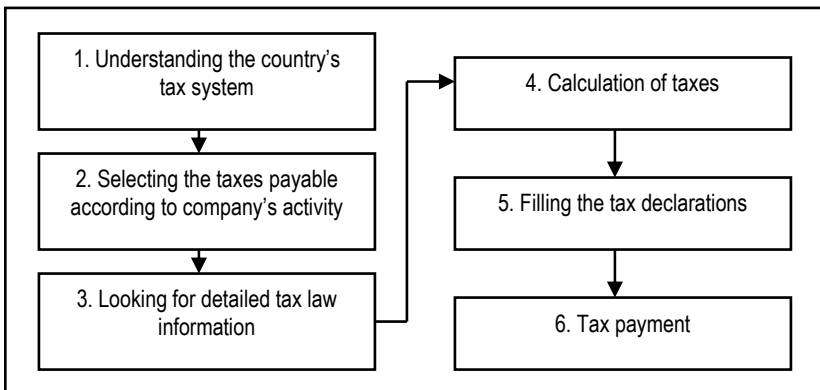


Figure 7.1.1. The tax payment process

The law of every Lithuanian tax can be found in Register of Legal Acts (Figure 7.1.2).



Figure 7.1.2. The Lithuanian legal acts searching system

For the tax collection and enterprises' control in Lithuanian is responsible the State Tax Inspectorate Under the Ministry of Finance (Figure 7.1.3).



Figure 7.1.3. The website of State Tax Inspectorate

7.2. Lithuanian tax system

The brief description of main taxes and tariffs paid by Lithuanian business enterprises is given below.

PROFIT TAX	15%
-------------------	------------

Main tariff – 15%.

Reduced tariff – 5%. Can be applied for small personal enterprises if:

- The company has no more than 10 employees.
- The revenue of a year does not exceed 300 000 EUR.

VALUE ADDED TAX (VAT)	21%
------------------------------	------------

Main tariff – 21%.

The company must register as the VAT payer if the revenue of last 12 months exceeds 45 000 EUR.

PERSONAL INCOME TAX	15%
----------------------------	------------

Main tariff – 15%.

The main tariff is applied to:

- Labour income.
- Dividend income.

Reduced tariff – 5%. It is applied for personal activity income.

EXCISE DUTY	
--------------------	---



The excise duty is applied to:

- Alcohol.
- Tobacco products.
- Energetical products: fuel for transport, coal, etc.
- Electricity (for business).

ENVIRONMENT POLLUTION TAX



The environment pollution tax is applied to:

- Taxed products.
- Package of products.
- Pollution from mobile sources.
- Pollution from stationary sources.

Taxed products

The environment pollution tax must be paid when a company has produced or imported the products given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1

Taxed products

Product	Tariff (EUR / t)
1. Tyres (> 3 kg):	
1.1. New	86
1.2. Used	86
1.3. Remould	104
2. Accumulators	144
3. Bateries	2 896
4. Filters of fuel or oil	463
5. Air filters	463
6. Car shock-absorbers (hydraulic)	347

Package of products

Table 7.2.2

Taxed package

Package	Tariff (EUR / t)
Glass	57
Plastic	521
PET	579
Combined	579
Metal	753
Paper	28
Other	57

Pollution from mobile sources

Table 7.2.3

Tax tariffs of pollution from mobile sources

Transport type	Fuel	Tariff (EUR / t)
Road transport	Benzine	7
	Diesel	8
	Liquid gas	7
	Compressed gas	6
Water transport	Benzine	11
	Diesel	12
	Fuel oil (sulphur < 0,5%)	2,8
	Fuel oil (sulphur 0,5-1,5%)	5
	Fuel oil (sulphur 1,5-2,5%)	7
Railway transport	Diesel	9
Air transport	Float-land cycle*	1,7*

The tax payable depends on the quantity of fuel used. The tax amount is also influenced on the ecological characteristics of road transport. The example is given in Table 7.2.4.

Table 7.2.4

The impact of transport's ecological characteristics on tax payable

Engine	Fuel	Quantity of fuel used (t)	Tax (EUR)
EURO - I	Diesel	20	77
EURO - II	Diesel	20	66
EURO - III	Diesel	20	54
EURO - IV	Diesel	20	36
EURO - V	Diesel	20	21

Pollution from stationary sources

The full information about tariffs applied for pollution from the stationary sources can be found in Environment Pollution Tax Law.

Examples:

- The pollution of atmosphere: SO₂ – 104 EUR/t, NO_x – 196 EUR/t, etc.
- The pollution of ground and water: BDS₇ – 256 EUR/t, nitrogen – 201 EUR/t, phosphorus – 1 007 EUR/t, etc.

TAX OF STATE'S NATURAL RESOURCES



When the enterprise uses the natural resources it must pay the tax according to Table 7.2.5 and Table 7.2.6.

Table 7.2.5

Tax tariffs of minerals

No.	Resources	Unit	Tariff (EUR)
1.	Anhydrite	m ³	1,45
2.	Dolomite	m ³	0,72
3.	Peat	m ³	0,58
4.	Amber	kg	20,22
5.	Chalk-stone	m ³	0,61
6.	Chalk-marl	m ³	0,65
7.	Clay:	m ³	
	Devonian period		0,63
	Triassic period		0,61
	Other		0,37
...
13.	Other sand	m ³	0,28
14.	Gravel	m ³	0,32

Table 7.2.6

Tax tariffs of water and construction soil

No.	Resources	Tariff (EUR/m ³)
1.	Underground water (except mineral):	
	a) Supplied for households and heating systems	0,02
	b) Water in tare for commercial purposes	3,13
	c) Other water	0,07
2.	Mineral water (except used for treatment)	3,13
3.	Mineral water (used for treatment)	1,56
4.	Surface-water for industry and agriculture	0,002
5.	Surface water for cooling of thermal power-stations	0,0002
6.	Surface water for fishery	0,0001
7.	Surface water for water power-stations	0,00001
8.	Surface water for nuclear power-station	0,0003
9.	Construction soil	0,19

IMMOVABLE PROPERTY TAX



The tariffs of immovable property tax can be set by every municipality in range of 0,3% – 1,0%. The example of tax tariffs set by Panevėžys town municipality is given in Table 7.2.7.

Table 7.2.7

Tax tariffs set by Panevėžys town municipality in 2015

Town	Main tariff	Tariff for unused or derelict property
Panevėžys	0,8	3

INDUSTRIAL PROPERTY REGISTRATION TAX



The industrial property objects are:

- Invention patents.
- Design.
- Topographies of semiconductor products.
- Brands.

Table 7.2.8

Examples of tax tariffs

No.	Taxation object	Tariff (EUR)
1.	Invention patents:	
a)	Invention patent application	86
b)	Issuance of patent	34
c)	Assurance of patent's validity in 3 – 20 years	81 – 347
2.	Design:	
a)	Design application	69
b)	Registration of design	69
c)	Assurance of design's registration validity (for 5 years)	86 – 173
3.	Topographies of semiconductor products:	
a)	Registration of topography	69
4.	Brands:	
a)	Registration of brand	69
b)	Extension of brand registration for 1 year	69

GUARANTEE FUND PAYMENTS

0,2%

The Guarantee Fund compensates the salaries for employees in case of company's bankruptcy. The payments for Guarantee Fund are 0,2% from the calculated salaries of every employee.

OTHER TAXES IN LITHUANIA



The other taxes paid by business enterprises in Lithuania:

- Tax of hydrocarbon resources.
- Manufacturing tax in sugar industry.
- Surplus tax in sugar industry.
- Tax for using the state's assets.
- State's duty.
- Land tax.

7.3. The business process model: Part 4

The taxes paid by bread production enterprise in the model are given in Table 7.2.9.

Table 7.2.9

Taxed package

Package	Tariff
Profit tax	15%
Value added tax (VAT)	21%
Personal income tax (calculated in Chapter 5.3)	15%
Environment pollution tax (plastic package of products)	521 EUR/t
Environment pollution tax (diesel for transport)	8 EUR/t
Immovable property tax	0,8%
Guarantee Fund payments (calculated in Chapter 5.3)	0,2%

8. COST-PRICE CALCULATION



The tasks of this chapter:

- To explain the classification of main activity costs.
- To present the cost-price calculation process and methods.
- To calculate the cost-price of production in business model.

8.1. Main activity costs classification

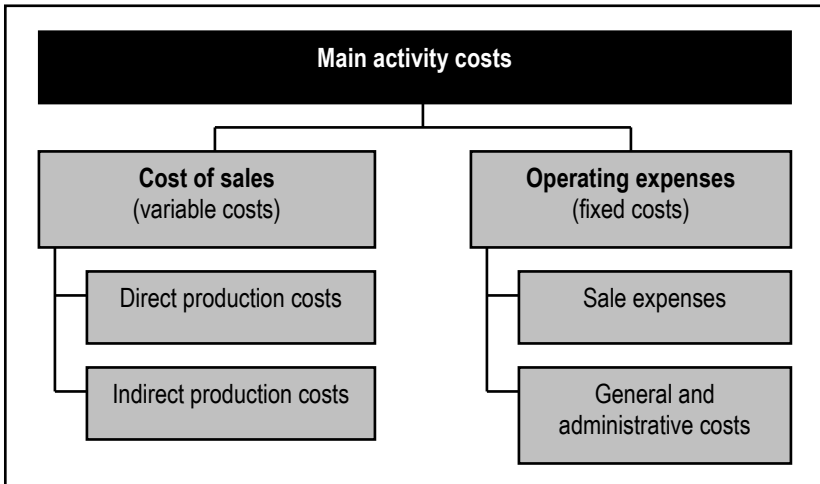


Figure 8.1.1. The classification of main activity costs

The cost type is determined by the variability of expenses according to the amount of production (Figure 8.1.1). This classification is used in the accounting process and preparing the income statement of a company.

The cost types related to main activity of enterprise:

- Variable costs (cost of sales).
- Fixed costs (operating expenses).

The variable costs depend on the quantity of products produced while the fixed costs mostly do not vary significantly changing the production amount. The total costs is the sum of variable and fixed costs (Figure 8.1.2).

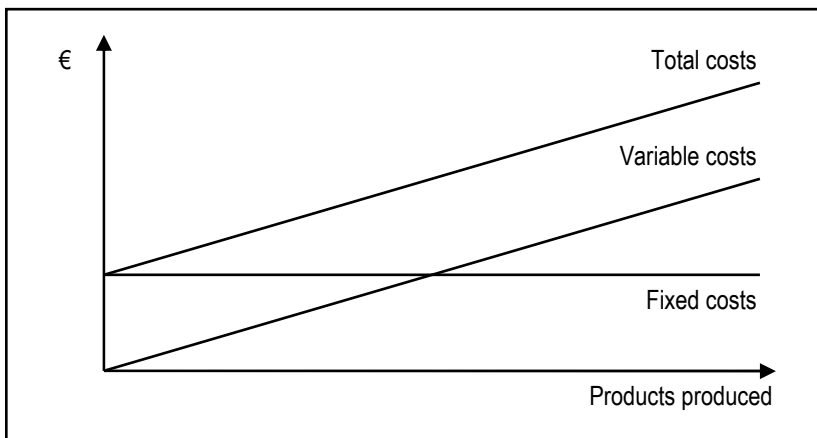


Figure 8.1.2. The fixed, variable and total costs

Examples of variable costs (cost of sales):

Direct production costs:

- Raw materials.
- Components of products.
- Energy expenses in production process.
- Salaries and social insurance payments of producing workers.

Indirect production costs:

- Salaries and social insurance payments of auxiliary workers.
- Depreciation of producing equipment.
- Auxiliary materials used in production process.

Examples of fixed costs (operating expenses):

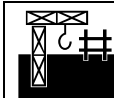
Sale expenses:

- Salaries and social insurance payments of sale employees.
- Costs of sale buildings (electricity, heating, ...).
- Advertisements.
- Products' transportation expenses.

General and administrative costs:

- Salaries and social insurance payments of general and administration employees.
- Costs of general and administration buildings.
- Telephone, internet and other office costs.
- Taxes.
- Enterprise's representation costs.
- Bad debts.

8.2. Cost-price calculation process and methods



The **cost-price** is the aggregated production producing costs.

The cost-price indicates how many expenses company has in the products manufacturing and selling processes (Figure 8.2.1). The activity of every company is specific, so companies must prepare the cost-price calculation methodology.

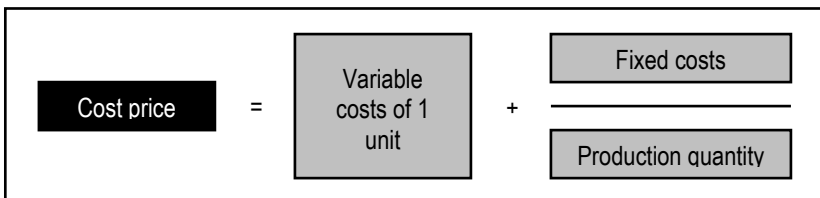


Figure 8.2.1. The cost-price calculation

When company knows the cost-price it is possible to set price and plan profit. If the price is less than cost-price, the company will not produce and sell products. The company must know in advance the necessary expenses related to its activity and control the activity to be not loss-making. Compared the cost-price to the selling price it is possible to manage the product's profitability.

The company is profitable if:

$$\text{Revenue} > \text{Expenses}$$

The company must evaluate all expenses:

- Producing the products.
- Advertising, distributing and selling the products.
- Managing the company.

The cost-price calculation methods are shown in Figure 8.2.2.

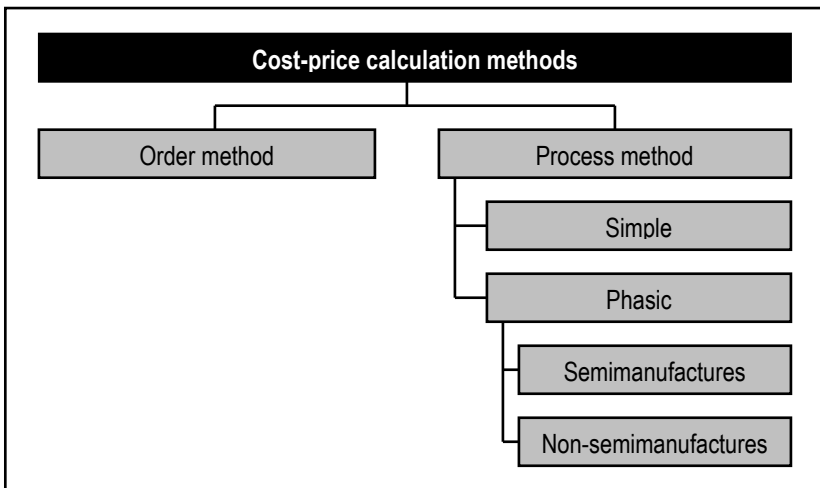


Figure 8.2.2. The cost-price calculation methods

1. Order method

This method is applied in companies that produce products according to unitary orders or series.

The examples of cost-price calculated for unitary (individual) products:

- Buildings.
- Ships.
- Books, etc.

All variable expenses are attributed for individual orders separately. It doesn't matter the period of expenses (Figure 8.2.3).

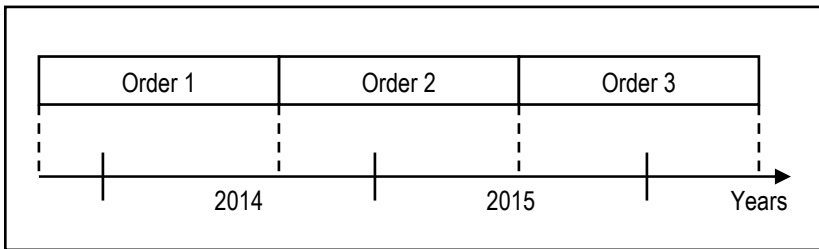


Figure 8.2.3. The order cost-price calculation method

The general and administrative costs of a year can be distributed:

- According to the quantity of products.
- According to the revenue.
- According to the working time (Figure 8.2.4).

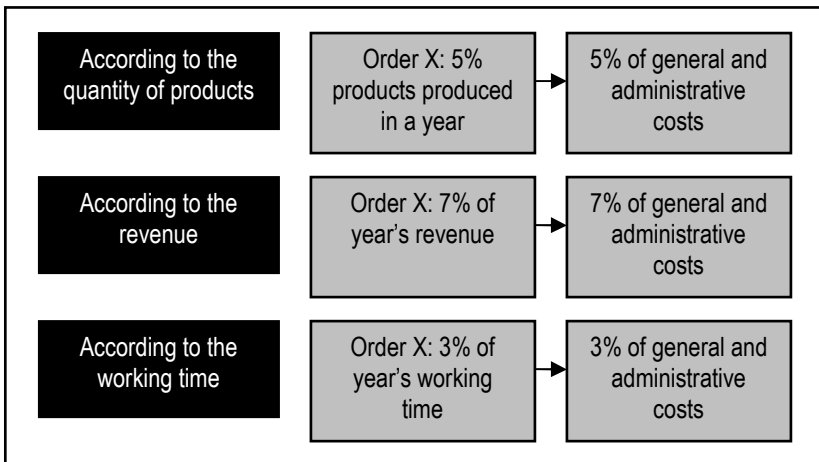


Figure 8.2.4. The distribution of general and administrative costs

2. Process method

The process method is applied in mass production. In cost-price calculation all expenses of a year are distributed for all products produced in a year (Figure 8.2.5).

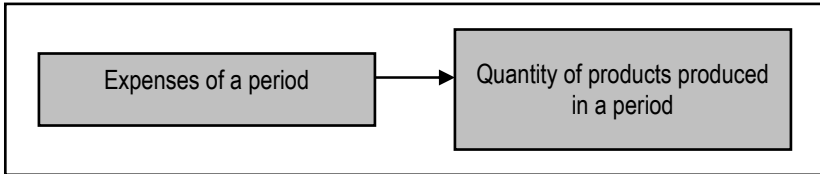


Figure 8.2.5. The distribution of expenses of a period

The cost-price of 1 unit is calculated the expenses dividing by quantity of products:

$$\text{Cost-price} = \text{Expenses (1 year)} / \text{Quantity of products (1 year)}$$

(8.2.1)

Properly calculated cost-price allows:

- To set price of a product.
- To predict the profit of a company.
- To improve the manufacturing process applying innovations and evaluating the efficiency of company.

2.1. Simple process method

Simple method is applied in production where the technological process cannot be divided into different phases. In this case all expenses are distributed for all production process. The cost-price is calculated dividing the expenses by quantity of products produced.

The types of producing process:

- Consecutive operations.
- Parallel operations.

In case of consecutive operations the works are being done one after another (Figure 8.2.6).

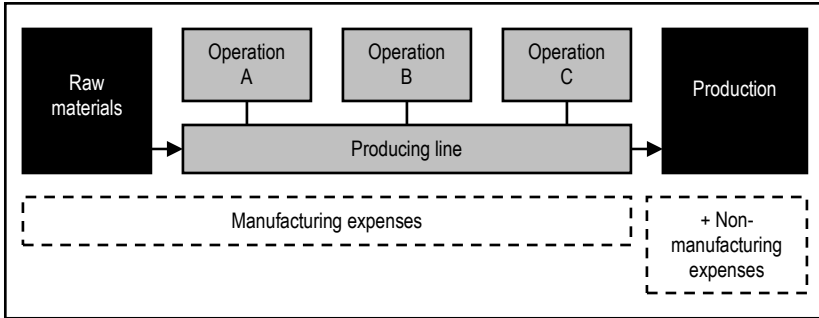


Figure 8.2.6. The consecutive manufacturing operations

In case of parallel operations the works can be done in parallel at the same time (Figure 8.2.7).

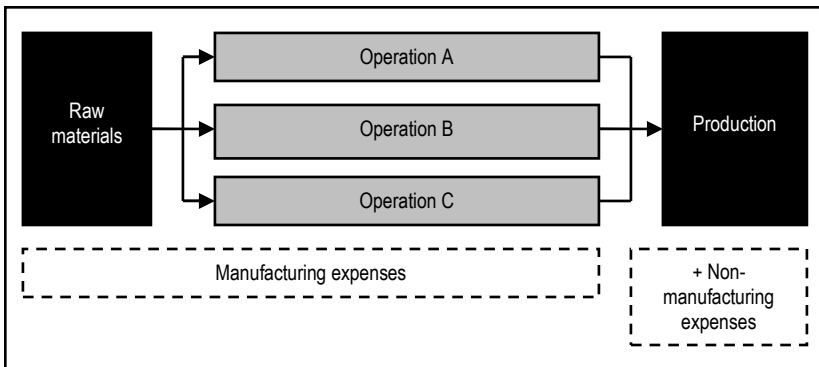


Figure 8.2.7. The parallel manufacturing operations

In long manufacturing process when the period is finished the companies have unfinished products. In this case the manufacturing expenses must be separated for finished and unfinished products. Calculating the cost-price only expenses of finished products must be evaluated (Figure 8.2.8).

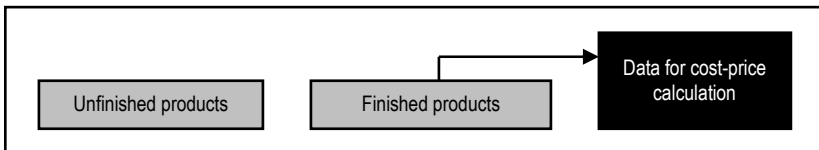


Figure 8.2.8. The data used for the cost-price calculation

Example:

Table 8.2.1

Data for the cost-price calculation (EUR)

Costs	All products	Unfinished products	Finished products
	A	B	C = A - B
Direct production costs	200 000	10 000	190 000
Indirect production costs	20 000	1 000	19 000
Total	220 000	11 000	209 000

Production information:

- Non-manufacturing expenses – 50 000 EUR
- The quantity of finished products – 10 000 units

Cost-price of 1 unit = $(209\ 000 + 50\ 000) / 10\ 000 = 25,9$ EUR

2.2. Phasic process method

This method is applied in companies where manufacturing process can be divided into different producing phases. In this case the product goes through the different producing phases until it is finished. The accounting of expenses is organized in different phases that the product goes through.

In the producing process there can be consecutive and parallel operations (Figure 8.2.9).

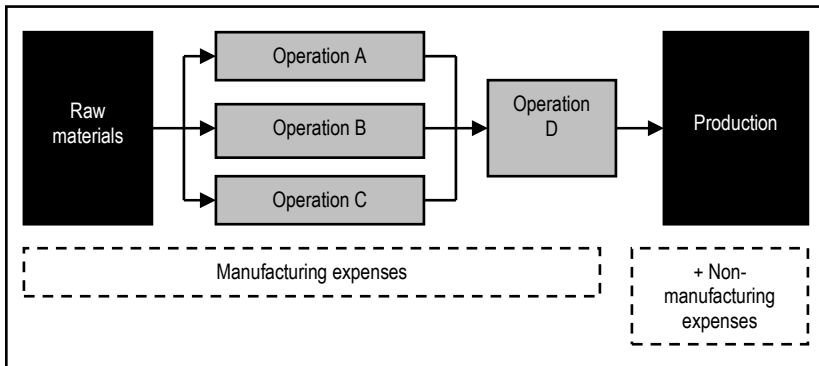


Figure 8.2.9. The consecutive and parallel manufacturing operations

2.2.1. Semimanufactures phasic process method

The cost-price of product is calculated in last phase. The manufacturing expenses are accumulated in different phases (Figure 8.2.10).

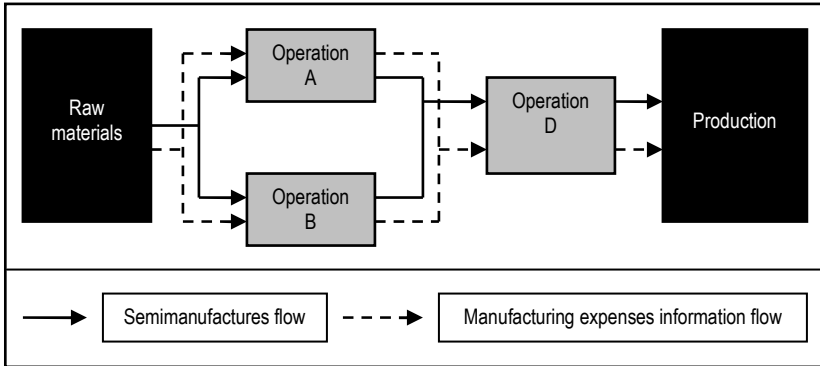


Figure 8.2.10. The semimanufactures phasic process method

The cost-price calculation example is given in figure 8.2.11.

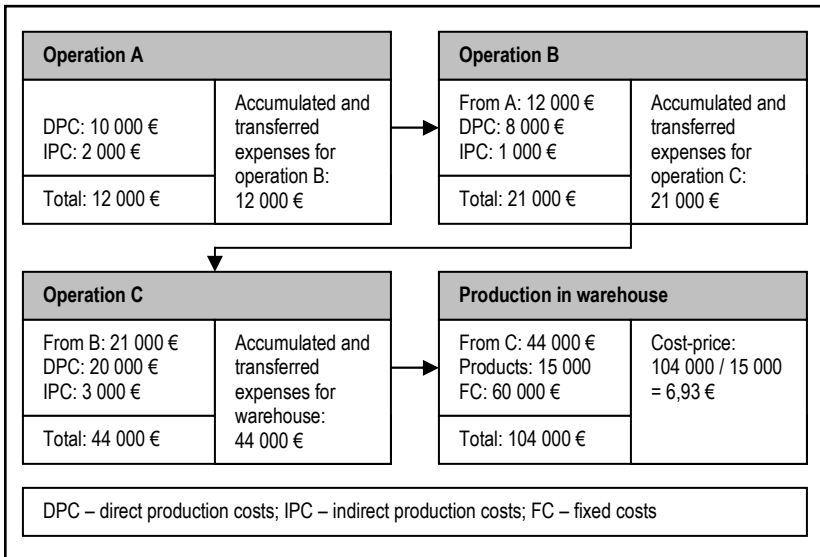


Figure 8.2.11. The cost-price calculation process

2.2.2. Non-semimanufactures phasic process method

The expenses of different phases are transferred directly to the last phase where the cost-price is calculated (Figure 8.2.12).

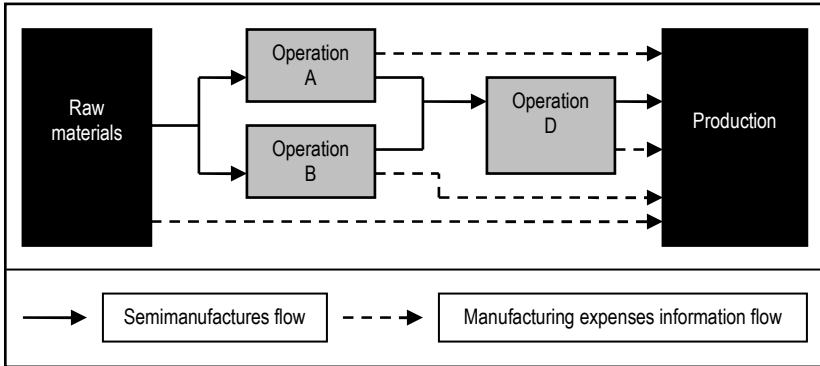


Figure 8.2.12. The non-semimanufactures phasic process method

The cost-price calculation example is given in figure 8.2.13.

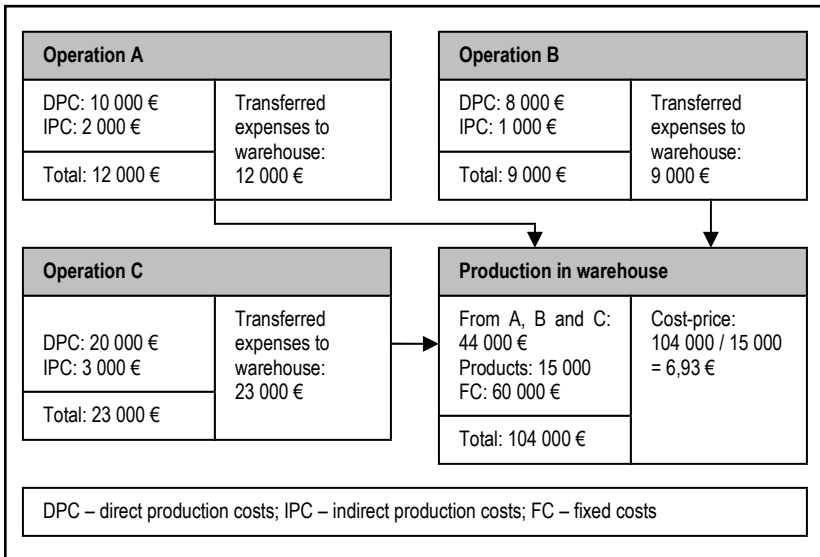


Figure 8.2.13. The cost-price calculation process

The cost-price types

The cost-price types:

- Manufacturing cost-price.
- Full cost-price.
- Commercial cost-price.

The manufacturing cost-price includes only production expenses (direct and indirect). When the general and administrative expenses are added to the production expenses the full cost-price is calculated. The commercial cost-price includes all expenses of enterprises main activity: production, general and administrative and selling expenses (Figure 8.2.14).

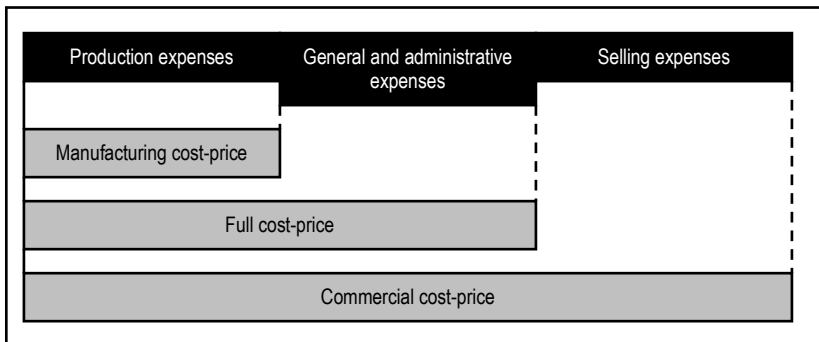


Figure 8.2.15. The cost-price types

8.3. The business process model: Part 5

Direct production costs

The direct production costs in business model:

- Raw materials – 127 433 EUR.
- Energy (electricity, gas) – 28 093 EUR.
- Salaries and social insurance expenses of producing workers are calculated in Table 8.3.1 (according to Chapter 5.3).

Table 8.3.1

The production workers' salaries fund of 1 year (EUR)

Employee	Fund
Technologist	11 397,71
Production worker (1)	5 470,84
Production worker (2)	5 470,84
Production worker (3)	5 470,84
Production worker (4)	5 470,84
Production worker (5)	5 470,84
Total:	38 751,91

Total direct production costs: 194 277,91 EUR.

Indirect production costs

The indirect production costs in business model:

- Auxiliary materials – 348 EUR.
- Diesel for transport – 6 517 EUR (5 667 litres × 1,15 EUR / litre).
- Salary and social insurance expenses of auxiliary worker are calculated in Table 8.3.2 (according to Chapter 5.3).

Table 8.3.2

The auxiliary worker's salary fund of 1 year (EUR)

Employee	Fund
Auxiliary worker	4 722,48
Total:	4 722,48

Total indirect production costs: 11 587,48 EUR.

Total cost of sales: 194 277,91 + 11 587,48 = 205 865,39 EUR.

Operating expenses

Selling expenses:

- Advertisements – 869 EUR.

General and administrative expenses:

- Administrative building expenses (heating, electricity) – 3 475 EUR.
- Telephone, office expenses – 927 EUR.
- Salaries and social insurance expenses of general and administrative personnel are calculated in Table 8.3.3 (according to Chapter 5.3).

Table 8.3.3

The general and administrative personnel salaries fund of 1 year (EUR)

Employee	Fund
Director	13 677,25
Accountant	11 397,71
Secretary	4 722,48
Trading agent	7 294,50
Storekeeper	4 722,48
Driver	4 722,48
Guard	4 722,48
Total:	51 259,38

- Taxes (without VAT and profit tax) – 2 328,48 EUR. The calculation of payable taxes according to Table 7.2.9 is given below.

a) Environment pollution tax

Package:

The package of 1 kg product (bread) is 10 g plastic package.

The package of 240 000 kg products (in 1 year):
 $0,01 \text{ kg} \cdot 240\,000 \text{ kg} = \mathbf{2\,400 \text{ kg}} = \mathbf{2,4 \text{ t}}$ of plastic package.

Tax tariff: 521 EUR/t (Table 7.2.2).

Environment pollution tax for package (in 1 year):
 $2,4 \text{ t} \cdot 521 \text{ EUR/t} = \mathbf{1\,250,4 \text{ EUR}}$.

Fuel:

Diesel (for transportation of products in 1 year) – 5 667 litres.

Weight of diesel: $5\,667 \text{ l} \cdot 0,84^* = 4\,760,28 \text{ kg} = \mathbf{4,76028 \text{ t}}$.

* Fuel capacity to mass recalculating coefficients:

- Benzine – 0,75.
- Diesel – 0,84.
- Liquid gas – 0,54.
- Compressed gas – 0,69.

Tax tariff: 8 EUR/t (Table 7.2.3).

Environment pollution tax for fuel (in 1 year):

$4,76028 \text{ t} \cdot 8 \text{ EUR/t} = \mathbf{38,08 \text{ EUR}}$.

b) Immovable property tax

The tariff set by municipality – **0,8%** of immovable property value (Table 7.2.7).

The value of enterprise's building – 130 000 EUR (Table 4.3.1).

Immovable property tax: $130\,000 \text{ EUR} \cdot 0,008 = \mathbf{1\,040 \text{ EUR}}$.

Total operating expenses: 58 858,86 EUR.

Total costs to produce 240 000 kg of bread in 1 year: 264 724,25 EUR.



The commercial cost-price of 1kg bread:

$264\,724,25 \text{ EUR} / 240\,000 \text{ kg} = \mathbf{1,10 \text{ EUR}}$.

9. SETTING OF PRODUCT'S PRICE



The tasks of this chapter:

- To explain the product's price setting methods.
- To set the price of product in business model.

9.1. The product's price setting methods

The enterprises can set the product's price:

- Adding the premium (profit margin) to the cost-price (Figure 9.1.1).
- According to the similar products' prices of other companies (Table 9.1.1).

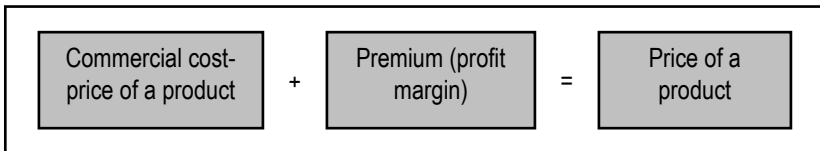


Figure 9.1.1. The price setting adding the premium to the cost-price

Table 9.1.1

The price setting according to the prices of similar products in the market

Product	Price
Product of competitor A	X
Product of competitor B	Y
Product	Z

Necessary condition:

Price of a product (Z) > Commercial cost-price of a product

9.2. The business process model: Part 6

The price of bread in the model is set according to the prices of similar products in the market.

Table 9.2.1

The prices of similar products in the market

Competitor	Price (EUR/kg)
Company A	1,30
Company B	1,36
Company C	1,39



The price of 1 kg bread:

264 724,25 EUR / 240 000 kg = **1,30 EUR.**

The profit margin of 1 product: $1,30 - 1,10 = 0,20$ EUR

The calculation of profit margin percentage:

1,10 EUR – 100%

1,30 EUR – X%

$X = (1,30 \times 100) / 1,10 = 118,18\%$

The profit margin of 1 product: $118,18\% - 100\% = \mathbf{18,18\%}$

10. THE FINANCING OF A COMPANY



The tasks of this chapter:

- ❑ To characterize the main financing sources of enterprises.
- ❑ To make company's financing decisions in business model.

10.1. The main company's financing sources

The company's financing process includes the selection of the best combination of financing sources to obtain the necessary assets and getting the capital (Figure 10.1.1).

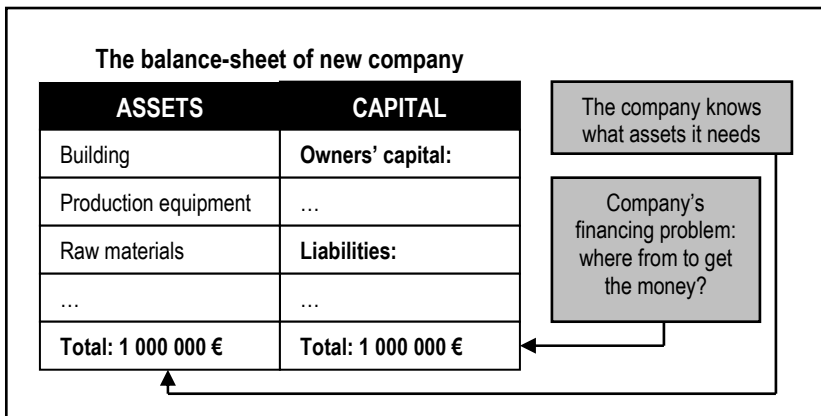


Figure 10.1.1. The essence of a company's financing

The financing sources of fixed assets (investments)

1. Shares (shareholders' capital)

The joint-stock companies form or increase the paid in capital issuing shares.

In Lithuania the minimum owners' capital required:

- Large joint-stock company – 40 000 EUR.
- Medium and small joint-stock company – 2 500 EUR.

The owners must have this quantity of money to establish new company.

2. Long-term debts

The fixed assets can be bought getting the long-term credits from commercial banks if a company has not the sufficient amount of owners' capital. The debt term must not exceed the assets usage term (Figure 10.1.2).

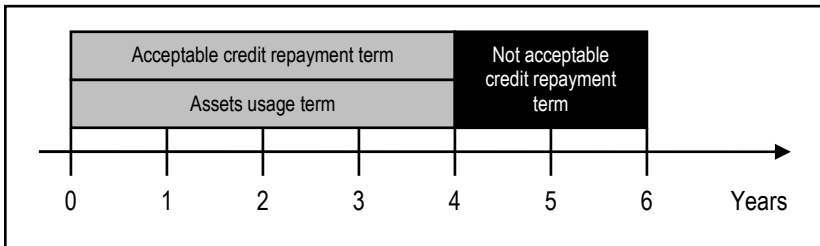


Figure 10.1.2. The link between assets usage and credit repayment terms

3. Bonds

The company can issue the bonds as the debt securities to the financial market. If investors buy them, the company gets money. The redeem term of bonds usually is longer than 1 year. When the bonds are issued the company must pay the coupon payments (interest) for investors until the bonds are redeemed. At the moment of redemption the company must repay the debt (the nominal value of bonds) for the investors (Figure 10.1.3).

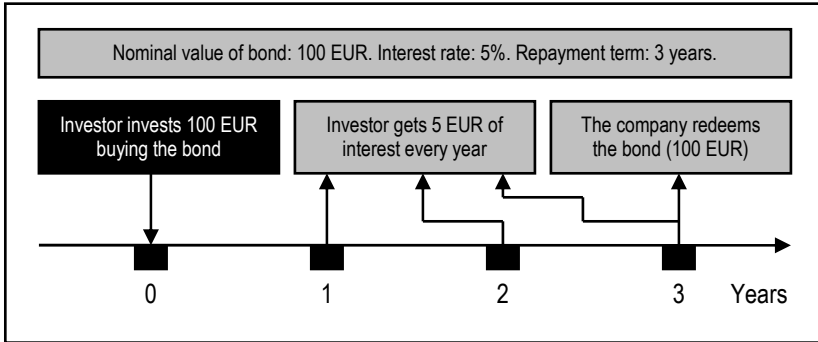


Figure 10.1.3. The cash flows of a company related to the issued bonds

4. Leasing

The company does not need to have all money to buy the assets. When the agreement with the leasing company is signed the seller of product (computer, producing equipment, etc.) gets money from leasing company. The leasing debt must be repaid in several years (Figure 10.1.4).

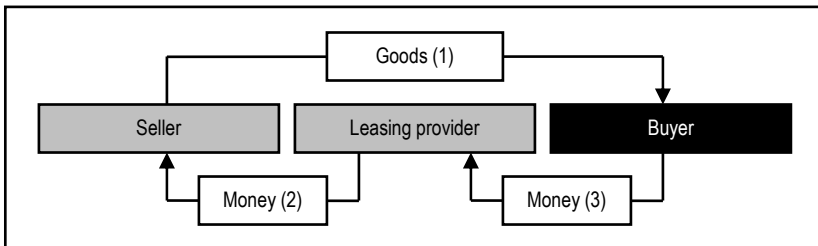


Figure 10.1.4. The financing of assets by leasing

5. Retained earnings

The net income of a year is the property of company's owners.

The shareholders can:

- Share the net income as dividends.
- The profit can be left in company and invested to the company's expansion (retained earnings in Figure 10.1.5).

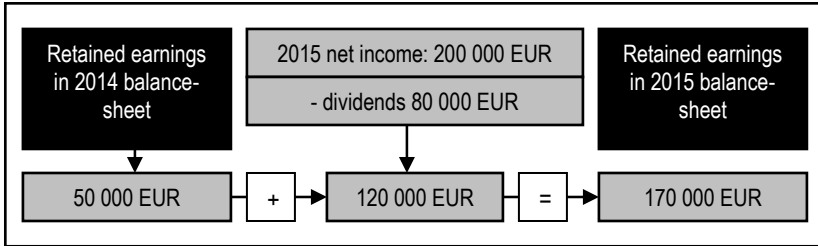


Figure 10.1.5. The retained earnings calculation process

6. Depreciation funds

In the depreciation funds the money is accumulated to renew the fixed assets. The transfers from net income of a year to funds are equal to annual depreciation costs of fixed assets (Figure 10.1.6).

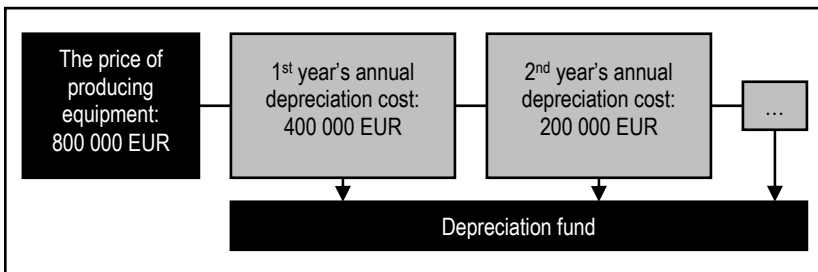


Figure 10.1.6. The depreciation funds accumulation process

7. Subsidies

The support for a company from the government or international funds can increase the owners' capital for the investments.

8. Money from sold fixed assets

The not necessary assets of a company can be sold and the money can be used to buy the necessary assets.

The financing sources of current assets

1. Short-term credits from banks

The short-term credits often do not exceed the 90 days term. Also there are another short-term financing services of commercial banks:

- Credit line.
- Overdraft.

CREDIT LINE

The company can borrow money that it needs at any time not exceeding the specified limit in the credit line agreement. For the debt bank calculates interest. Also the company must pay for bank the commitment payment (Figure 10.1.7).

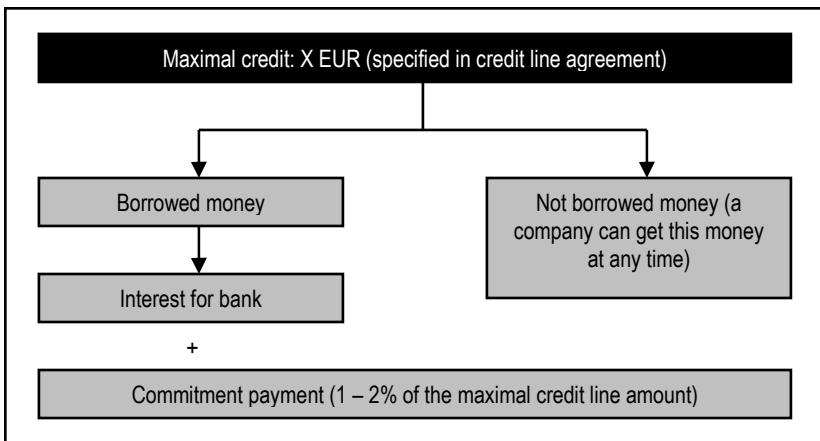


Figure 10.1.7. The credit line financing process

OVERDRAFT

When the agreement of overdraft is signed the company's account in bank can be negative. The company can make the payments from its account not having money not exceeding the specified limit. For the debt bank calculates interest (Figure 10.1.8).

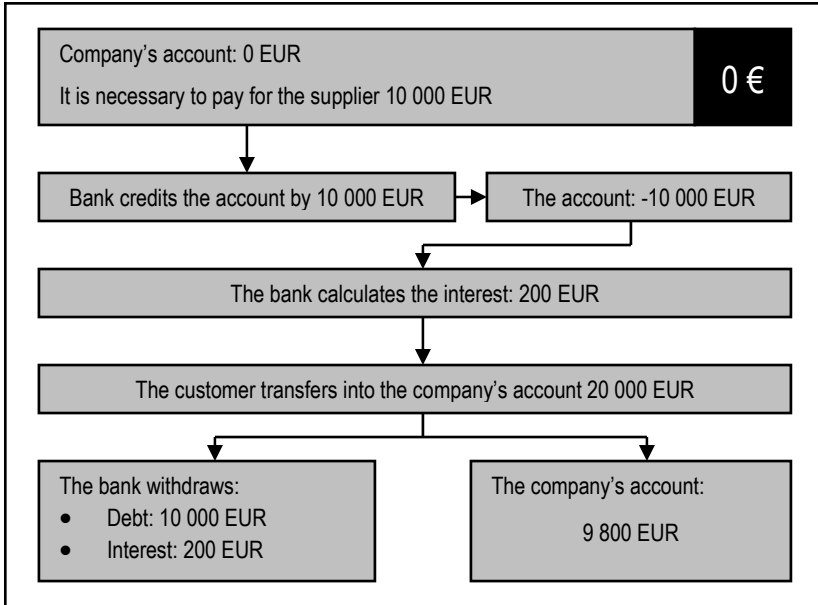


Figure 10.1.8. The process of overdraft

2. Commercial credits

The commercial credits are the debts between companies selling and buying goods. When the invoice is not paid the buyer has the commercial credit. Usually the term to pay invoice is set up to 90 days (Figure 10.1.9).

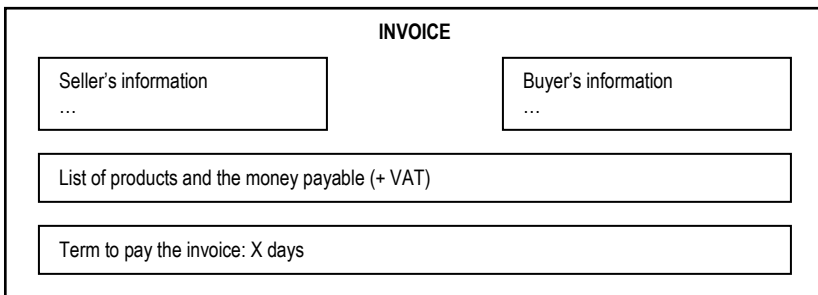


Figure 10.1.9. The general structure of invoice

3. Short-term bills

The short-term bills are the debt documents of reliable companies. These bills usually are issued up to 6 months.

Example:

Company A must pay 10 000 EUR for company B until September 30, 2015.

4. Delayed payments

If it is possible the company can delay payments for suppliers, employees, etc. when the company has not sufficient quantity of money. This is applicable when the financial condition of a company is bad.

The resources sufficiency assessment process

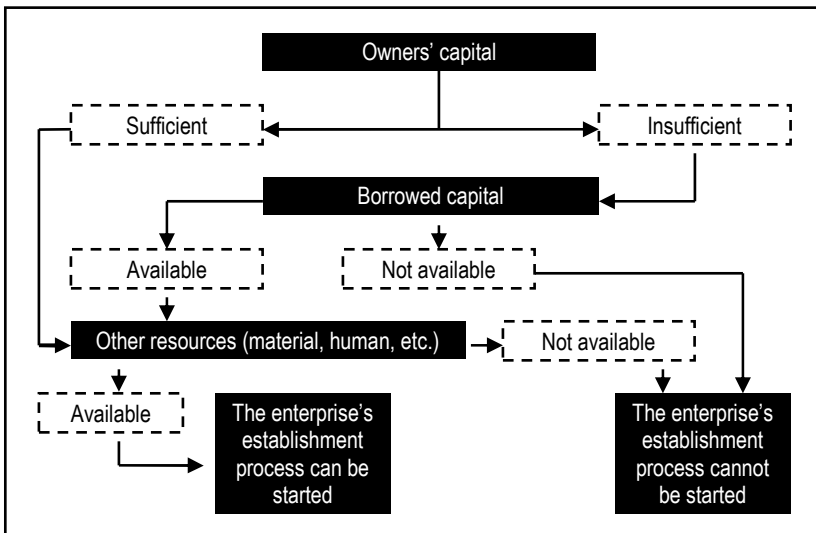


Figure 10.1.10. The resources sufficiency assessment process

10.2. The business process model: Part 7

The calculation of total necessary capital to start the activity

The necessary capital for fixed assets – **240 000 EUR** (Table 4.3.2).

The necessary current assets for 1 month are given below.

Direct manufacturing expenses:

Raw materials:

127 433 EUR / 12 months = 10 619,42 EUR.

Energy in producing process (electricity, gas):

28 093 EUR / 12 months = 2 341,08 EUR.

Salaries and social insurance for producing workers:

38 751,91 EUR / 12 months = 3 229,33 EUR.

Indirect manufacturing expenses:

Auxiliary materials:

348 EUR / 12 months = 29 EUR.

Diesel for transport:

6 517 EUR / 12 months = 543,08 EUR.

Salaries and social insurance for auxiliary workers:

4 722,48 EUR / 12 months = 393,54 EUR.

Operating expenses:

Advertisements:

869 EUR / 12 months = 72,42 EUR.

Administrative building expenses (heating, electricity):

3 475 EUR / 12 months = 289,58 EUR.


Telephone, office expenses:
 927 EUR / 12 months = 77,25 EUR.

Salaries and social insurance for general and administrative personnel:
 51 259,38 EUR / 12 months = 4 271,62 EUR.

Taxes (without VAT and profit tax):
 2 328,48 EUR / 12 months = 194,04 EUR.

The necessary capital for current assets (for 1 month):

Direct manufacturing expenses (16 189,83 EUR)
 + Indirect manufacturing expenses (965,62 EUR)
 + Operating expenses (4 904,91 EUR)
 = 22 060,36 EUR ≈ **22 060 EUR**

	<p>Total necessary capital for fixed and current assets:</p> <p>240 000 + 22 060 = 262 060 EUR</p>
---	--

The selection of financing sources

Financing sources in the business model:

- Owners' capital.
- Long term debt (for 5 years).
- Credit line (for current assets).

Table 10.2.1

The financing sources of enterprise

ASSETS	EUR	CAPITAL	EUR
Fixed assets	240 000	Shareholders' equity	210 000
		Long-term debt	36 200
Current assets	22 060	Current liabilities	15 860
Total:	262 060		262 060

Debts:

- Long term debt (5 years, interest rate – 20%) – **36 200 EUR.**
- Credit line (to 100 000 EUR, interest rate – 10%) – **15 860 EUR.**

11. THE BALANCE-SHEET OF THE ACTIVITY START



The tasks of this chapter:

- ❑ To explain the main stages of simplified accounting process.
- ❑ To make the company's balance-sheet in business model.

11.1. The main stages of accounting process

The main stages of the accounting process are given in Figure 11.1.1.

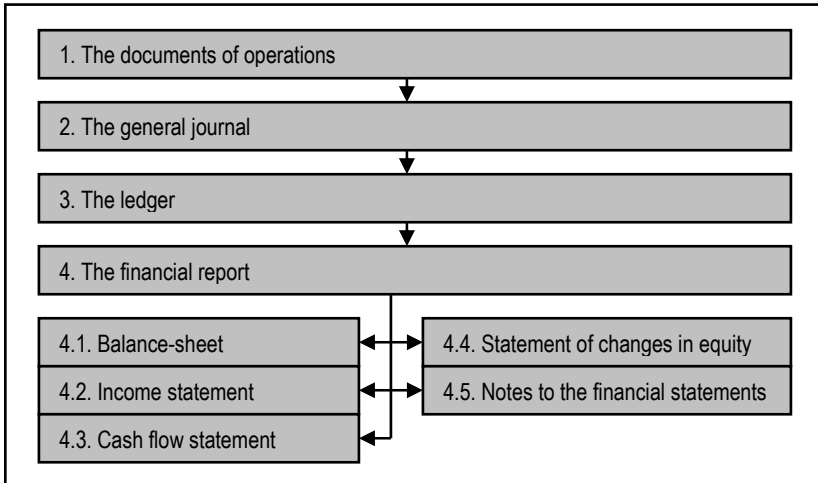


Figure 11.1.1. The main stages of accounting process

The documents of operations

The initial documents of accounting confirm every operation. These documents must be filled in the process of operation or just after it finishes.

The examples of initial documents of accounting:

- Selling of goods: invoice, check of cash register.
- Getting of money: till income order.
- Spending of money: till expenses order, sheet of payments.
- Money transfer: order of payments.

The general journal

The general journal is the register where all operations are registered in the chronological order. Every operation is registered according the principles of double-entry bookkeeping (Table 11.1.1).

Table 11.1.1

The registration of accounting operations

Entry	Change	Registration
Assets (in balance-sheet)	Increase	Debit
Costs (in income statement)	Decrease	Credit
Capital (in balance sheet)	Increase	Credit
Income (in income statement)	Decrease	Debit

The ledger

The ledger is the register where all operations related to every entry of balance-sheet and income statement can be seen. The example of ledger account is given in Table 11.1.2.

Table 11.1.2

The account of ledger

Date	Debit	Credit	Balance of the account	
			Debit	Credit
...
...



The balance of the account is calculated in the same side (debit or credit) where the increase of account is registered.

The financial report

The main aim of financial report is to present the financial condition of a company for the internal and external users of financial information (Figure 11.1.2).

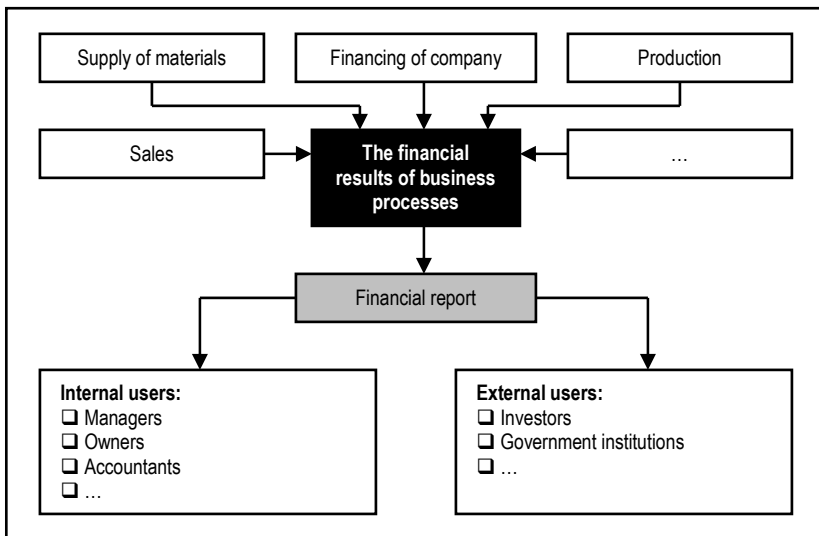


Figure 11.1.2. The aim of financial report

The statements of the financial report are characterized below.

1. Balance-sheet

In the balance-sheet the assets, owners' capital and liabilities are shown in the last day of the financial year. When the new company is established the balance-sheet must be prepared before the beginning of its activity. The structure of the balance-sheet is given in Table 11.1.3.

Table 11.1.3

The structure of the balance-sheet

ASSETS	EUR	CAPITAL	EUR
Fixed assets	...	Owners' capital	...
Current assets	...	Subsidies	...
...	...	Liabilities	...
Total assets:	...	Total capital:	...

The simplified explanation of the balance-sheet's sides can be:

- Assets – what a company has?
- Capital – what money a company used to buy the assets?

The accounting equation: Assets = Capital.

Fixed assets – the assets that company will use more than 1 year. Examples: buildings, land, cars, producing equipment, computers, furniture, etc.

The types of fixed assets:

- *Tangible assets* – land and buildings, motor vehicles, furniture, office equipment, computers, fixtures and fittings, plant and machinery.
- *Intangible assets* – software of computers, licences.
- *Financial assets* – securities of other companies (that a company has more than 1 year).
- *Other assets*.

Current assets – the assets that company will use less than 1 year. Examples: raw materials, production prepared to sell, office paper, ink for printers, money, etc.

The types of current assets:

- *Inventories* – the goods and materials that a company holds for the production purpose or resale. The classification of inventories:
 - *Raw materials* – materials and components scheduled for use in making a product.
 - *Work in process* – materials and components that have began their transformation to finished goods.
 - *Finished goods* – goods ready for sale to customers.
 - *Goods for resale* – returned goods that are salable.

- *Accounts receivable* – the debts of clients. When the goods are sold but clients have not paid money, their debts are shown as accounts receivable. Usually companies allow to pay the debts in 30, 60 or 90 days.
- *Prepaid expenses* for future services that will be used within a year.

Example:

The price of truck repair – 3 000 EUR.

The company has paid in advance – 1 000 EUR (prepaid expenses).

The rest (2 000 EUR) will be paid when the repairing is finished.

- *Cash and cash equivalents* – the money in a company and the bank account.

Owners' capital (shareholders' equity):

- Paid in capital – the money that company has got from shareholders (owners) when they bought shares.
- Reserves – the money accumulated by company from earned profit for the loss restitution. The companies must transfer not less than 5% of net profit until the reserves reach 10% of paid in capital.
- Retained earnings – the net profit that was left in company by shareholders.

Example:

Retained earnings in the balance-sheet (2014): 5 000 EUR.

The net profit of year 2015: 50 000 EUR.

The transfer to reserves from profit in 2015: $50\,000 \times 0,05 = 2\,500$ EUR.

The dividends for shareholders: 20 000 EUR.

Retained earnings (2015): $50\,000 - (2\,500 + 20\,000) = 27\,500$ EUR.

Retained earnings in balance sheet (2015): $5\,000 + 27\,500 = 32\,500$ EUR.

Subsidies (additional part in capital) are the support for a company from the government or international funds.

Liabilities are the debts of a company:

- *Current liabilities* – the debts of a company that must be repaid in next financial year.
- *Long term debts* – the debts of a company that must be repaid later than next financial year.

2. Income statement

In the income statement all income and costs of the financial year are registered and the different types of enterprise's profit are calculated (Table 11.1.4).

Table 11.1.4

The structure of the income statement

	EUR
Revenue	
– Cost of sales	
= Gross profit	
– Operating expenses	
= Operating profit	
+ Net other income	
+ Net financial and investment income	
= Profit before income tax	
– Income (profit) tax expense	
= Profit of the year (Net income)	

Revenue (sales) – the amount of revenue generated by the company in the financial year (without the value added tax).

Cost of goods sold – the amount represents costs directly associated with making or acquiring the products.

Gross profit – the amount is determined by subtracting the cost of goods sold from net sales. It does not include any operating expense or income taxes.

Operating expenses are the daily expenses incurred in the operation of the company. The order in which the expenses are listed in the income statement varies among businesses. One method is to list them in order of size, beginning with the larger items. Miscellaneous expense is usually shown as the last item, regardless of

size. Examples: salaries of managers and general personnel, communication expenses, heating of buildings, electricity, taxes (except VAT and profit tax).

The groups of operating expenses in the income statement:

- Sale expenses.
- General and administrative costs (explained in Chapter 8.1).

Operating profit (net operating income) represents the amount of income earned in the company's main activity before paying income taxes.

Other income is the gain or loss on the sale of assets and other (not main) activity (net income).

Financial and investment income: the interest, dividend, securities and other financial income (net income).

Profit before income tax: Operating profit + Other income + Financial income.

Income tax is calculated according to Profit Tax Law as the 15% of profit before income tax.

Profit of the year (net income). This type of profit is basically the bottom line of income statement. If it is positive, the company is profitable. If it is negative, the company is loss-making. This is the profit or loss the business has made after all its income and all of its expenses have been taken into consideration.

3. Cash flow statement

The cash flow statement reports the cash generated and used during the time interval specified in its heading.

The cash flow types:

- Positive cash flows – the money that a company gets in the financial year.
- Negative cash flows – the money that a company pays in the financial year.

The types of enterprise's activity:

- Operating activity – the main activity of a company (producing, trade, services).
- Investing activity – the cash flows of buying and selling the investment assets.
- Financing activity – the cash flows of debts, interest, dividends and securities.

The cash flow statement of a year includes only real money receiving and spending in this year.

Example:

The cash flows of a company in 2014:

- Money from customers of sold production – 1 000 000 EUR.
- Payments for suppliers – 300 000 EUR.
- Equipment bought in this year – 200 000 EUR.
- Sold building – 50 000 EUR.
- Loan repayments – 100 000 EUR.
- Interest payments – 10 000 EUR.
- Loan received – 400 000 EUR.

The cash flow statement is given in Table 11.1.5.

Table 11.1.5

The example of cash flow statement

		EUR
A.	Cash flows from operating activities:	
1.	Money from customers of sold production (+)	1 000 000
2.	Payments for suppliers (-)	-300 000
	Net cash flow from operating activities	700 000
B.	Cash flows from investing activities:	
1.	Equipment bought in this year (-)	-200 000
2.	Sold building (+)	50 000
	Net cash flow from investing activities	-150 000
C.	Cash flows from financing activities:	
1.	Loan repayments (-)	-100 000
2.	Interest payments (-)	-10 000
3.	Loan received (+)	400 000
	Net cash flow from financing activities	290 000
	Net cash flow of the year	840 000

The net cash flow is the difference between the positive and negative cash flows:

$$\text{Net cash flow} = \text{Positive cash flows} - \text{Negative cash flows} \quad (11.1.1)$$

4. Statement of changes in equity

The statement of changes in equity shows the changes of the shareholders' capital in the financial year.

Example:

The owners' capital operations of a company in 2014:

- The new shares were issued. The value of new shares – 500 000 EUR.
- The activity of a company in 2014 was profitable. The transfer from earned net income to the legal reserve – 5 000 EUR.
- The company from net income increased other (not compulsory) reserves by 10 000 EUR.
- The retained earnings from net income (the money left in the company by the owners) increased by 20 000 EUR.

The statement of changes in equity is given in Table 11.1.6.

Table 11.1.6

The statement of changes in equity

	Share capital	Legal reserve	Other reserves	Retained earnings	Total
Balance-sheet (2013)	1 000 000	20 000	6 000	80 000	1 106 000
Balance-sheet (2014)	1 500 000	25 000	16 000	100 000	1 641 000

5. Notes to the financial statements

In the notes to the financial statements a company presents the significant changes in previous financial reports and their reasons. Every entry of the balance-sheet and income statement is explained. The significant change usually is 5% or higher.

Example:

In 2014 the long term debt of a company increased by 100 000 EUR because the company bought a warehouse and got the loan from bank. The loan must be repaid in 3 years (Table 11.1.7).

Table 11.1.7

The change of liabilities in the balance-sheet (EUR)

	2013	2014
Long-term debt	200 000	300 000

11.2. The business process model: Part 8

The operations before the start of enterprise's activity

Financing of enterprise:

1. The shares issued: +210 000 EUR.
2. Long-term debt: +36 200 EUR.
3. Short-term debt (credit line): +15 860 EUR.

Fixed assets:

4. Building: -130 000 EUR.
5. Car: -30 000 EUR.
6. Production equipment: -70 000 EUR.
7. Assets of administrative room: -7 000 EUR.
8. Software for computer: -3 000 EUR.

Current assets:

9. Raw materials (for 1 month): -10 619 EUR.

The general journal

The general journal of business model is given in Table 11.2.1.

Table 11.2.1

The general journal of business model

Date		Debit	Credit
2015-11-12	Money	210 000	
	Paid in capital		210 000
2015-11-28	Money	36 200	
	Long-term bank credit		36 200
2015-11-29	Money	15 860	
	Short-term bank credit		15 860
2015-12-04	Building	130 000	
	Money		130 000
2015-12-05	Car	30 000	
	Money		30 000
2015-12-06	Production equipment	70 000	
	Money		70 000
2015-12-07	Assets of administrative room	7 000	
	Money		7 000
2015-12-08	Computer software	3 000	
	Money		3 000
2015-12-16	Raw materials	10 619	
	Money		10 619

The ledger

All accounts of the ledger in business model are given in tables below.

Table 11.2.2

Paid in capital

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-11-12		210 000		210 000

Table 11.2.3

Money

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-11-12	210 000		210 000	
2015-11-28	36 200		246 200	
2015-11-29	15 860		262 060	
2015-12-04		130 000	132 060	
2015-12-05		30 000	102 060	
2015-12-06		70 000	32 060	
2015-12-07		7 000	25 060	
2015-12-08		3 000	22 060	
2015-12-16		10 619	11 441	

Table 11.2.3

Long-term bank credit

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-11-28		36 200		36 200

Table 11.2.4

Short-term bank credit

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-11-29		15 860		15 860

Table 11.2.5

Building

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-04	130 000		130 000	

Table 11.2.6

Car

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-05	30 000		30 000	

Table 11.2.7

Production equipment

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-06	70 000		70 000	

Table 11.2.8

Assets of administrative room

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-07	7 000		7 000	

Table 11.2.9

Computer software

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-08	3 000		3 000	

Table 11.2.10

Raw materials

Date	Debit	Credit	Balance of the account	
			Debit	Credit
2015-12-16	10 619		10 619	

The balance-sheet starting the activity of enterprise

Before starting the activity the company must submit the balance-sheet (Table 11.2.11) for the state's juridical persons registry.

Table 11.2.11

The balance-sheet

ASSETS	EUR	CAPITAL	EUR
A. Fixed assets	240 000	C. Owners' capital	210 000
Tangible assets	237 000	- Paid in capital	210 000
- Building	130 000	D. Subsidies	0
- Car	30 000	E. Liabilities	52 060
- Production equipment	70 000	Long-term liabilities	36 200
- Administrative assets	7 000	- Long-term bank credit	36 200
Intangible assets	3 000	Short-term liabilities	15 860
- Computer software	3 000	- Short-term bank credit	15 860
B. Current assets	22 060		
Inventories	10 619		
- Raw materials	10 619		
Money	11 441		
Total assets:	262 060	Total capital:	262 060

12. THE INCOME AND COSTS CALCULATION



The tasks of this chapter:

- To explain the depreciation costs of fixed assets.
- To make the company's income statement in business model.

12.1. The calculation of depreciation costs

To understand what is the aim of fixed assets depreciation costs calculation the simple example is given below.

Table 12.1.1

The simplified income statement (2014)

	EUR
Revenue	100 000
– Costs (materials, salaries, energy, etc.)	70 000
= Profit before income tax	30 000
– Income (profit) tax expense	$30\,000 \times 0,15 = 4\,500$
= Profit of the year (Net income)	25 500

In 2014 the company bought a car (50 000 EUR). This is also expenditures of a year, but company cannot write all this sum in income statement of 2014. The money must be divided into several future periods as **annual depreciation costs** (Figure 12.1.1).

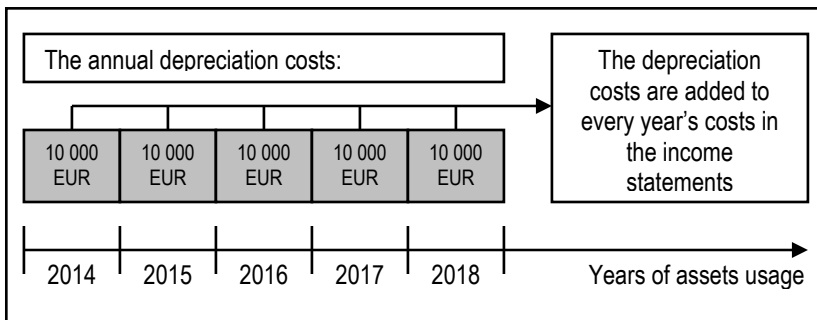


Figure 12.1.1. The aim of annual depreciation costs

The annual depreciation costs (as expenditures of every year) reduce the profit tax paid for government (Table 12.1.2).

Table 12.1.2

The simplified income statement (2014)

	EUR
Revenue	100 000
– Costs (materials, salaries, energy, etc.)	$70\,000 + 10\,000 = 80\,000$
= Profit before income tax	20 000
– Income (profit) tax expense	$20\,000 \times 0,15 = 3\,000$
= Profit of the year (Net income)	27 000

The method of depreciation calculation for the different assets (buildings, cars, computers, etc.) and minimal number of years are determined in **Profit tax law** (the extract is given in Table 12.1.3).

Table 12.1.3

The depreciation calculation methods for different types of assets

Fixed assets	Method	Minimum years of assets usage
Buildings	Straight-line	15
Producing equipment	Straight-line, double-declining balance	5
Furniture	Straight-line	6
Computers	Straight-line, double-declining balance	3
...

10%

The liquidation value cannot be higher than 10% of the assets price.

The methods of annual depreciation costs calculation:

1. Straight-line depreciation.
2. Production depreciation.
3. Sum-of-years depreciation.
4. Double-declining balance method.

Straight-line depreciation

The annual depreciation cost:

$$N = \frac{V_1 - V_2}{T} \quad (12.1.1)$$

V_1 – the price of the assets;

V_2 – the liquidation value of the assets (e.g. the money expected to get from scrap metal);

T – number of years (the assets expected to use in company).

Example. The price of car – 21 000 EUR. The liquidation value – 1 000 EUR. The car will be used for 4 years.

The annual depreciation cost:

$$N = \frac{V_1 - V_2}{T} = \frac{21000 - 1000}{4} = 5000 \text{ EUR} \quad (12.1.2)$$

Table 12.1.4

The depreciation costs (EUR)

Year	Value of assets in the beginning of year	The annual depreciation cost	Value of assets in the end of year
1	21 000	5 000	16 000
2	16 000	5 000	11 000
3	11 000	5 000	6 000
4	6 000	5 000	1 000



The calculation of depreciation costs using “Microsoft Excel”

The annual depreciation costs can be calculated using function SLN.

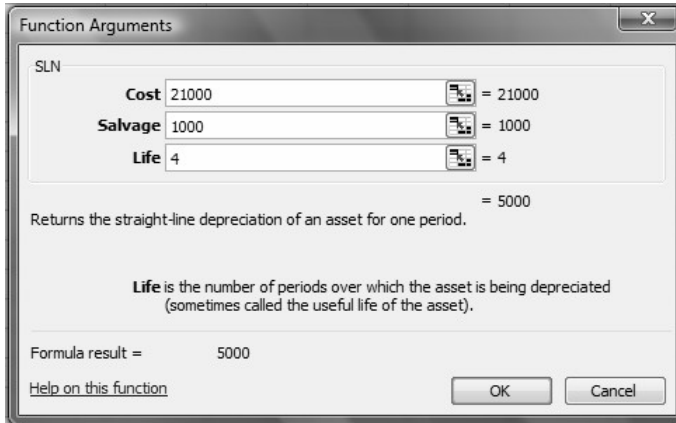


Figure 12.1.2. The window of function SLN

Production depreciation

The annual depreciation cost:

$$N = \frac{(V_1 - V_2) \cdot P}{P_{\max}} \quad (12.1.3)$$

P – the quantity of production produced in a year;

P_{\max} – the maximal quantity of production that producing equipment is able to produce (in all years of use).

Example. The price of producing machine – 21 000 EUR. The liquidation value – 1 000 EUR. The equipment will be used for 4 years. The machine is able to produce 10 000 products in 4 years.

The products produced in every year:

- 1st year – 1 000 products;
- 2nd year – 3 000 products;
- 3rd year – 4 000 products;
- 4th year – 2 000 products.

The annual depreciation costs:

$$N_1 = \frac{(V_1 - V_2) \cdot P_1}{P_{\max}} = \frac{(21000 - 1000) \cdot 1000}{10000} = 2000 \text{ EUR} \quad (12.1.4)$$

$$N_2 = \frac{(V_1 - V_2) \cdot P_2}{P_{\max}} = \frac{(21000 - 1000) \cdot 3000}{10000} = 6000 \text{ EUR} \quad (12.1.5)$$

$$N_3 = \frac{(V_1 - V_2) \cdot P_3}{P_{\max}} = \frac{(21000 - 1000) \cdot 4000}{10000} = 8000 \text{ EUR} \quad (12.1.6)$$

$$N_4 = \frac{(V_1 - V_2) \cdot P_4}{P_{\max}} = \frac{(21000 - 1000) \cdot 2000}{10000} = 4000 \text{ EUR} \quad (12.1.7)$$

Table 12.1.5

The depreciation costs (EUR)

Year	Value of assets in the beginning of year	The annual depreciation cost	Value of assets in the end of year
1	21 000	2 000	19 000
2	19 000	6 000	13 000
3	13 000	8 000	5 000
4	5 000	4 000	1 000

Sum-of-years depreciation

The annual depreciation cost:

$$N = \frac{(V_1 - V_2) \cdot (T - i + 1) \cdot 2}{T \cdot (T + 1)} \quad (12.1.8)$$

i – the number of a year the depreciation is being calculated.

Example. The price of car – 21 000 EUR. The liquidation value – 1 000 EUR. The car will be used for 4 years.

The annual depreciation costs:

$$N_1 = \frac{(21000 - 1000) \cdot (4 - 1 + 1) \cdot 2}{4 \cdot (4 + 1)} = 8000 \text{ EUR} \quad (12.1.9)$$

$$N_2 = \frac{(21000 - 1000) \cdot (4 - 2 + 1) \cdot 2}{4 \cdot (4 + 1)} = 6000 \text{ EUR} \quad (12.1.10)$$

$$N_3 = \frac{(21000 - 1000) \cdot (4 - 3 + 1) \cdot 2}{4 \cdot (4 + 1)} = 4000 \text{ EUR} \quad (12.1.11)$$

$$N_4 = \frac{(21000 - 1000) \cdot (4 - 4 + 1) \cdot 2}{4 \cdot (4 + 1)} = 2000 \text{ EUR} \quad (12.1.12)$$

Table 12.1.6

The depreciation costs (EUR)

Year	Value of assets in the beginning of year	The annual depreciation cost	Value of assets in the end of year
1	21 000	8 000	13 000
2	13 000	6 000	7 000
3	7 000	4 000	3 000
4	3 000	2 000	1 000



The calculation of depreciation costs using “Microsoft Excel”

The annual depreciation costs can be calculated using function SYD.

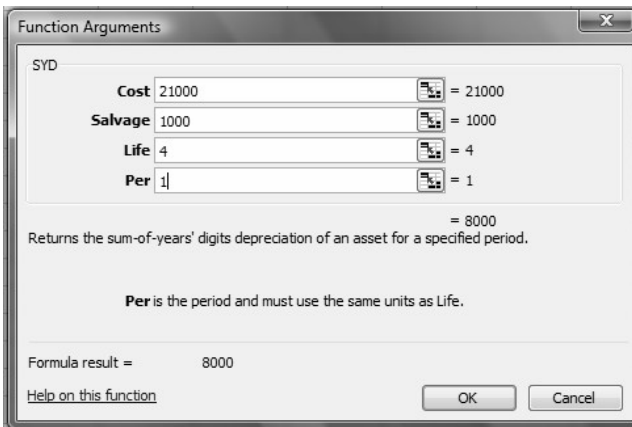


Figure 12.1.3. The window of function SYD

Double-declining balance method

The annual depreciation costs (except the last year):

$$N = L_i \cdot n \quad (12.1.13)$$

L_i – the value of assets in the beginning of a year;

n – depreciation percentage.

Depreciation percentage:

$$n = \frac{100}{T} \cdot 2 \quad (12.1.14)$$

The annual depreciation cost of last year:

$$N = L_i - V_2 \quad (12.1.15)$$

Example. The price of equipment – 21 000 EUR. The liquidation value – 1 000 EUR. The equipment will be used for 5 years.

Depreciation percentage:

$$n = \frac{100}{T} \cdot 2 = \frac{100}{5} \cdot 2 = 40\% = 0,4 \quad (12.1.16)$$

The depreciation cost of 1st year:

$$N_1 = L_1 \cdot n = 21\,000 \cdot 0,4 = 8\,400 \text{ EUR} \quad (12.1.17)$$

The depreciation cost of 2nd year:

$$N_2 = L_2 \cdot n = 12\,600 \cdot 0,4 = 5\,040 \text{ EUR} \quad (12.1.18)$$

The depreciation cost of 3rd year:

$$N_3 = L_3 \cdot n = 7\,560 \cdot 0,4 = 3\,024 \text{ EUR} \quad (12.1.19)$$

The depreciation cost of 4th year:

$$N_4 = L_4 \cdot n = 4\,536 \cdot 0,4 = 1\,814,4 \text{ EUR} \quad (12.1.20)$$

The depreciation cost of the last year:

$$N_5 = L_5 - V_2 = 2\,721,6 - 1\,000 = 1\,721,6 \text{ EUR} \quad (12.1.21)$$

Table 12.1.7

The depreciation costs (EUR)

Year	Value of assets in the beginning of year	The annual depreciation cost	Value of assets in the end of year
1	21 000	8 400	12 600
2	12 600	5 040	7 560
3	7 560	3 024	4 536
4	4 536	1 814,4	2 721,6
5	2 721,6	1 721,6	1 000



The calculation of depreciation costs using “Microsoft Excel”

The annual depreciation costs can be calculated using function DDB.

Function Arguments

DDB

Cost: 21000 = 21000

Salvage: 1000 = 1000

Life: 5 = 5

Period: 1 = 1

Factor: = number

= 8400

Returns the depreciation of an asset for a specified period using the double-declining balance method or some other method you specify.

Period is the period for which you want to calculate the depreciation. Period must use the same units as Life.

Formula result = 8400

[Help on this function](#)

OK Cancel

Figure 12.1.4. The window of function DDB

In program's “Microsoft Excel” functions *Cost* is the price of assets, *Salvage* is the liquidation value, *Life* is the number of years that the assets will be depreciated, and *Period* is the number of a year for which the annual depreciation cost is being calculated.

12.2. The business process model: Part 9

The fixed assets' annual depreciation costs of 1st year company's activity are calculated in Table 12.2.1.

Table 12.2.1

The depreciation costs (EUR)

Fixed assets	Price, EUR	Depreciation method	Usage of assets (years)	Liquidation value, EUR	Annual depreciation cost, EUR
Building	130 000	Straight-line	20	2 600	6 370
Car	30 000	Straight-line	10	1 200	2 880
Producing equipment	70 000	Straight-line	10	1 750	6 825
Assets of administrative room	7 000	Straight-line	10	70	693
Software	3 000	Straight-line	5	0	600
Total:	240 000	-	-	-	17 368

Price of product (without VAT) – 1,30 EUR/kg.

Revenue: 1,30 EUR × 240 000 kg = **312 000 EUR**.

Cost of sales:

Direct manufacturing expenses (194 277,91 EUR)
 + Indirect manufacturing expenses (11 587,48 EUR)
 + Depreciation of fixed assets:

- Building (6 370 EUR)
- Car (2 880 EUR)
- Producing equipment (6 825 EUR)

= 221 940,39 EUR ≈ **221 940 EUR**

Operating expenses:

Operating expenses (58 858,86 EUR)
 + Depreciation of fixed assets:

- Assets of administrative room (693)
 - Software (600)
- = 60 151,86 EUR ≈ **60 152 EUR**

Net financial and investment income:

- Long term debt interest (7 240 EUR)
- Credit line interest (1 586 EUR)

Total: **8 826 EUR**

Profit tax: $21\,082 \cdot 0,15 = 3\,162,3$ EUR ≈ **3 162 EUR**

The income statement of the business model is given in Table 12.2.2.

Table 12.2.2

The income statement of the business model

	EUR
Revenue	312 000
– Cost of sales	-221 940
= Gross profit	90 060
– Operating expenses	-60 152
= Operating profit	29 908
+ Net other income	0
+ Net financial and investment income	-8 826
= Profit before income tax	21 082
– Income (profit) tax expense	-3 162
= Profit of the year (Net income)	17 920

13. PLANNING OF CASH FLOWS



The tasks of this chapter:

- ❑ To explain the peculiarities of cash flows.
- ❑ To model the company's cash flow statement.

13.1. The main peculiarities of cash flows

The differences between income statement and cash flow statement:

- Revenue \neq Positive cash flow.
- Expenses \neq Negative cash flow.

Example:

If the goods are sold in 2014 the revenue (10 000 EUR) will be registered in 2014. The cash flow must be registered in the year when the company really gets the money: 8 000 EUR in 2014 and 2 000 EUR in 2015 (Figure 13.1.1).

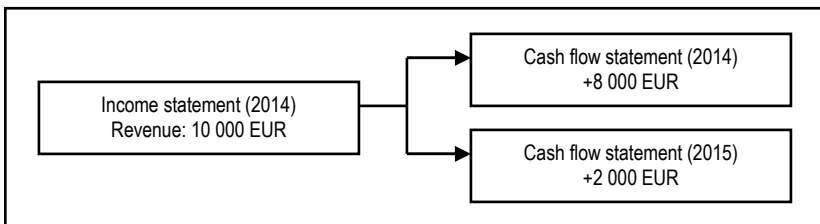


Figure 13.1.1. The example of cash flow registration in accounting

To show all positive and negative cash flows of a financial year the enterprises prepare the cash flow statements. The structure of cash flow statement is given in Table 11.1.5. To plan the cash flows of one month the enterprises use the cash flows plan (Table 13.1.1).

Table 13.1.1

The structure of cash flow plan

	EUR
1. The money in the beginning of a month	
2. Positive cash flows:	
...	
Total positive cash flows	
3. All money of a month (1 + 2)	
4. Negative cash flows:	
...	
Total negative cash flows	
5. The money in the end of a month (3 – 4)	

If the money in the end of a month is positive or equal to 0 the company will have the sufficient quantity of money to make all payments of this month. If this entry is negative the company must find the external short-term financing sources to make all payments of the month.

13.2. The business process model: Part 10

The cash flow plan of a month

Price of the product including VAT: $1,30 \text{ EUR} \times 1,21 = 1,57 \text{ EUR}$

Money inflow for the production sold: $20\,000 \text{ kg} \times 1,57 \text{ EUR} = 31\,400 \text{ EUR}$

VAT: $0,27 \text{ EUR} \times 20\,000 \text{ kg} = 5\,400 \text{ EUR}$

Environment pollution tax (package): $1\,250,4 \text{ EUR} / 12 = 104,2 \text{ EUR}$

Environment pollution tax (fuel): 38,08 EUR / 12 = 3,17 EUR

Immovable property tax: 1 040 EUR / 12 = 86,67 EUR

Profit tax: 3 162 EUR / 12 = 263,5 EUR

Table 13.1.2

The cash flow plan of 1 month

	EUR
1. The money in the beginning of a month	11 441
2. Positive cash flows:	
- Money inflow for the production sold	31 400
Total positive cash flows	31 400
3. All money of a month	42 841
4. Negative cash flows:	
- Raw materials	10 619
- Energy	2 341
- Salaries and social insurance payments	7 894
- Auxiliary materials	29
- Diesel for transport	543
- Advertisement	72
- Administrative building expenditures	290
- Office and telephone expenditures	77
- VAT	5 400
- Environment pollution tax (package)	104
- Environment pollution tax (fuel)	3
- Immovable property tax	87
- Profit tax	264
Total negative cash flows	27 723
5. The money in the end of a month	15 118

The cash flow statement of a year

Money inflow for the production sold: 240 000 kg × 1,57 EUR = 376 800 EUR

Taxes (without VAT and profit tax) – 2 328 EUR

VAT: 0,27 EUR × 240 000 kg = 64 800 EUR

Profit tax: 3 162 EUR

Total taxes: 2 328 + 64 800 + 3 162 = 70 290 EUR

Table 13.1.3

The cash flow statement of first year

		EUR
A.	Cash flows from operating activities:	
1.	Money inflow for the production sold	376 800
2.	Salaries and social insurance payments	-94 734
3.	Raw materials	-127 433
4.	Energy	-28 093
5.	Auxiliary materials	-348
6.	Diesel for transport	-6 517
7.	Advertisement	-869
8.	Administrative building expenditures	-3 475
9.	Taxes	-70 290
10.	Office and telephone expenditures	-927
	Net cash flow from operating activities	44 114
B.	Cash flows from investing activities:	
1.	Building	-130 000
2.	Car	-30 000
3.	Producing equipment	-70 000
4.	Assets of administrative room	-7 000
5.	Software	-3 000
	Net cash flow from investing activities	-240 000
C.	Cash flows from financing activities:	
1.	Shares	210 000
2.	Long-term debt	36 200
3.	Short-term debt	15 860
4.	Interest payments	-8 826
	Net cash flow from financing activities	253 234
	Net cash flow of the year	57 348

14. THE ESTIMATION OF PROJECT'S EFFICIENCY



The tasks of this chapter:

- To explain the methods of project's efficiency assessment.
- To estimate the efficiency of developed business model.

14.1. The methods of project's efficiency assessment

Financial ratios

1. Profitability ratios

1. Gross profit margin:

$$GPM = \text{Gross profit} / \text{Net sales} \quad (14.1.1)$$

The ratio indicates the proportion of gross profit in sales (must be ≥ 0).

2. Main activity profit margin:

$$APM = (\text{Net sales} - (\text{Cost of goods sold} + \text{Operating Expenses})) / \text{Net sales} \quad (14.1.2)$$

The ratio indicates the proportion of operating profit in sales (must be ≥ 0).

3. Net profit margin:

$$NPM = \text{Net income} / \text{Net sales} \quad (14.1.3)$$

The ratio indicates the proportion of net income in sales (must be ≥ 0).

4. Return on assets:

$$ROA = \text{Net income} / \text{Total assets} \quad (14.1.4)$$

The ratio indicates how many EUR of net income earns 1 EUR of total assets (must be ≥ 0).

5. Return on equity:

$$ROE = \text{Net income} / \text{Shareholders' equity} \quad (14.1.5)$$

The ratio indicates how many EUR of net income earns 1 EUR of shareholders' equity (must be ≥ 0).

2. Solvency ratios

1. Current ratio:

$$CR = \text{Current assets} / \text{Current liabilities} \quad (14.1.6)$$

A company is able to repay the short term debts if $CR \geq 1$.

2. Quick ratio:

$$QR = (\text{Current assets} - (\text{Inventories} + \text{Prepayments})) / \text{Current liabilities} \quad (14.1.7)$$

A company is able to repay the short term debts quickly if $QR \geq 1$.

3. Cash ratio:

$$CSR = \text{Cash and marketable securities} / \text{Current liabilities} \quad (14.1.8)$$

The ratio indicates what proportion of current liabilities a company is able to repay by cash and money in bank's account.

4. Solvency ratio:

$$SR = \text{Shareholders' equity} / \text{Total liabilities} \quad (14.1.9)$$

The ratio indicates by how many EUR of shareholders' equity the 1 EUR of liabilities is covered (must be ≥ 1).

3. Capital structure ratios

1. Debt ratio:

$$DR = \text{Total liabilities} / \text{Total assets} \quad (14.1.10)$$

The ratio indicates what proportion of assets was bought using loans (must be $\leq 0,5$).

4. Turnover (efficiency) ratios

1. Fixed assets turnover ratio:

$$FTA = \text{Net sales} / \text{Fixed assets} \quad (14.1.11)$$

The ratio indicates how many EUR of sales earns 1 EUR of fixed assets (the higher than 0, the better).

2. Assets turnover ratio:

$$AT = \text{Net sales} / \text{Total assets} \quad (14.1.12)$$

The ratio indicates how many EUR of sales earns 1 EUR of total assets (the higher than 0, the better).

The break-point

The break-point indicates the minimal quantity of products must be sold in a year to have the enterprise's activity not loss-making (Figure 14.1.1).

Calculation by using income statement:

$$P_{cr} = \frac{VS}{K_{BP}} \quad (14.1.13)$$

VS – fixed costs;
 K_{BP} – gross profitability.

$$K_{BP} = BP / P \quad (14.1.14)$$

BP – gross profit;
 P – revenue.

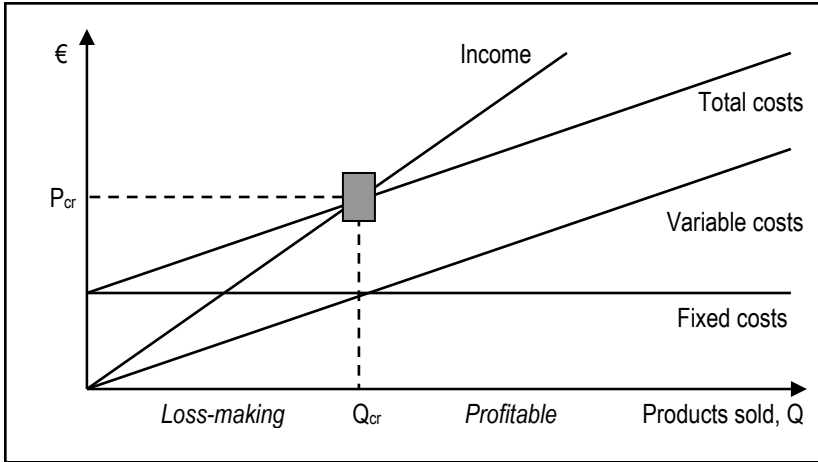


Figure 14.1.1. The break-point

Net present value (NPV)

Calculation:

$$NPV = \sum CF_i \cdot u_{i;k} \quad (14.1.15)$$

CF_i – net cash flow of a year;
 $u_{i;k}$ – discounting coefficient.

Discounting coefficient:

$$u_{i;k} = \frac{1}{(1 + k)^i} \quad (14.1.16)$$

i – number of years from the beginning of company's activity;
 k – discount rate.

The discount rate is often used as the highest deposit interest rate of commercial banks. Also in the EU investment projects it is recommended 5%.

If $NPV > 0$ the project is acceptable, $NPV \leq 0$, the project is rejectable.

The NPV can be calculated using „Microsoft Excel“ function NPV (Figure 14.1.2).

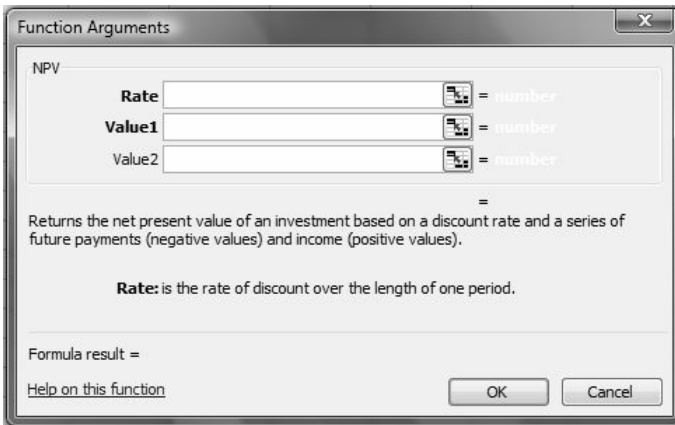


Figure 14.1.2. The window of function NPV

Internal return rate (IRR)

IRR shows the least interest rate that banks must pay for the deposits (1 year) in order to refuse the project.

If discount rate (deposit interest rate) < IRR, the project is acceptable.

The IRR can be calculated using „Microsoft Excel“ function IRR (Figure 14.1.3).

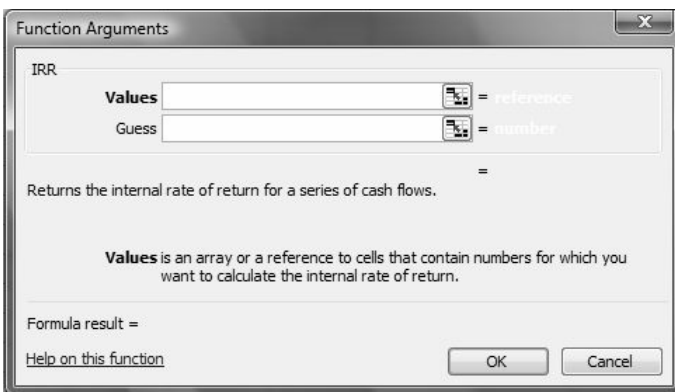


Figure 14.1.3. The window of function IRR

Return period of a project

The return period:

$$AP = t + \frac{I_{t+1}}{CF_{t+1}} \quad (14.1.17)$$

t – the number of years before return of investments;

I_{t+1} – not returned investments in the beginning of year $t + 1$;

CF_{t+1} – the net cash flow of year $t + 1$.

The return period indicates after what time the money invested into the project will be returned to the owners of enterprise (Figure 14.1.4).

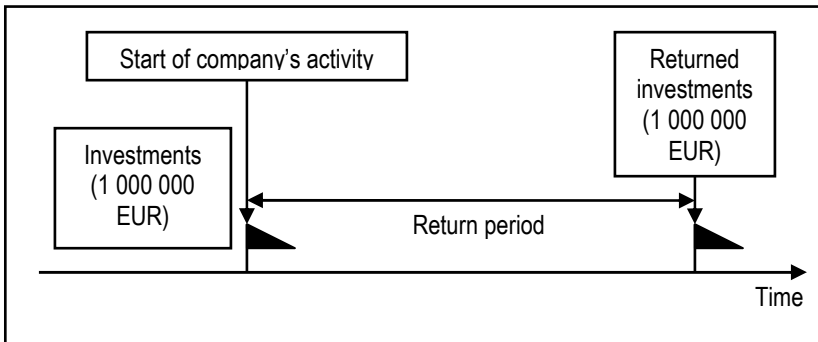


Figure 14.1.4. The return period of a project

14.2. The business process model: Part 11

Financial ratios

The financial ratios of developed business model are calculated in Tables 14.2.1 – 14.2.4.

Table 14.2.1

The profitability ratios of business model

	2015-12-31
Gross profit margin	0,2887
Main activity profit margin	0,0959
Net profit margin	0,0574
Return on assets	0,0684
Return on equity	0,0853

The profitability analysis results:

- The proportion of gross profit in sales is 28,87%, variable costs – 71,13%.
- The proportion of operating profit in sales is 9,59%, variable and fixed costs – 90,41%.
- The proportion of net income in sales is 5,74%.
- 1 EUR of total assets earns 0,0684 EUR of net income.
- 1 EUR of shareholders' equity earns 0,0853 EUR of net income.

Table 14.2.2

The solvency ratios of business model

	2015-12-31
Current ratio	1,3909
Quick ratio	0,7214
Cash ratio	0,7214
Solvency ratio	4,0338

The solvency analysis results:

- The company is solvent in 1 financial year perspective because using the current assets the company is able to repay 1,3909 times more current liabilities than it has.
- The company can quickly repay 72,14% of short term debts.
- The company is able to repay 72,14% of current liabilities by money that it has.
- The 1 EUR of liabilities is covered by 4,0338 EUR of the shareholders' equity.

Table 14.2.3

The capital structure ratio of business model

	2015-12-31
Debt ratio	0,1987

The 19,87% of assets were bought by using loans. The ratio does not exceed the safe level of 50%.

Table 14.2.4

The turnover ratios of business model

	2015-12-31
Fixed assets turnover	1,3
Assets turnover	1,1906

The efficiency analysis results:

- The 1 EUR of fixed assets earns 1,3 EUR of revenue.
- The 1 EUR of total assets earns 1,1906 EUR of revenue.

The break-point

The data for the calculation of break point:

- Fixed costs (operating expenses) – 60 152 EUR (Table 12.2.2).
- Gross profit margin – 0,2887 (Table 14.2.1).

The break-point:

$$P_{cr} = \frac{VS}{K_{BP}} = \frac{60152}{0,2887} = 208\,355 \text{ EUR} \quad (14.2.1)$$

The year's revenue of company must be higher than 208 355 EUR to ensure the profitable performance. The predicted revenue is 312 000 EUR (Table 12.2.2).

Net present value (NPV)

The alternative for the enterprise's project is to keep the money as the bank deposit.

The discount rate is 1,05% as the highest interest rate of the 1 year's deposits (Table 14.2.5).

The project will be estimated for the 10 years period.

Table 14.2.5

The interest rates of the 1 year's deposits in Lithuanian banks (2015-02-23)

Bank	Interest rate (%)
Medicinos bankas	0,85
Šiaulių bankas	1
DNB	0,1
SEB	0,1
Finasta	1,05
Danske Bank	0,25
Nordea	0,45
Citadele	1,01
Swedbank	0,2

The predicted cash flows of years 2016 – 2020 are given in Table 14.2.6.

Table 14.2.6

The cash flows of years 2016 – 2020 (EUR)

	2016	2017	2018	2019	2020
NCF* from operating activities	44 114	44 114	44 114	44 114	44 114
NCF* from investing activities	-240 000	0	0	0	0
NCF* from financing activities	253 234	-30 100	-12 840	-11 440	-18 240
Net cash flow of the year	57 348	14 014	31 274	32 674	25 874

* NCF – net cash flow.

The predicted cash flows from financial activity of years 2016 – 2020 are given in Table 14.2.7.

Table 14.2.7

The predicted cash flows from financial activity of years 2016 – 2020 (EUR)

	2016	2017	2018	2019	2020
Shares	210 000	0	0	0	0
Long-term debt	36 200	-7 000	-7 000	-7 000	-15 200
Short-term debt	15 860	-15 860	0	0	0
Interest	-8 826	-7 240	-5 840	-4 440	-3 040
NCF from financing activities	253 234	-30 100	-12 840	-11 440	-18 240

The long-term debt (36 200 EUR, interest rate is 20%) will be repaid for bank in 5 years by different payments method. The long-term debt repayment schedule is given in Table 14.2.8.

Table 14.2.8

The long-term debt repayment schedule (EUR)

Year	Not repaid credit	Repayable credit	Interest	Payment
2016	36 200	0	7 240	7 240
2017	36 200	7 000	7 240	14 240
2018	29 200	7 000	5 840	12 840
2019	22 200	7 000	4 440	11 440
2020	15 200	15 200	3 040	18 240
Total	-	36 200	27 800	64 000

The short-term credit will be repaid in the beginning of 2017. In this year the interest for bank will not be paid.

The predicted cash flows of years 2021 – 2025 are given in Table 14.2.9.

Table 14.2.9

The cash flows of years 2021 – 2025 (EUR)

	2021	2022	2023	2024	2025
NCF* from operating activities	44 114	44 114	44 114	44 114	44 114
NCF* from investing activities	0	0	0	0	0
NCF* from financing activities	0	0	0	0	0
Net cash flow of the year	44 114	44 114	44 114	44 114	44 114

* NCF – net cash flow.

The predicted cash flows from financial activity of years 2021 – 2025 are given in Table 14.2.10.

Table 14.2.10

The predicted cash flows from financial activity of years 2021 – 2025 (EUR)

	2016	2017	2018	2019	2020
Shares	0	0	0	0	0
Long-term debt	0	0	0	0	0
Short-term debt	0	0	0	0	0
Interest	0	0	0	0	0
NCF from financing activities	0	0	0	0	0

The predicted cash flows of years 2016 – 2025 are given in Table 14.2.11. Also the net present value (NPV) of the project is calculated.

Table 14.2.11

The net present value of the project (EUR)

Year	Net cash flow
Investments	-262 060
2016	57 348
2017	14 014
2018	31 274
2019	32 674
2020	25 874
2021	44 114
2022	44 114
2023	44 114
2024	44 114
2025	44 114
NPV	96 516



The NPV > 0, so the investment project is acceptable.

Internal return rate (IRR)

The IRR of the project is 7,13%.

The discount rate of the project (r) is 1,05%.



The IRR > r , so the investment project is acceptable.

It would be worth to keep the money as bank deposit if the interest rate would be 7,13% or higher.

Return period of the project

The returned investments in the end of year are calculated below.

$$P_1 = CF_1 = 57\,348 \text{ EUR}$$

$$P_2 = CF_1 + CF_2 = 57\,348 + 14\,014 = 71\,362 \text{ EUR}$$

$$P_3 = CF_1 + CF_2 + CF_3 = 57\,348 + 14\,014 + 31\,274 = 102\,636 \text{ EUR}$$

$$P_4 = \dots$$

Table 14.2.12

The returned investments in the end of year (EUR)

No.	Year	Net cash flow (CF _i)	Returned investments in the end of year (P _i)
0	Investments	-262 060	-
1	2016	57 348	57 348
2	2017	14 014	71 362
3	2018	31 274	102 636
4	2019	32 674	135 310
5	2020	25 874	161 184
6	2021	44 114	205 298
7	2022	44 114	249 412
8	2023	44 114	293 526
9	2024	44 114	337 640
10	2025	44 114	381 754

The condition:

$$P_t < |\text{INV}| < P_{t+1}$$

INV – invested money.

$$249\,412 < 262\,060 < 293\,526$$

$$P_7 < |\text{INV}| < P_8$$

Number of years before return of investments $t = 7$.

The next step is to calculate the not returned investments in the beginning of every year.

Not returned investments in the beginning of 1st year:

$$I_1 = |\text{INV}| = 262\,060 \text{ EUR}$$

Not returned investments in the beginning of 2nd and further years:

$$I_2 = |INV| - CF_1 = 262\,060 - 57\,348 = 204\,712 \text{ EUR}$$

$$I_3 = |INV| - (CF_1 + CF_2) = 262\,060 - (57\,348 + 14\,014) = 190\,698 \text{ EUR}$$

$$I_4 = \dots$$

Table 14.2.13

Not returned investments in the beginning of year (EUR)

No.	Year	Net cash flow (CF _i)	Not returned investments in the beginning of year (I _i)
0	Investments	-262 060	-
1	2016	57 348	262 060
2	2017	14 014	204 712
3	2018	31 274	190 698
4	2019	32 674	159 424
5	2020	25 874	126 750
6	2021	44 114	100 876
7	2022	44 114	56 762
8	2023	44 114	12 648
9	2024	44 114	-
10	2025	44 114	-

The return period:

$$AP = t + \frac{I_{t+1}}{CF_{t+1}} = 7 + \frac{12\,648}{44\,114} = 7,29 \text{ years} \quad (14.2.2)$$

1 year – 365 days

0,29 year – X days

X = 106 days



The project's return period is 7 years and 106 days.

15. MODELING OF CLIENTS SERVICING SYSTEM



The tasks of this chapter:

- To explain the main principles of mass servicing theory.
- To model the clients servicing system.

15.1. Theory of mass service

The satisfaction of customers is the result of their comparison of experience in a company with expectations. The factors determining customers' satisfaction can change together with their age, income, economic and social environment, life style, etc. The satisfaction of customers is very important for companies because the number of satisfied customers increase the financial results of a company. The company must know how the products, services and servicing can satisfy the customer and what changes are necessary.

The satisfaction is influenced not only by quality and price but also the servicing of clients is very important factor.

About the servicing customers decide according to:

- View of company's building.
- Place and working time convenience.
- Information about goods, services and prices.
- Offering of goods.
- The servicing personnel presence, courtesy, prevenience, attention.
- Personnel qualification.
- Problems solving.
- Attention to permanent customers.
- Rapidity of servicing.

- Confidentiality of agreements.
- Quality guarantee.
- Possibility to change goods.
- Precision of payments, etc.

People meet various servicing systems in shops, banks, car repair, airports, etc. Such systems are called mass servicing systems (MSS). For the evaluation of MSS performance the theory of mass service can be applied.

Applying theory of mass service it is possible to know:

- How many clients will be serviced in 1 hour.
- How many workers will be busy.
- What part of day the servicing system can have no clients.
- How many customers 1 worker will service.

Theory of mass service allows to estimate the servicing system's efficiency.

The analysis results allow to:

- Optimize the quantity of servicing workers.
- Evaluate the necessity of servicing equipment.
- Recommend the average time to service 1 client.
- Designate the servicing order, etc.

The company applying the theory of mass service can find the balance between customers' satisfaction and selling expenses more easy (Figure 15.1.1).

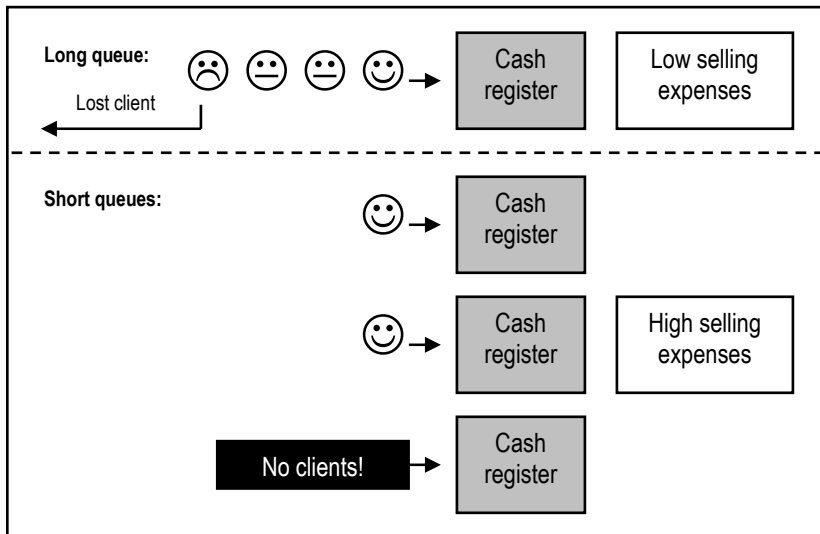


Figure 15.1.1. The selling expenses and customers' satisfaction

The types of mass servicing systems:

- **Systems with refusal.** If all servicing channels are busy the new application does not wait for servicing.
- **Systems with queues.** The new application waits for servicing in a queue (Figure 15.1.2).

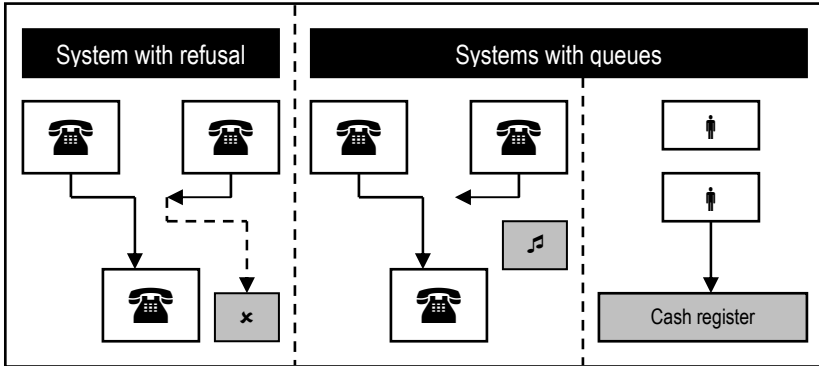


Figure 15.1.2. The types of mass servicing systems

The types of mass servicing systems according to the number of servicing channels:

- **One channel MSS** – the system has 1 servicing channel.
- **Multiple channel MSS** – the system has 2 or more servicing channels (Figure 15.1.3).

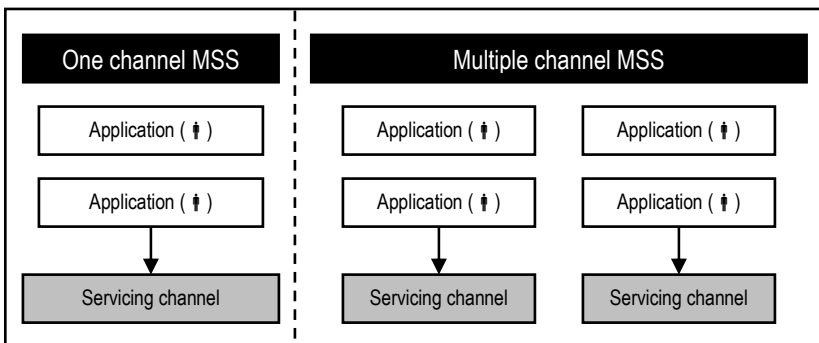


Figure 15.1.3. The types of mass servicing systems

Servicing channel (SC) is the minimal quantity of employees and equipment that is able to service 1 application. Application (A) is the request of a client for servicing.

One channel system with refusal

Intensity of servicing:

$$\mu = \frac{1}{\bar{t}_{ap}} \quad (15.1.1)$$

\bar{t}_{ap} is the average time to service 1 application.

Relative servicing capacity:

$$q = \frac{\mu}{\lambda + \mu} \quad (15.1.2)$$

λ is the intensity of applications flow (the average numbers of applications in time unit).



q indicates what proportion of applications will be serviced.

Absolute servicing capacity:

$$N = \lambda \cdot q \quad (15.1.3)$$



N indicates the average number of serviced applications in time unit.

Probability of refusal:

$$P_{ats} = 1 - q \quad (15.1.4)$$



P_{ats} indicates the proportion of applications that will not be serviced.

Example

The company has 1 phone operator. The new call when line is busy is not serviced. The intensity of calls – 2 calls in 1 minute. The average time to service 1 client is 3 minutes.

The company wants to know:

1. Relative servicing capacity.
2. Absolute servicing capacity.
3. Probability of refusal.

Intensity of servicing:

$$\mu = \frac{1}{\bar{t}_{ap}} = \frac{1}{3} = 0,333 = 33,3\% \quad (15.1.5)$$

Relative servicing capacity:

$$q = \frac{\mu}{\lambda + \mu} = \frac{0,333}{2 + 0,333} = 0,143 = 14,3\% \quad (15.1.6)$$

The system services 14,3% of calls.

Absolute servicing capacity:

$$N = \lambda \cdot q = 2 \cdot 0,143 = 0,286 \quad (15.1.7)$$

System services 0,286 calls in 1 minute. In 1 hour 17 calls are serviced:

$$0,286 \text{ calls/min.} \cdot 60 \text{ min.} = 17,16 \approx 17 \text{ calls} \quad (15.1.8)$$

Probability of refusal:

$$P_{ats} = 1 - q = 1 - 0,143 = 0,857 = 85,7\% \quad (15.1.9)$$

85,7% of calls are not serviced.

Multiple channel system with refusal

Probability of refusal:

$$P_{ats} = \frac{\alpha^n}{n!} \cdot P_0 \quad (15.1.10)$$

α is the product of applications flow intensity and the average time to service 1 application:

$$\alpha = \lambda \cdot \bar{t}_{ap} \quad (15.1.11)$$

n – the number of servicing channels ($n!$ – factorial: $1 \cdot 2 \cdot \dots \cdot n$);
 P_0 – the probability that there are no applications in the system:

$$P_0 = \frac{1}{1 + \frac{\alpha}{1!} + \frac{\alpha^2}{2!} + \dots + \frac{\alpha^n}{n!}} \quad (15.1.12)$$

Relative servicing capacity:

$$q = 1 - P_{ats} \quad (15.1.13)$$

Absolute servicing capacity:

$$N = \lambda \cdot q \quad (15.1.14)$$

Average busy channels:

$$\bar{n} = \alpha \cdot (1 - P_{ats}) \quad (15.1.15)$$

Example

The company has 4 telephone operators. The new call when line is busy is not serviced. The intensity of calls – 2 calls in 1 minute. The average time to service 1 client is 3 minutes.

The company wants to know:

1. Probability of refusal.
2. Relative servicing capacity.
3. Absolute servicing capacity.
4. Average busy channels.

The calculation of α and P_0 :

$$\alpha = \lambda \cdot \bar{t}_{ap} = 2 \cdot 3 = 6 \quad (15.1.16)$$

$$P_0 = \frac{1}{1 + \frac{\alpha}{1!} + \frac{\alpha^2}{2!} + \dots + \frac{\alpha^n}{n!}} = \frac{1}{1 + \frac{6}{1!} + \frac{6^2}{2!} + \frac{6^3}{3!} + \frac{6^4}{4!}} = \frac{1}{1 + \frac{6}{1} + \frac{36}{2} + \frac{216}{6} + \frac{1296}{24}} = \frac{1}{115} = 0,0087 \quad (15.1.17)$$

Probability of refusal:

$$P_{ats} = \frac{\alpha^n}{n!} \cdot P_0 = \frac{6^4}{4!} \cdot 0,0087 = \frac{1296}{24} \cdot 0,0087 = 0,4698 = 46,98\% \quad (15.1.18)$$

4 servicing channels do not service 46,98% of calls.

Relative servicing capacity:

$$q = 1 - P_{ats} = 1 - 0,4698 = 0,5302 = 53,02\% \quad (15.1.19)$$

The company services 53,02% of calls.

Absolute servicing capacity:

$$N = \lambda \cdot q = 2 \cdot 0,5302 = 1,0604 \quad (15.1.20)$$

The company services 1,0604 calls in 1 minute.

Average busy channels:

$$\bar{n} = \alpha \cdot (1 - P_{ats}) = 6 \cdot (1 - 0,4698) = 3,1812 \quad (15.1.21)$$

One channel system with queue

Probability of refusal:

$$P_{ats} = \frac{\alpha^{m+1}(1-\alpha)}{1-\alpha^{m+2}} \quad (15.1.22)$$

m is the maximal length of queue.

Relative servicing capacity:

$$q = 1 - P_{ats} \quad (15.1.23)$$

Absolute servicing capacity:

$$N = \lambda \cdot q \quad (15.1.24)$$

Average applications (clients) in a queue:

$$\bar{m} = \frac{\alpha^2 [1 - \alpha^m (m + 1 - m\alpha)]}{(1 - \alpha)(1 - \alpha^{m+2})} \quad (15.1.25)$$

Example

In a branch of bank 1 employee services clients. Into this bank in every 2 minutes arrives 1 client. The average time to service 1 client is 3 minutes. New clients do not stand into the queue if there are 5 people.

The data:

- Number of servicing channels $n = 1$.
- Length of queue $m = 5$.
- Intensity of applications flow $\lambda = 0,5$ (1 client in 2 minutes).
- Average time to service 1 client $\bar{t}_{ap} = 3$ min.

The company wants to know:

1. Probability of refusal.
2. Relative servicing capacity.
3. Absolute servicing capacity.
4. Average number of applications in a queue.

The calculation of α :

$$\alpha = \lambda \cdot \bar{t}_{ap} = 0,5 \cdot 3 = 1,5 \quad (15.1.26)$$

Probability of refusal:

$$P_{ats} = \frac{\alpha^{m+1} (1 - \alpha)}{1 - \alpha^{m+2}} = \frac{1,5^6 (1 - 1,5)}{1 - 1,5^7} = 0,354 = 35,4\% \quad (15.1.27)$$

1 servicing channel does not service 35,4% of clients.

Relative servicing capacity:

$$q = 1 - P_{ats} = 1 - 0,354 = 0,646 \quad (15.1.28)$$

Bank services 64,6% of clients.

Absolute servicing capacity:

$$N = \lambda \cdot q = 0,5 \cdot 0,646 = 0,323 \text{ clients/min.} \quad (15.1.29)$$

In 1 hour bank services in average 19 clients:

$$0,323 \text{ clients / min} \times 60 \text{ min.} = 19,38 \text{ clients} \quad (15.1.30)$$

Average applications (clients) in a queue:

$$\bar{m} = \frac{\alpha^2 [1 - \alpha^m (m + 1 - m\alpha)]}{(1 - \alpha)(1 - \alpha^{m+2})} = \frac{1,5^2 [1 - 1,5^5 (5 + 1 - 5 \cdot 1,5)]}{(1 - 1,5)(1 - 1,5^7)} = 3,47 \quad (15.1.31)$$

In average there are 3,5, i. e. 3 – 4 clients in a queue.

Multiple channel system with queue

Probability that all channels are free:

$$P_0^{-1} = \sum_{i=0}^n \frac{\alpha^i}{i!} + \frac{1}{n!} \sum_{j=n+1}^{n+m} \frac{\alpha^j}{n^{j-n}} \quad (15.1.32)$$

$$P_0 = \frac{1}{P_0^{-1}} \quad (15.1.33)$$

Probability of refusal:

$$P_{ats} = P_{n+m} = \frac{\alpha^{n+m}}{n^m n!} P_0 \quad (15.1.34)$$

Relative servicing capacity:

$$q = 1 - P_{ats} \quad (15.1.35)$$

Absolute servicing capacity:

$$N = \lambda \cdot q \quad (15.1.36)$$

Average applications (clients) in a queue:

$$\bar{m} = \frac{\alpha^{n+1}}{nn!} \cdot \frac{P_0 [1 - \gamma^m (m + 1 - m\gamma)]}{(1 - \gamma)^2} \quad (15.1.37)$$

$$\gamma = \alpha / n \quad (15.1.38)$$

Average number of busy channels:

$$\bar{n} = \frac{N}{\mu} \quad (15.1.39)$$

15.2. The business process model: Part 12

In future the owners of bread production company suppose to establish the bread shop. In this shop 2 employees will service the clients. It is predicted that into the shop in every 2 minutes will arrive 1 client. The average time to service 1 client will be 3 minutes. New clients will not stand into the queue if there are 5 people.

The data:

- Number of channels $n = 2$.
- Length of queue $m = 5$.
- Intensity of applications flow $\lambda = 0,5$ (1 client in 2 minutes).
- Average time to service 1 client $\bar{t}_{ap} = 3$ min.

The company wants to know:

1. Probability that all employees are free (no applications in the system).
2. Probability of refusal.
3. Relative servicing capacity.
4. Absolute servicing capacity.
5. Average number of applications in a queue.
6. Average number of busy channels.

The calculation of α :

$$\alpha = \lambda \cdot \bar{t}_{ap} = 0,5 \cdot 3 = 1,5 \quad (15.2.1)$$

Probability that all employees are free (no applications in the system):

$$P_0^{-1} = \sum_{i=0}^2 \frac{\alpha^i}{i!} + \frac{1}{2!} \sum_{j=2+1}^{2+5} \frac{\alpha^j}{2^{j-2}} = 1 + \frac{\alpha}{1!} + \frac{\alpha^2}{2!} + \frac{1}{2} \left(\frac{\alpha^3}{2} + \frac{\alpha^4}{2^2} + \frac{\alpha^5}{2^3} + \frac{\alpha^6}{2^4} + \frac{\alpha^7}{2^5} \right) = 5,918 \quad (15.2.2)$$

$$P_0 = \frac{1}{5,918} = 0,169 \quad (15.2.3)$$

Probability of refusal:

$$P_{ats} = P_{n+m} = P_7 = \frac{\alpha^{n+m}}{n^m n!} P_0 = \frac{1,5^{2+5}}{2^5 \cdot 2!} \cdot 0,169 = 0,045 \quad (15.2.4)$$

Every 23rd client (1/0,045 = 22,22) will not be serviced.

Relative servicing capacity:

$$q = 1 - P_{ats} = 1 - 0,045 = 0,955 \quad (15.2.5)$$

The shop will service 95,5% of clients.

Absolute servicing capacity:

$$N = \lambda \cdot q = 0,5 \times 0,955 = 0,48 \text{ clients /min.} \quad (15.2.6)$$

In 1 hour 29 clients will be serviced (0,48 × 60 = 28,8).

Average applications (clients) in a queue:

$$\bar{m} = \frac{\alpha^{n+1}}{n n!} \cdot \frac{P_0 [1 - \gamma^m (m+1 - m\gamma)]}{(1 - \gamma)^2} = \frac{1,5^{2+1}}{2 \cdot 2} \cdot \frac{0,169}{(1 - 0,75)^2} [1 - 0,75^5 (5 + 1 - 5 \cdot 0,75)] = 1 \quad (15.2.7)$$

$$\gamma = \alpha / n = 1,5 / 2 = 0,75 \quad (15.2.8)$$

Average number of busy channels:

$$\bar{n} = \frac{N}{\mu} = \frac{0,48}{0,33} = 1,44 \quad (15.2.9)$$

The additional simulation of shop with 1 and 3 servicing channels was implemented. According to the results the managers can choose the optimal number of servicing employees in the shop (Table 15.2.1).

Table 15.2.1

Servicing rates depending on the number of channels in the shop

Rate	Number of servicing employees		
	1	2	3
Probability of refusal (%)	35,4	4,5	0,4
Every which client will not be serviced	3	22	269
Serviced clients (%)	64,6	95,5	99,6
Average serviced clients in 1 hour	19,4	28,8	29,9
Average number of clients in a queue	3,47	1	0,21

The graphs visualizing the data of Table 15.2.1 are given below. According to the analysis results the shop must establish 2 or 3 servicing channels.

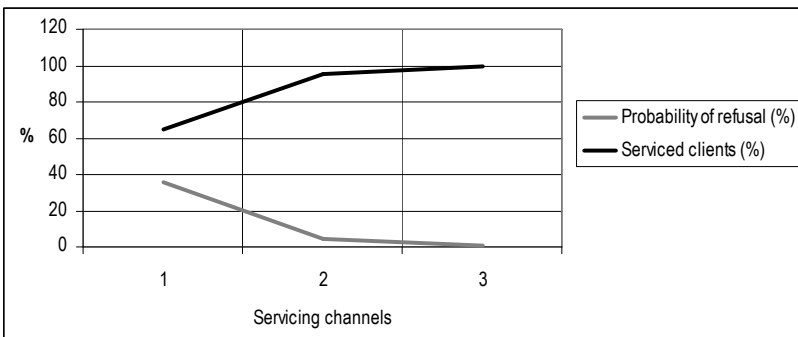


Figure 15.2.1. The probability of refusal and serviced clients

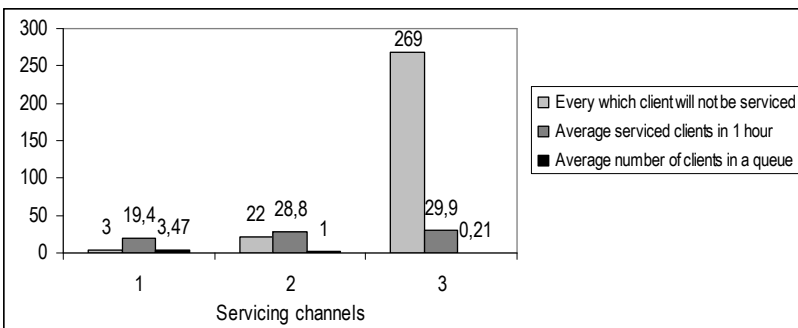


Figure 15.2.2. The parameters of servicing system

16. THE ANALYSIS OF BUSINESS ENVIRONMENT



The tasks of this chapter:

- To present the data sources for the business environment analysis.
- To analyze the main indicators of business environment.

16.1. The data sources for the analysis

The analysis of business environment includes:

- The legal environment.
- The macroeconomic environment.
- The analysis of industry branch.
- The market analysis.



The legal environment data sources

The data sources for the legal environment analysis:

- The legal acts of Lithuanian government can be found in Register of Legal Acts (Figure 7.1.2): <https://www.e-tar.lt>.
- Also the legal acts of Lithuanian government can be found in the website of Seimas of the Republic of Lithuania (Figure 16.1.1): <http://www3.lrs.lt> → Legal acts of the Republic of Lithuania.
- The special permits necessary to start some business types in Lithuania can be found in the website of Business Gateway Lithuania (Figure 16.1.2): <http://www.verslovertai.lt> → Search for permits.

Document Search

Number:

Date since (mm.dd.yyyy):  Date till (mm.dd.yyyy): 

Institution:

Type: Law Draft Law Consolidated Legal Document Constitution Statute

Status:

Language: English

Title: All of the Words

Text: All of the Words

Publication: year of issue: volume #: document # in the volume:

Connection to EU Legal Acts: required: not required:

Thesaurus Eurovoc 4.2:

Search: only for chosen term

Sort results by: Date

Figure 16.1.1. The law acts searching system (<http://www3.lrs.lt>)

SEARCH OF REGULATIONS FOR BUSINESS



Competent authority

Activities



Figure 16.1.2. The business permits searching system (<http://www.verslovertai.lt>)

The macroeconomic environment data sources

The comprehensive data for the macroeconomic environment analysis can be found in the Official Statistics Portal of Statistics Lithuania (Figure 16.1.3): <http://osp.stat.gov.lt>.

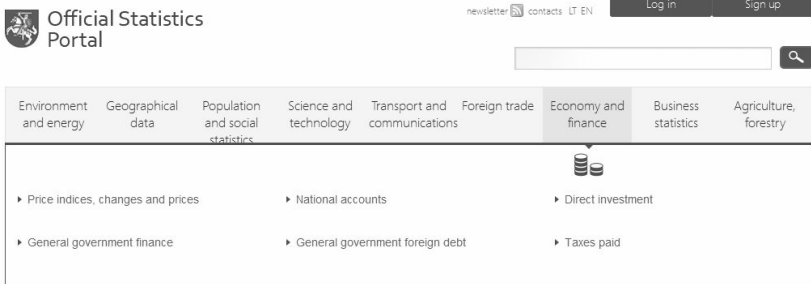


Figure 16.1.3. The Official Statistics Portal of Lithuania (<http://osp.stat.gov.lt>)

The main Lithuanian macroeconomic indicators together with other EU countries can be found in EUROSTAT database (Figure 16.1.4): <http://ec.europa.eu/eurostat>.

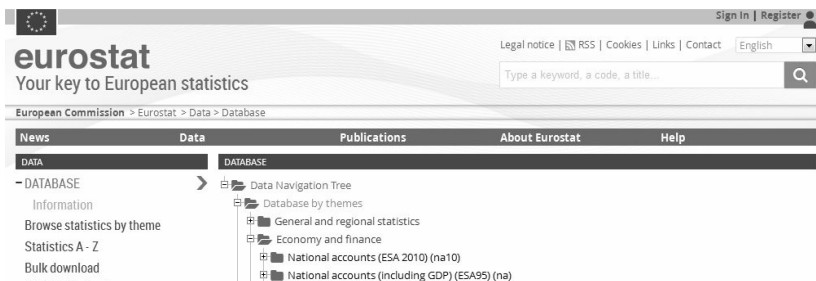


Figure 16.1.4. The statistical database of EUROSTAT (<http://ec.europa.eu/eurostat>)

The main Lithuanian macroeconomic indicators together with other countries of the World can be found in World Bank database (Figure 16.1.5): <http://worldbank.org>.

Economy & Growth	
Agriculture, value added (% of GDP)	Gross savings (% of GDP)
Cash surplus/deficit (% of GDP)	Imports of goods and services (% of GDP)
Central government debt, total (% of GDP)	Industry, value added (% of GDP)
Charges for the use of intellectual property, payments (BoP, current US\$)	Inflation, consumer prices (annual %)
Charges for the use of intellectual property, receipts (BoP, current US\$)	Inflation, GDP deflator (annual %)
Current account balance (BoP, current US\$)	Net ODA received (% of GNI)

Figure 16.1.5. The statistical database of World Bank (<http://worldbank.org>)

The industry branch statistical data sources

The aggregated financial results, the average financial ratios and non-financial indicators of Lithuanian enterprises can be found in Statistics Lithuania website selecting the category *Business statistics* (Figure 16.1.6).

The screenshot shows the 'Official Statistics Portal' website. At the top right, there are links for 'newsletter', 'contacts', 'LT EN', 'Log in', and 'Sign up'. A search bar is located below these links. The main navigation menu includes categories: Environment and energy, Geographical data, Population and social statistics, Science and technology, Transport and communications, Foreign trade, Economy and finance, Business statistics (highlighted), and Agriculture, forestry. Under the 'Business statistics' category, a sub-menu is visible with the following items: Financial and insurance activities, Enterprise bankruptcy, Business structure and finance (highlighted), Investment in tangible fixed assets, Services, Industry, Construction, Operating economic entities, Tourism, Business trends, and Domestic trade.

Figure 16.1.6. The source of Lithuanian business statistics (<http://osp.stat.gov.lt>)

Selecting the category Business structure and finance the comprehensive data for the industry branch financial and non-financial analysis can be found (Figure 16.1.7).

The screenshot shows the 'Database of Indicators' page for 'Business structure and finance'. The breadcrumb trail is 'OSP > Business statistics > Business structure and finance > Database of Indicators'. The page title is 'Business structure and finance'. The left sidebar contains links for 'Predefined tables', 'Database of Indicators', 'Methodology', and 'Metadata'. The main content area lists several indicators with expand/collapse icons and information icons:

- Annual structural business statistics (M)
- Financial indicators of enterprises (individual enterprises and natural persons excluded)
- Financial Indicators of Small, Medium and Large Enterprises
 - Turnover (public, private companies, state, municipal, individual enterprises, etc.)
 - Total equity to total liabilities ratio (public, private companies, state, municipal, individual enterprises, etc.)
 - Gross investment in tangible assets including acquired by financial leasing (public, private companies, state, municipal, individual enterprises, etc.)
 - Number of persons employed (public, private companies, state, municipal, individual enterprises, etc.)
 - Exports (public, private companies, state, municipal, individual enterprises, etc.)
 - Net profit, loss (-) (public, private companies, state, municipal, individual enterprises, etc.)

Figure 16.1.7. The financial and non-financial indicators of Lithuanian business (<http://osp.stat.gov.lt>)

The market analysis data sources

The information about market, the requirements of potential customers, their consumption habits can be gathered implementing the market research. This research can be implemented by the company itself or this service can be bought from the other market research providers (Figure 16.1.8).

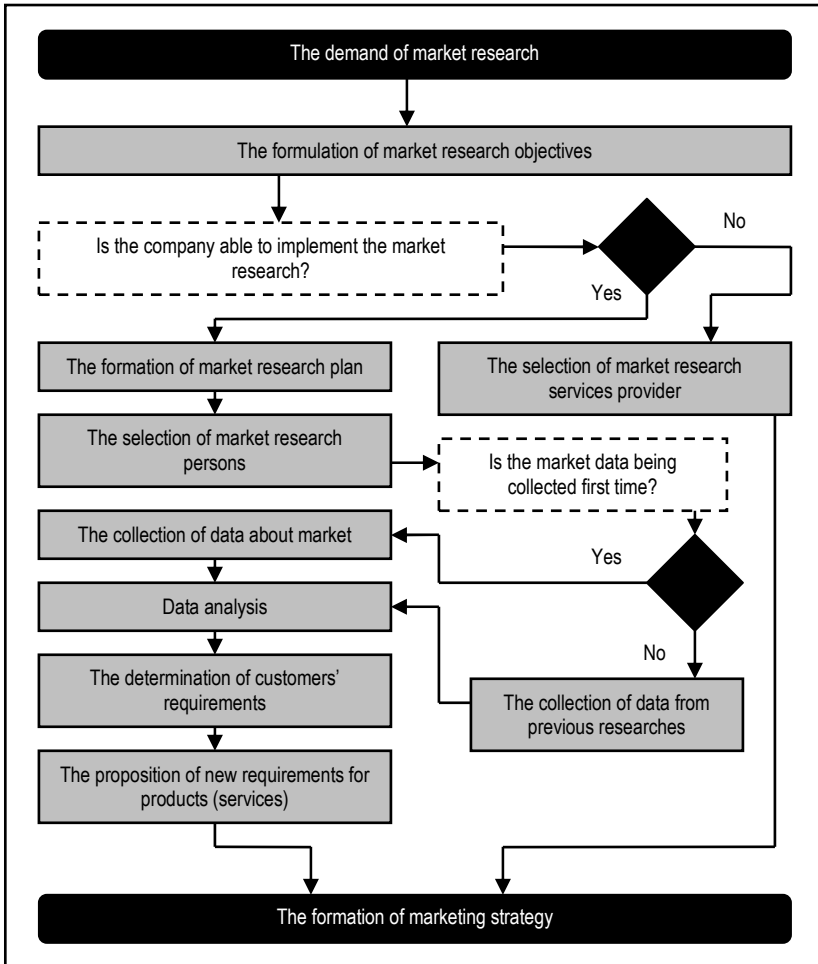


Figure 16.1.8. The process of market research

16.2. The business process model: Part 13

The macroeconomic environment of business model

The gross domestic product (GDP) of Lithuania in 2014 was 36 287,9 million EUR (Figure 16.2.1). Since 2010 this macroeconomic indicator is growing, so using the developed polynomial regression model the predicted GDP in 2015 is about 40 billion EUR, in 2016 this indicator can reach 40,5 billion EUR.

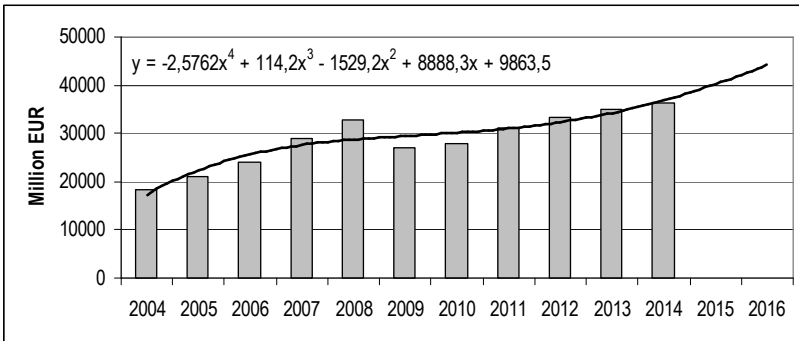


Figure 16.2.1. The GDP of Lithuania in 2004 – 2014

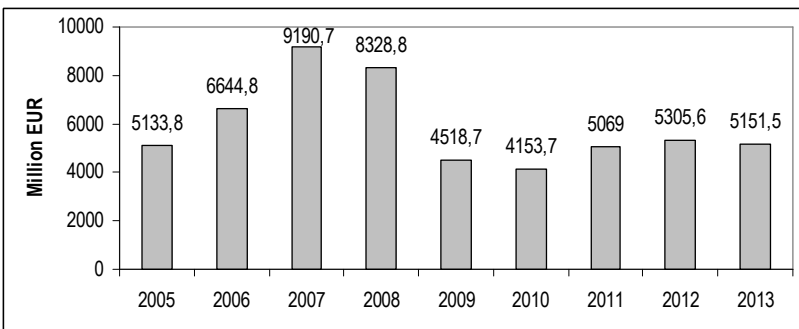


Figure 16.2.2. The gross capital formation (investments) in 2005 – 2013

The highest gross capital formation (investments) of Lithuanian enterprises was 9,2 billion EUR in 2007 (Figure 16.2.2). After the recent economic downturn this indicator does not grow significantly and in 2013 it was 5,2 billion EUR.

The average salaries of employees in Lithuania since 2010 are growing (Figure 16.2.3). In 2014 the average salary before taxes was 676,4 EUR, after taxes – 526,5 EUR.

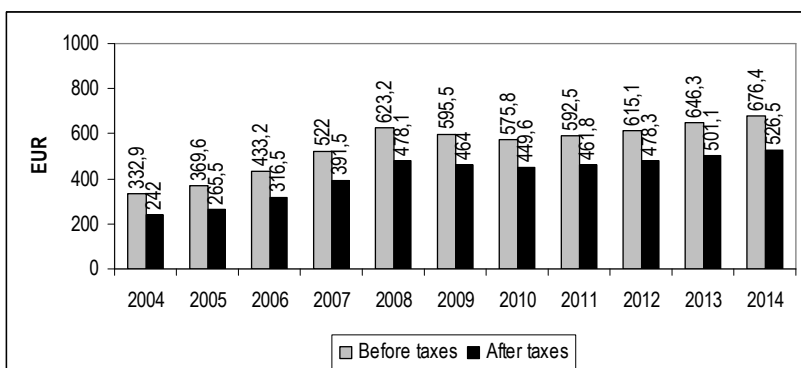


Figure 16.2.3. The average salaries of employees in 2004 – 2014

The highest number of bankrupted companies was in 2009 year's economic downturn – 1 844. Until 2011 this number was decreasing but since 2012 the growth of bankruptcies in Lithuania was observed. In 2014 the bankruptcy process was started in 1 636 business enterprises (Figure 16.2.4).

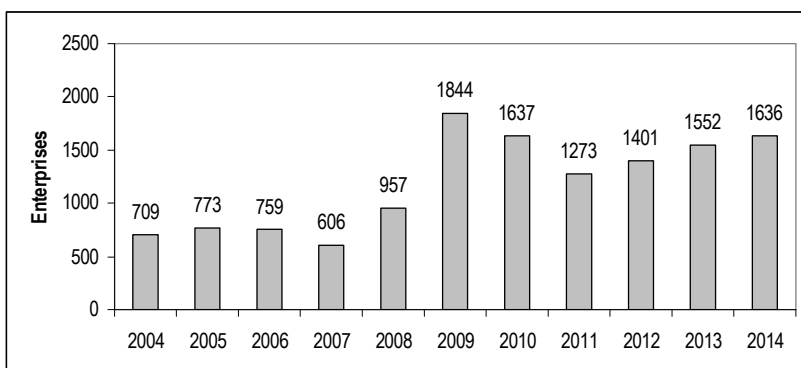


Figure 16.2.4. The number of bankrupted enterprises in 2004 – 2014

In 2014 the unemployment rate in Lithuania was 9,5%. The number of unemployed people in this year was 173 thousands (Figure 16.2.5).

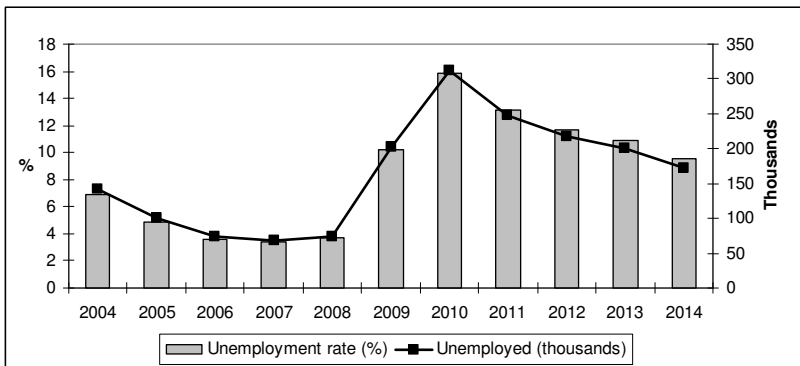


Figure 16.2.5. The unemployment statistics in 2004 – 2014

■ The industry branch statistics

The revenue of Lithuanian bakeries and mealy products manufacturing is growing since 2011. In 2013 the aggregated revenue of this industry sector was 253,9 million EUR (Figure 16.2.6).

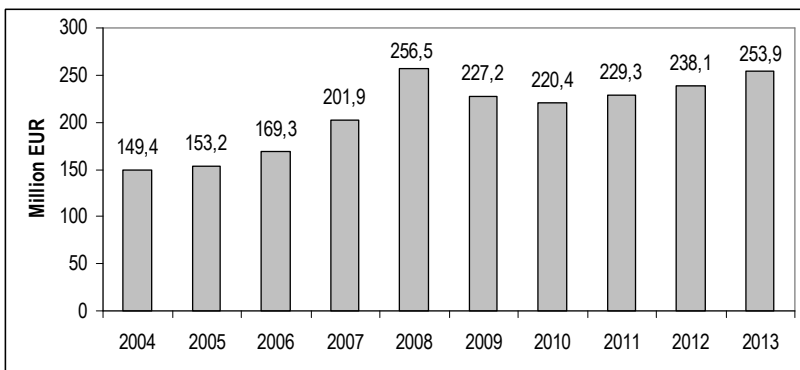


Figure 16.2.6. The revenue of Lithuanian bakeries and mealy products manufacturers in 2004 – 2013

In period of 2004 – 2013 only year 2006 was loss making for Lithuanian bakeries and mealy products manufactories. Since 2011 the profit in this industry sector is constantly growing (Figure 16.2.7).

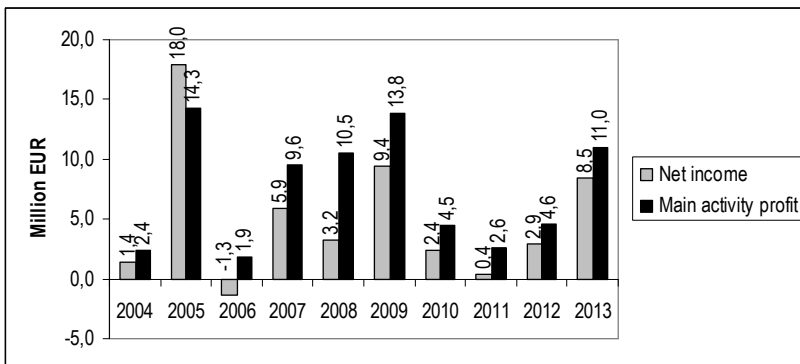


Figure 16.2.7. The main activity profit and net income of Lithuanian bakeries and mealy products manufactories in 2004 – 2013

In 2013 the net profitability of Lithuanian bakeries and mealy products manufactories was 3,33%, return on equity – 10,02%, return on assets – 5,72% (Table 16.2.1).

Table 16.2.1

The profitability ratios of Lithuanian bakeries and mealy products manufactories

Year	Net profitability (%)	ROE (%)	ROA (%)
2004	0,95	2,68	1,52
2005	11,72	22,88	14,51
2006	-0,78	-1,48	-0,92
2007	2,92	9,2	4,03
2008	1,26	3,59	1,69
2009	4,15	14,29	6,53
2010	1,08	3,47	1,64
2011	0,17	0,62	0,27
2012	1,21	4,2	2,01
2013	3,33	10,02	5,72

The aggregated statistics indicates that enterprises of bakery and mealy products manufacturing are not highly indebted and solvent. In 2013 the debt ratio in this industry branch was 0,43, current ratio – 1,56, quick ratio – 1,12, solvency ratio – 1,34 (Table 16.2.2).


Table 16.2.2

The solvency and capital structure ratios of Lithuanian bakeries and mealy products manufactories

Year	Debt ratio	Current ratio	Quick ratio	Solvency ratio
2004	0,45	1,21	0,87	1,2
2005	0,35	1,3	0,99	1,82
2006	0,39	1,33	1	1,52
2007	0,55	1,12	0,82	0,79
2008	0,53	1,09	0,81	0,89
2009	0,54	1,29	1,03	0,85
2010	0,52	1,08	0,79	0,9
2011	0,56	1,09	0,8	0,77
2012	0,52	1,17	0,86	0,93
2013	0,43	1,56	1,12	1,34

The business starting attractiveness indicators of Lithuania

The Global Opportunity Index allows to assess the attractiveness of countries for business investments.

	http://www.globalopportunityindex.org
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Composite Score		Country	Economic Fundamentals		Regulatory Barriers		Ease of Doing Business		Quality of Regulations		Rule of Law	
Rank	Score		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
26	6.67	Lithuania	30	6.05	25	8.20	5	8.14	33	5.67	48	5.27

Figure 16.2.8. The Global Opportunity Index of Lithuania

In the list of 98 countries Lithuania is in the 26th place. In Figure 16.2.8 the 5 criterions are evaluated that compose the overall ranking of the country. The interval of scores is [0; 10].

The Index of Economic Freedom reflects the business environment of a country. In 2015 the rank of Lithuania was 15 and this country was classified into the category of mostly free countries (Figure 16.2.9).


<http://www.heritage.org/index/>



Figure 16.2.9. The Index of Economic Freedom of Lithuania

The Ease of Doing Business rank presents the position of a country in the world in regard to the business starting conditions. In 2015 the ranks of Lithuania was 24 (Figure 16.2.10).


<http://www.doingbusiness.org>

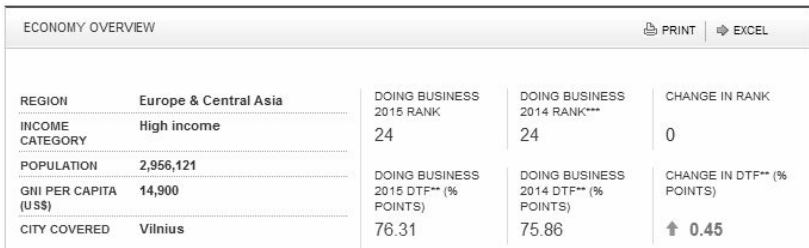


Figure 16.2.10. The Ease of Doing Business rank of Lithuania

17. THE ANALYSIS OF RISKS



The tasks of this chapter:

- To present the main risks that can cause the problems of business idea implementation.
- To analyze the financial risk of the business model.

17.1. The main business risks

The financial risk

The influence of product's price change on the profitability of company must be evaluated if the demand will be insufficient (Table 17.1.1).

Table 17.1.1

The sensitivity of enterprise's profit to the change of product's price

Product's price change	-1%	-5%	-10%
Net income of a year	Is > 0?	Is > 0?	Is > 0?

The analysis of activity results sensitivity to other possible negative factors and the analysis of enterprise's ability to meet the financial obligations must be implemented.

The management risk

If the managers have not sufficient experience, the means of qualification increase must be planned.

The external risks

The possible negative changes in the company's environment:

- Legal environment (tax system, environment protection).
- Technological environment (technological changes).
- Political environment (the influence of the state's membership in international organizations).
- Competition environment (the changes in behaviour of competitors).
- The influence of other factors.

17.2. The business process model: Part 14

The influence of product's price change on the profitability of company was evaluated in Table 17.2.1 if the demand will be insufficient.

Table 17.2.1

The income statement of the business model (EUR)

	Expected	-5%*	-10%*
Revenue	312 000	296 400	280 800
– Cost of sales	-221 940	-221 940	-221 940
= Gross profit	90 060	74 460	58 860
– Operating expenses	-60 152	-60 152	-60 152
= Operating profit	29 908	14 308	-1 292
+ Net other income	0	0	0
+ Net financial and investment income	-8 826	-8 826	-8 826
= Profit before income tax	21 082	5 482	-10 118
– Income (profit) tax expense	-3 162	-822	0
= Profit of the year (Net income)	17 920	4 660	-10 118

* *The product's price change*

The enterprise will be profitable in case of revenue decrease by 5%. If the fall of revenue is 10% or higher the enterprise will be loss-making.

If the decision to start the enterprise's establishment is made the main steps of this process are given in Figure 17.2.1.

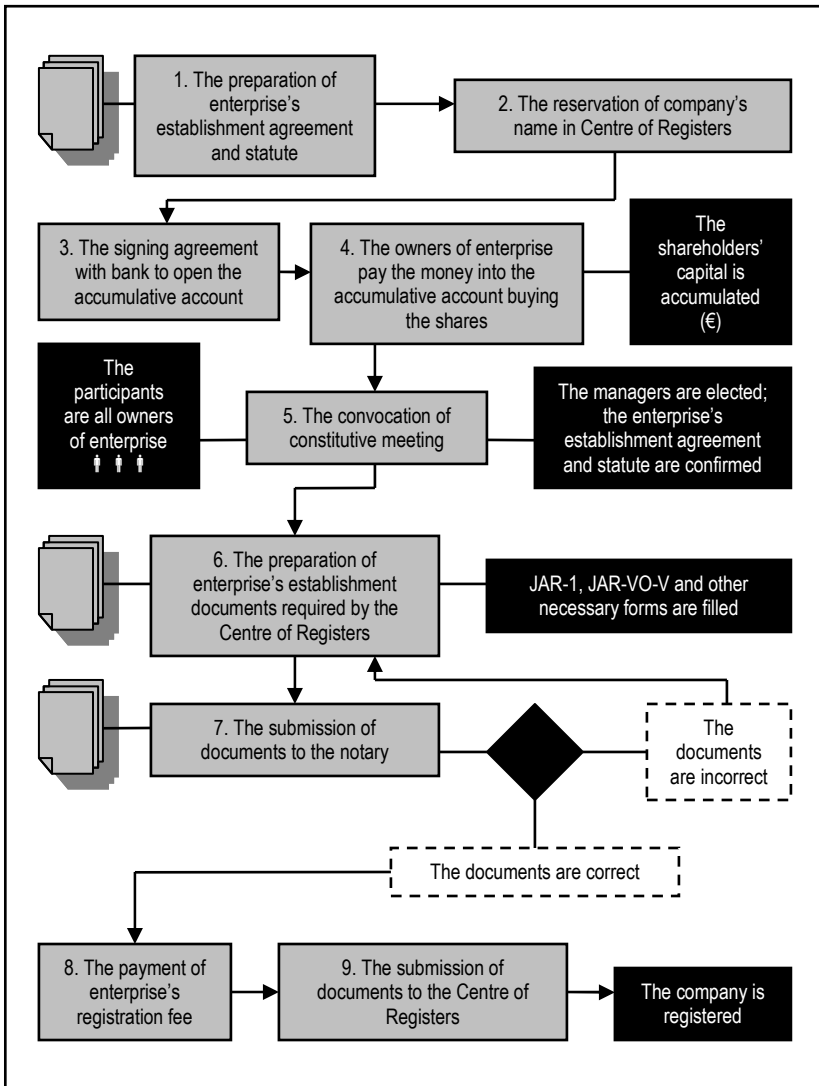


Figure 17.2.1. The joint-stock company establishment process

The Gantt chart is used to plan the enterprise's establishment works. This chart can be drawn using „Express Project“ software (Figure 17.2.2).

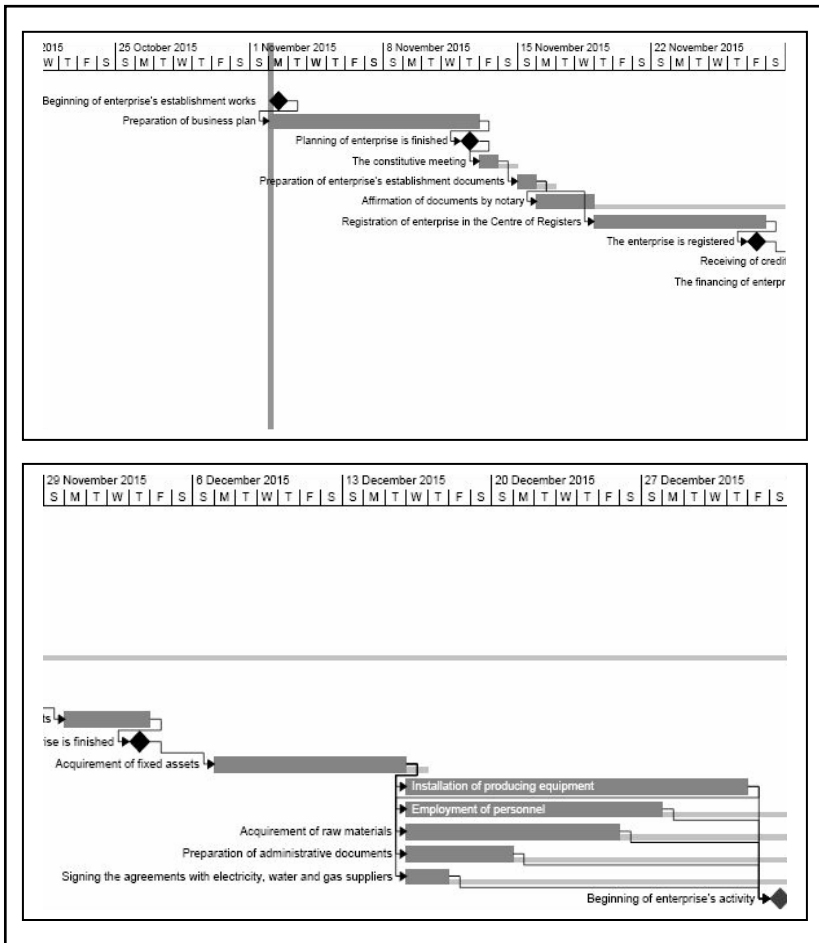


Figure 17.2.2. The Gantt chart of enterprise establishment process

18. BUSINESS PROCESS MODELING NOTATION



The aim of this chapter is to explain the general principles of Business Process Modeling Notation (BPMN) and to present the examples of BPMN diagrams.

The Business Process Modeling Notation (BPMN) is a graphical notation that describes the logic of steps in a business process. This is the internationally accepted process modeling standard.

There are 3 main types of elements that describe the process behavior (Figure 18.1).

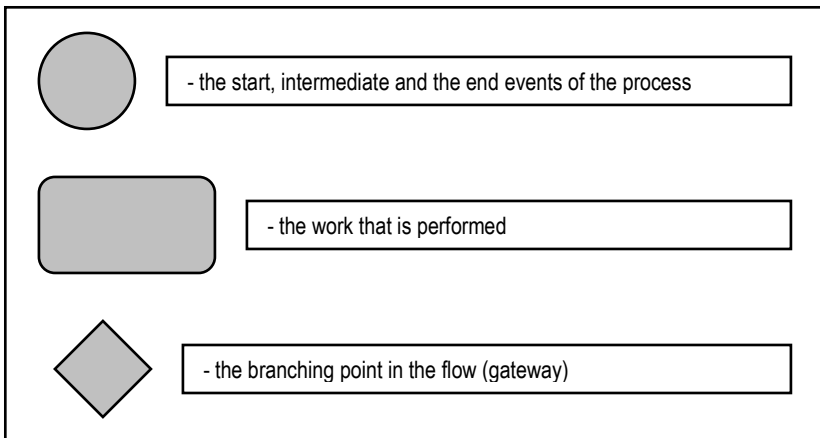


Figure 18.1. The main elements of BPMN

These elements are connected by sequence lines to represent how the process flows. Also the performers of operations can be seen in BPMN.

The example of BPMN is given in Figure 18.2 that allows to manage the incidents in the manufacturing process.

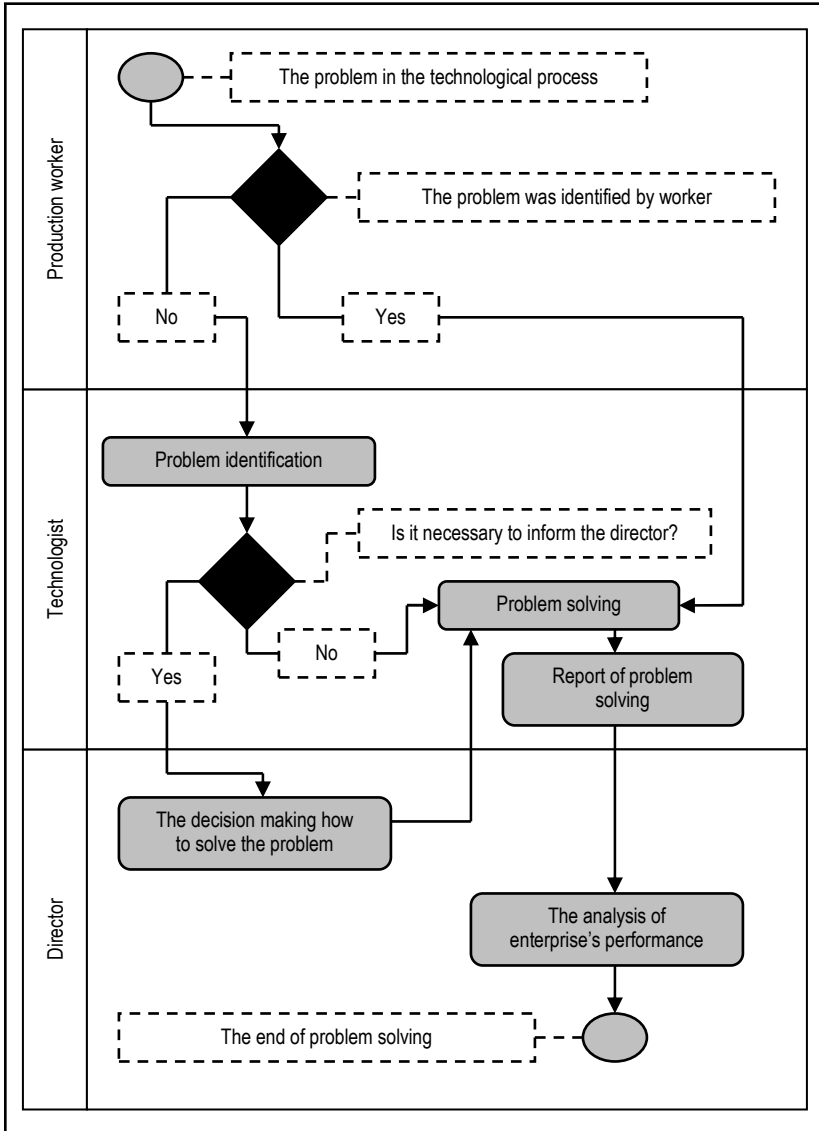


Figure 18.2. The BPMN diagram of incidents management in manufacturing process

The raw materials management process is given in Figure 18.3.

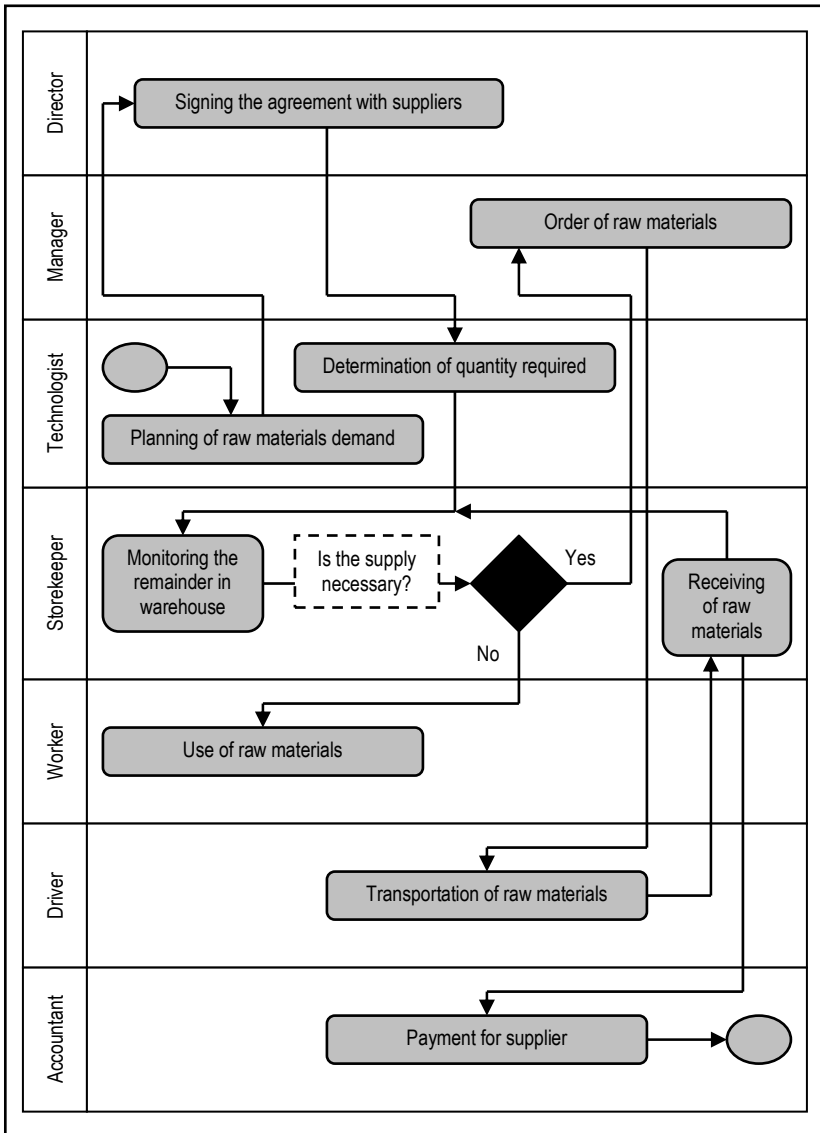


Figure 18.3. The BPMN diagram of raw materials management process

The customers' orders fulfilment process is given in Figure 18.4.

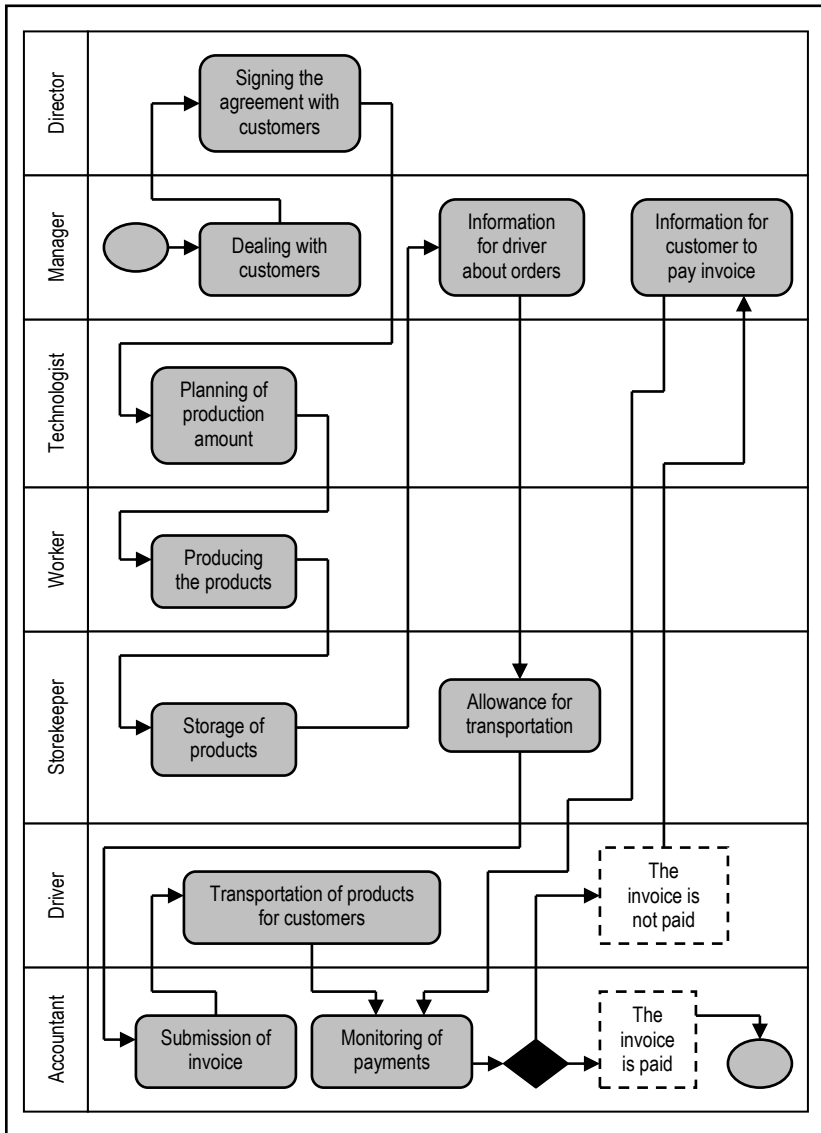


Figure 18.4. The BPMN diagram of customers' orders fulfilment process

The credit approval process in commercial banks is given in Figure 18.5.

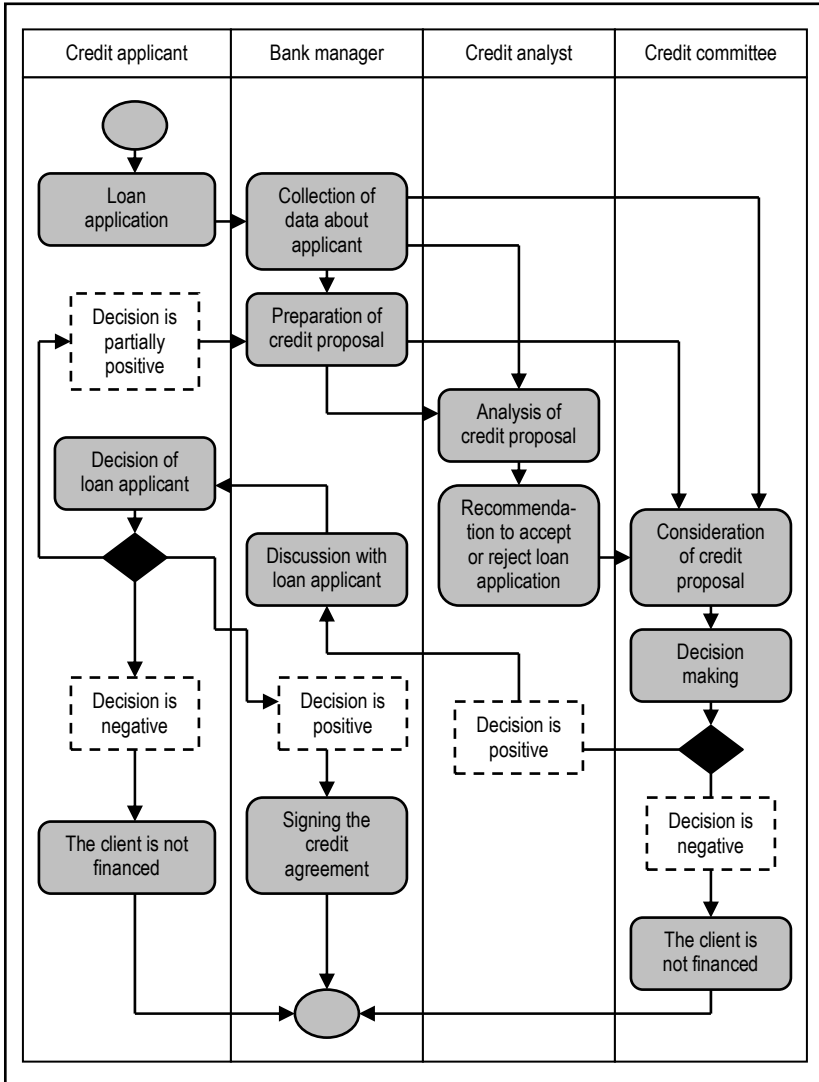


Figure 18.5. The BPMN diagram of credit approval process in bank

It is impossible to develop the set of universal business process schemes that can be applied in all enterprises. Some of business processes are more standardized like the company's financial modeling given in this book, while some processes (like manufacturing, servicing, etc.) are unique that require the understanding of business process modeling principles and process actions and interactions. Figure 18.6 shows the conceptual difference between the restrictive and the constructive approach to modeling.

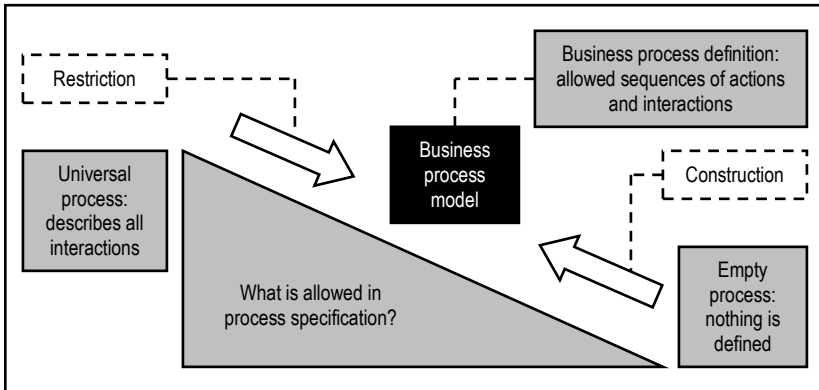


Figure 18.6. The approaches to define the business processes (Fleischmann, Stary, 2012)

The business process modeling in all situations must include the understanding of organizational objectives, process improvement objectives, and process improvement measures (Figure 18.7).

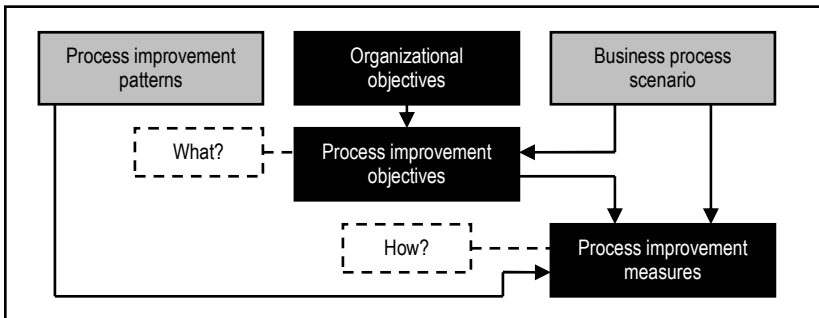


Figure 18.7. The conceptual framework of business process modeling (Lohrmann, Reichert, 2014)

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