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Wrocław University of Technology

Information Systems Architecture and Technology

Information as the Intangible Assets and Company Value Source

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PART III. SOME COMPUTER SUPPORT SYSTEMS IN MANAGEMENT

INTRODUCTION

Contemporary organizations seem to be knowledge based organizations. The shareholders that build company value on the base of knowledge know the risk of loosing workers but they are still investing in consultants and their knowledge because these are the requirements of a competitive market. It involves connecting people with people, as well as people with information. Lei Edvinsson – director of the Scandia wrote (Edvinsson L., *Navigating the knowledge Economy*, Book House Publishing, 2002):

> *Industrial value chain process no longer dominate value creation. Today it is innovation, it is seeking New ways of meeting market demands, that is yielding the highest return on investment – much more than improving incrementally a company's existing production line. And that means that you have to invest* (...) *In New structures that help you to innovate and to make a difference.*

In today's information-driven economy, companies uncover the most opportunities – and ultimately derive the most value – from intellectual rather than physical assets. Companies offering high added value products are characterized – beside standard type for all organizations – by some unique characteristics of organizations that base on knowledge which are essential elements of value and they are called "invisible capital", "intangible assets" or "intellectual capital". These elements are described as assets or capital, but both mean the same – these are the value factors which complement book value to market value and is effected by company ability to profit generation. These elements are: human capital, structural capital, partner capital, customer capital, brand value, ability to obtain contracts and ability to implement profitable.

The factors that determine value of the business which exist in contemporary dynamically changing environment are not deterministic. They follow the unpredicted environment changes and internal changes of the company. Information technologies take place a great role in this area – in collecting the required information, processing them and applying some analytical techniques, as: computer simulation, expert systems, genetic algorithms which can improve quality of managerial information.

The book titled *Information Systems Architecture and Technology – Information as the Intangible Assets and Company Value Source* in gain to address very hot topics in

the field of today's various models of management systems – is devoted to information systems concepts and applications supporting managerial process of organizations. The selected and reviewed chapters have been divided into three parts:

Part I: *The Role of Information in Management Process*
Part II: *Processing Managerial Information*
Part III: *Some Computer Support Systems in Management*

The book provides representation of research in the area of contemporary management information systems.

The first part – *The Role of Information in Management Process* – focuses on various type of information that is useful in managerial decision process.

The second part – *Processing Managerial Information* – considers special models of information processing and designing for management of organization.

In the third part – *Some Computer Support Systems in Management* – some selected computer models of organizations' management are considered. Here are considered various types of organization and supporting systems.

PART I. THE ROLE OF INFORMATION IN MANAGEMENT PROCESS

The information is going to be the most important asset in the management process of organization at contemporary market. Right collected information create the company success.

The objective of the Chapter 1 examines how total aspirations of enterprises can be quantified. It will discuss the reliability of the management processes and analytical techniques employed by this approach as well as an examination of key drivers of value and the influence of risk there in.

Financial information are one of the most important factor that should be considered in management process. In Chapter 2 the Author writes about usage of the CAPM model in the calculation of profitability of real investment project. Here, there is a problem with calculation of beta coefficient since the real investment projects are not quoted on the stock exchange and there is no historical data that investor could base his calculations on. So the managers have to use the information about similar projects. In the paper the example of beta calculation is presented

The Chapter 3 contains the results of the analysis of data taken from the National Statistical Office allow to reducing electricity consumption. Electricity has found a wide application in industry and industry is consuming a significant portion of electricity. Because of electricity in Poland is expensive so it makes cost of production high.

In Chapter 4 risk measuring in European project is considered. That contains the concept of system supporting risk management in construction projects realized by Polish communes and supported by the European Union. Risk is considered here as a possible event with negative consequences for the project.

An attractiveness of offers is a key to successful trade – this is a well-known rule. In traditional, simple markets, an attractive offer means that an offered commodity is in demand, and a price is profitable. In the Chapter 5 the Authors propose to decompose these difficulties into some pieces which we call "levels". They show, that problems encountered in these levels are of different nature, so they need different means to be solved. They also present related aspects of our formal model M3 (Multi-commodity Market Model), designed to represent such complex trade problems and to enable an effective communication between trade parties.

The Chapter 6 presents a case study – considers cost of information sourcing on the example of Wrocław University of Technology.

The aim of Chapter 7 is to collect basic information that will help organizing the knowledge of a financial condition of a company, in particular the terminology used to define this concept as much as the essence of research, measurement and evaluation of company's financial condition.

The Chapter 8 refers to previously presented research on the creation of a model for internet mortgage market. The Chapter presents the description of Internet mortgage market in selected European Union countries. For better understanding of the complexities of this kind of market functioning the comparison is made between mortgage markets in Poland, Estonia, Germany and The United Kingdom. The Authors assumed that some processes occurring on the markets selected for comparison can also influence the Polish Internet mortgage market functioning, which is the reason of the analysis that is presented.

PART II. PROCESSING MANAGERIAL INFORMATION

In dynamically changing environment there is a lot of information which can support management process. Of course that collected information is required to be processed right way. Many models and application use to be used for this task.

In the Chapter 9 the Authors focused on implementations of simulation models, mainly the type Monte Carlo, in spreadsheets. In the literature there is a large wealth of many examples and exercises to help the reader in learning the skills to use a simulation approach. However, no attempts grouping and generalization of these examples, no proposal "templates" for subsequent examples. To emphasize that due to the volume of the present report, the Authors move only certain classes of issues.

The Chapter 10 deals mainly with non profit investments. In the work there are main theoretical issues connected with public investment as well as basic and most common methods of investment project efficiency calculation. The theoretical reflection is widened by a final results presentation of application the investment efficiency assessment methods.

The goal of the company is to create value for the shareholders. The Chapter 11 deals with important issues connected with the project team composition, describes tasks and

responsibilities of the team, and elaborates on the influence of time on the project team-related considerations. Next, it discusses relationships between the project team and other stakeholders during ES adoption. Enterprise systems (ES) are complex software packages that integrate all areas of the company. They are large scale IS projects which span the whole organization and extend over a long time. In consequence, traditional project team management approaches are often not sufficient to support a team during these long, organization spanning projects.

Business processes are strongly based on information technologies, so effectiveness of IT appears to be crucial issue. In the Chapter 12 focuses on the problem of measuring evolution of IT organizations. Following question can be raised: is it possible to support process of changes the IT organization to run it smoother, faster, easier but with reduced risk level and under full control as well?. The propos solution that is expected to help in orderly and formalized acquisition and processing the knowledge about all internal processes of the organization with the use of intelligent systems

The main focus of the Chapter 13 is to present a concept and a prototype of a web-based system for an evaluation of academic teachers performed by their students. The system is based on a secure voting scheme involving distributed and independent units responsible for authentication, gathering of votes and presentation of results. The results can be used in improving process of teaching. This chapter presents a scheme of the voting process as well as the architecture of a system and a short discussion of possible practical implementation.

The Chapter 14 offers a solution to select indicators of high value in terms of predicting bankruptcy of enterprises with regard to a specific sectors in which companies operates.

PART III. SOME COMPUTER SUPPORT SYSTEMS IN MANAGEMENT

Dynamic development of the IT technologies creates the possibility of using them in the dynamic management process modeling and decision making processes supporting.

The Chapter 15 presents the solution that will facilitate the scaling. For many project managers it is difficult to do a correct scaling of the work effort for a given projects class since the methodology is in a form of a compendium of knowledge. This very often sparks a desire for consideration of all PMBOK processes in detail by projects manages, which leads to unnecessary overload of work in the project management. The solution is based on setting up the PMBOK standard as a model in the BPMN, distinguishing further activities in all 42 processes and linking them to the process output artifacts.

It was noted that the project manager's decisions are influenced by three fundamental parameters: the entropy of the project, the maturity of a client and the maturity of a team. The chapter 16 deals with issues related to team management and to supporting the selection of team management practices by a multi-agent system. This

chapter is a continuation of a series of works about research into the use of multi-agent systems to support IT project management.

A new approach to mapping from BPMN diagrams into XPDL standard and the implementation of these mappings made in Dodocum modeller environment is presented in the chapter 17. The business processes are modelled in the BPMN notation. In result refined BPMN diagrams and automatically generated DCD diagrams become round trip transformable, thus aligning services with business processes requirements. DCD diagrams are automatically translated into XPDL notation so they can be entered into any? BPM platform.

This necessitates the use of specific instruments for rational selection of capital sources as well as for capital generation. In the Chapter 18 the computer program is presented to cash flow level controlling.

The Chapter 19 presents a comparative analysis of five applications that are most common in Polish brokerages. One stated seven main functions important from a viewpoint of investors. The questionnaire survey was conducted to examine opinions of the users and to assess the importance of particular function. The results helped to state the significance of each function and to calculate the position of each analyzed application in the final ranking.

The book contains contribution accepted by revisers the submitted works. We hope that the book will be considered as a forum for presentation of original works on a good professional level and for discussions integrating different subject of enterprise management and changes as well as information systems planning, designing, development and implementation.

We thank all Authors who have submitted their works to be published in this book.

Wrocław, September 2011

Zofia Wilimowska

PART I

THE ROLE OF INFORMATION
IN MANAGEMENT PROCESS

Dorota KUCHTA, Joseph SUKPEN*

VALUE-BASED MANAGEMENT (VBM) AND THE PLACE OF RISK IN THIS MANAGEMENT APPROACH

The failure of many management methods to provide a holistic approach to enhance the creation, management and valuation of enterprise value has resulted in serious inadequacies in the existence and operations of many business entities. The Value-Based Management (VBM) approach is one of the recent management approaches that offers a holistic method for the improvement of business performance. This work will be looking at the concept of VBM: what it means, the principles behind it, its components as well as the place of uncertainty (risk) in this approach. This work examines how total aspirations of enterprises can be quantified. It will discuss the reliability of the management processes and analytical techniques employed by this approach as well as an examination of key drivers of value and the influence of risk there in. In its second part, this work examines whether or not this approach (VBM) accounts for every value an enterprise could possibly have.

1. INTRODUCTION

Over the years the argument for the maximization of shareholder value has steadily gained grounds. Prior to this development, many had argued on the contrary that stakeholder value should receive prominence over shareholder since this value caters for the interest of more persons and not just shareholders. Copeland et al. (2000) gives four major factors which have played significant roles in the ascendancy of shareholder value: "The emergence of an active market for corporate control in the 1980s, following the apparent inability of many management teams to respond effectively to major changes in their industries; The growing importance of equity-based features in the pay packages of most senior executives in the United States and many in Europe as well; The increased penetration of equity holdings as a percentage of household

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assets, following the strong performance of the U.S. and European equity markets since 1982; The growing recognition that many social security systems, especially in continental Europe and Japan, are heading for insolvency".

These factors among others created a fertile ground for the prominence of shareholder value since the many corporations at the time could not rise up to the opportunity of adjusting and changing the direction of their operations as they looked on at matured and unexploited business opportunities. These developments saw the introduction of market for corporate control whose premise is that managers have the right to manage the corporation as long as its market value cannot be significantly enhanced by an alternate group of managers with an alternative strategy. This entrenched poor performance of a company in terms of shareholder value as the key driver for change.

Although this ascendancy of shareholder value has been in place for while giving the impression that all business entities exist to create value for its owners, most corporate executives and managers do not always act to maximize shareholder value because of perceived conflicts with other goals (Young S.D., O'Byrne S.F. 2001). This work of Young and O'Byrne states clearly that shareholder value does not necessarily conflict with meeting the demands of employees, customers, suppliers, the environment and the local community. Companies which value their relationship with these constituents tend to outperform others, which means that value can be delivered to shareholders only if it the value these constituents seek are met.

In a bid to maximize shareholder value, a lot of new management approaches have been introduced with the sole aim of improving the performance of business enterprises. Even before the introduction of these recent approaches to management, there have always been the strategies aimed at improving the value of enterprises. Among some of these new management approaches include: Process management, total quality management, flat organizations, continuous improvement, empowerment, team building, kaizen, re-engineering and many others. Whilst some of these approaches have been successful to certain degrees, some of them have failed. Reasons for the failure of these approaches range from their conception through their performance metrics to their outcomes.

The wake these developments saw the introduction of the concept of Value-Based Management (VBM). This approach offers a holistic solution to the idea of shareholder value in organizations through its concentration on: value creation – where it proposes the generation of maximum future value through strategy; managing for value – through governance, change management, organizational culture, communication, leadership etc; measuring value through valuation.

The purpose of this work is to conduct a study on the literature available on VBM, explaining this concept of management approach, how it works in companies and the place of risk in the approach. The work equally identifies the principles on which VBM is based as well as some of key concepts associated with VBM. It identifies the

sources of risks in companies and how these risks are related to the various value drivers in the VBM approach.

2. LITERATURE REVIEW

There are extensive literature bordering on this topic of VBM, prominent among them include the approach of the following six consultants: Stern Stewart & Co., Marakon Associates, McKinsey & Co., PriceWaterhouseCoopers, L.E.K. Consulting and HOLT Value Associates. According to Bromwich (1998), there are a lot of questions as to which metrics should be used and the copyright on them. Apart from which management approach is used, VBM valuations are generally based on comparisons between: corporate market value and corporate book value and the residual income measure.

The relevance of VBM is opined by Young and O'Brian (2001); they believe that every exchange in business leaves managers confronted with the task of optimizing the allocation of scarce resources and this further intensified by the countless changes and evolutions that characterize the current economic and social environment. These challenges confronting managers reveal the inefficiencies existing in the existing systems as well as support the need an integrated management tool.

According to Mills and Weinstein (2000), shareholder value is given much more attention in the Anglo-Saxon countries and in continental Europe. Despite the fact that shareholder value has been in the known, it did not enjoy much prominence in the 1960s and 1990s. A research by McKinsey & Co reports that economies based on shareholder values appear to perform better that the other economic systems and that shareholder value caters for the interests of other stakeholders. (Copeland et al. 2000).

It is likely there is a paradigm shift by way of management objectives. While growth in sales and revenue in the past was the governing objective, analysis of customer or product profitability based on the residual income theory suggest that not every growth is worth pursuit. (Ameels et al. 2002). Management is increasingly realizing that real value creation is not reflected by traditional earning measures and this is because these traditional metrics are based on accounting and do not take into consideration risk, opportunity costs and the impact of inflation. Stern Stewart & Co. (Stern Stewart, 1999) calls this: "the switch from 'managing for earning' to 'managing for value'".

The best performance measure is arguably value since it is the only measure which requires complete information. Value can best be understood from a long-term strategic viewpoint; that is know how to manage the income statement and various positions on the balance sheet taken into consideration time periods and adjustments for risks. Enterprises are in search of an approach that serves as many purposes as possible and

whilst VBM approaches cover most of these, the other approaches are based at only the strategic and business unit levels. Ottossen and Weissenrieder (1996), stress the need for measurement systems that can be used communication both internally and externally.

In the case of VBM metrics, different authors have different perceptions of the various metrics and they each attach some level of significance to each of the metrics. For example, Rappaport is of the view that a company's stock price is the clearest measure of market expectations of its performance (Rappaport 1987). On the other hand, Ehrbar (1998) believes market value added has a unique ability to gauge shareholder creation because both valuations are captured – the degree of wealth creation for shareholders and performance.

The following authors (Ittner, Larcker 1998; Bromwich, Walker 1998; Dechow et al. 1999; O'Hanlon, Peasnell 2001) are of the opinion that the basis for many valued-based metrics is residual income. This income is "defined as the accounting income attributable to shareholders at the end of the period minus the accounting book value of shareholders funds at the end of the previous period multiplied by the cost of capital. It provides a clear indication of whether a firm has made enough profit to satisfy both creditors and equity holders" (Eiteman et al. 1999).

Though majority of authors agree that shareholder value maximization cannot be underestimated, the reason for advocating this maximization is not univocal. McKinsey & Co. (Copeland et al. 2000), PwC (Black et al. 1998), L.E.K. Consulting (Rappaport 1998) and HOLT Value Associates (Madden 1999) describe VBM as a means to succeed in business. Stern Stewart & Co. (Stewart 1999; Ehrbar 1998; Stern et al. 2001) on the other hand think the recognition of ownership is the ultimate reason to maximize the value of shareholders. Last but not the least, Marakon Associates (Mc Taggart et al. 1994; Mc Taggart and Kontes 1993; Miller 2000) think the essence of VBM is the fact that it is considered the best way to secure the going concern of the enterprise.

According to Ameels et al. (2002), "There is clear unanimity with regard to the various stakeholder groups. All consulting companies in our assessment (Stewart 1999; Ehrbar 1998; Stern et al. 2001) (Mc Taggart and Gillis 1998) (Copeland et al. 2000; Copeland 1994) (Black et al. 1998; Read 1997) (Rappaport 1998) (Madden 1999) agree that the interests of all stakeholder groups are best served when putting the shareholder first".

The findings of Ameels et al. in relation to the fundamentals for value creation are follows: despite consensus on value creation and even value maximization, there is a difference in the proposed brass tacks. Four of the six consultants viz. Marakon Associates, HOLT Value Associates, Stern Stewart & Co and L.E.K. Consulting point at the importance of a well-founded strategy. One of this group; Marakon Associates, appears to focus predominantly on strategy … a coherent strategy should allow companies to overcome both the internal force of constraints in the organizational structure

or culture and the external force of competition, in order to maximize shareholder value. Where HOLT Value Associates (Madden 1999) combine strategy with metrics, Stern Stewart & Co (Stern et al. 2001) incorporates strategy, structure and metrics, and refers to the road map to Value Creation created by Briggs & Stratton.

There are many more findings related to VBM, but while most of these findings seek a comparison of the various approaches to VBM, this work is concerned about different aspects of VBM. This work concentrates on the idea of VBM, its components, principles as well as the place of risk in VBM.

3. VALUE-BASED MANAGEMENT (VBM)

The concept of VBM has been defined differently by the many authors who have attempted an explanation of it but on the whole there have been some identifiable trends in the definitions proposed by these authors. The first group of definitions is focused on the output of VBM. Prominent among these definitions include:

- "Value-Based Management is essentially a management approach whereby companies' driving philosophy is to maximize shareholder value by producing returns in excess of the cost of capital" (Simms 2001).
- "Value-Based management is a framework for measuring and managing businesses to create superior long-term value for shareholders. Rewards are measured in terms of enhanced share price performance and dividend growth" (Marsh 1999).
- "Value-Based Management is based on the notion that the central objectives for all public traded companies is to maximize shareholder value. Because it offers companies a logical and systematic way to pursue improvements in shareholder value, it has received considerable action in the business press" (Bannister and Jesuthasan 1997).
- "Value-Based Management is a term that describes a management philosophy based on managing a firm with Economic Value Creation principles" (Armitage and Fog 1996).

All the definitions cited above all concentrated on the ability of the VBM concept to create or increase the shareholder value of enterprises in other words the end result of VBM implementation.

The second group of definitions is based on the combination of the process and outcome. In this case, the definitions are not based on the outcomes that would be achieved through an implementation of this process but also the process of implementation of this VBM concept. The following are a sample of some of these definitions:

- "Value-Based Management says, in a nutshell, the key to increased shareholder value lies in the integration of strategic planning, performance measurement and compensation" (Leahy 2000).

- "The founding principle underlying Value-Based Management is the discounted cash model of firm value. However, VBM is more than a performance measurement system. Proponents argue that if it is to be successful it must be used to tie performance to compensation. The guiding principle underlying the use of VBM, then, is that measuring and rewarding activities that create shareholder value will ultimately lead to greater shareholder value" (Martin, Petty 2000).
- "Value Based Management is a management approach which puts shareholder value creation at the centre of the company philosophy. The maximization of shareholder value directs company strategy, structure and processes; it governs executive remuneration and dictates what measures are used to monitor performance" (KPMG Consulting, 1999).
- "Value-Based Management is a combination of beliefs, principles and processes that effectively arm the company to succeed in the battle against competition from the outside and the institutional imperative from the inside. These beliefs, principles and processes form the basis of a systematic approach to achieving the company's governing objective" (Mc Taggart et al. 1994).
- "Value-Based Management is a managerial approach in which the primary purpose is shareholder wealth maximization. The objective of the firm, its systems, strategy, processes, analytical techniques, performance measurements and culture as their guiding objective shareholder wealth maximization" (Arnold 1998).

Whilst all these definitions agree that the end result of VBM is the enhancement of shareholder value, each of them do not offer the same processes to the achievement of this end. The recommended processes range from strategic planning, compensation according to performance, through analytical techniques to valuation and performance measurement.

The most complete definition of VBM is that proposed by the institute of Management Accountants. This definition includes the inputs, processes and output of VBM. They define VBM as "An approach to management whereby the company's overall aspirations, analytical techniques and management processes are aligned to help the company maximize its value by focusing management decision making on the key drivers of shareholder value" (Institute of Management Accountants, 1997).

Drawing conclusions from the numerous definitions cited above, it is clear that the concept of VBM is constituted of three significant features; management, approach and the maximization of shareholders value. As a management and control tool, VBM is used as an apparatus to allocate resources and assign tasks towards the realization of stated organizational objectives. As an approach, VBM consist of a set of repetitive activities which creates value all through the organization. It is a strictly disciplined process which is supposed to manifest in the heart of every business decision. The last feature of VBM is the maximization of shareholder value and this in other words means the generation of maximum value by the allocation of resources to the most valuable investments.

VBM combines a number of operational and analytical methodologies together and applies them in an orchestrated, integrated and disciplined manner, focused ultimately on driving the creation of economic value.

3.1. PRINCIPLES OF VBM

This part of the work which deals with the principles on which VBM thrives will be discussed based on the McKinsey Quarterly No. 3 (1994). These principles indicate the management approaches that the management of various corporations should adopt as well as the changes in strategy that is needed for them to make inroads in the maximization of shareholder value.

The first principle of VBM worth discussing is the fact that this management approach is not a staff-driven exercise. A number of companies pay lots of attention to the valuation of its cash flow forecasts, the cost of capital and many other assumptions with very little attention to the company's strategies and operations. This in other words leaves out a significant part of management at the operation business-unit level thereby making this whole process of valuation and an attempt to create value futile and staff-driven. In order for this management concept to be successful, it would have to align the enterprise's overall aspirations, analytical techniques and its management processes with the key drivers of value.

It is equally important that VBM is not a methodology. The management concept should focus rather on the reasons why and the procedure required for changing an organizational culture. Just as the use of valuation as a performance metric and decision--making tool is important to VBM so is the delicateness of organizational behavior. This principle advocates that all who are involved in the VBM process understand that this concept is not just like the implementation of any other management theory but that they realize that there are some short falls in the organization and that this management approach provides a procedure for the restoration, creation and management of shareholder value.

The availability of the right incentives and the necessary information to managers at all levels of the organization is another principle on which VBM thrives. The structure of management within enterprises makes it almost impossible for one level of management to come out with the appropriate ideas to formulate good strategies to reflect the aspirations of the enterprise. Most of the time senior management set the targets and do the allocation of resources but these decisions will be inappropriate if they do not make them based on the information provided by the management and staff down the ladder. The daily operational targets and performance measures of these staff should equally be driven by overall strategy developed by top level management. The manner of availability and exchange of information between the various levels of the enterprise creates fertile grounds for VBM approach to flourish.

It is required of senior managers to be able to analyze and identify which performance variables directly influence the value of the company. This is other words is the creation of a value mindset. The creation of a value mindset means that managers understand the ultimate objective of an enterprise is the maximization of value and that there are rules for deciding when stakeholder objectives outweighs this imperative. They must also understand the dynamics of the decisions taken during the enterprise's operation such that the right amount of resources are allocated to deserving options.

Equally important is the principle of identifying and understanding performance variables that create value for the business. The McKinsey quarterly defines a value driver as "…any variable that affects the value of the company. To be useful, however, value drivers need to be organized so that managers can identify which have the greatest impact on value and assign responsibility for them to individuals who can help the organization meet its targets". This understanding is important since it is impossible to act directly on value. It is only possibly to act on parameters which can be influence (e.g. customer satisfaction, capital expenditures, cost etc) which in turn can influence value.

These principles of VBM together work for the creation, sustainability and maximization of value within an enterprise. The correct observation of these principles result in a value creation mindset, the appropriate management processes and the right systems to translate the mindset and processes into action.

3.2. COMPONENTS OF VBM

Different consultants over the years have proposed different elements which in their opinion make up VBM. Most of these elements are relevant but they can be grouped into basically three broad headings which are: creating value, managing for value and measuring value. Each of these components of VBM is discussed in detail in the ensuing paragraphs.

3.2.1. CREATION OF VALUE

The measure of Economic Profit (EP) or the value already created by an enterprise often marks the beginning of the implementation of the VBM approach in any company. The EP measure comes with several other proposed value creation measures some of which include; the share value added, economic value added, return on net assets and many others. Despite the differences in their names, they each seek to measure the degree to which an enterprise creates wealth. It is important to note hear that the measure of the existing value of an enterprise does not in anyway create additional value for that organization but rather it gives a true reflection of the state of the enterprise based on which concrete decisions and strategies can be implemented to commence this value creation process.

The process of value creation starts with the formulation of strategies and the setting of performance targets designed to deliver the desired results, an important part of which is the identification of value drivers which influence EP performance. Value drivers are variables that affect or have a significant influence on the value of a company in other words; these are financial measures that depict the elements of EP. Some of the value drivers that cut across most enterprises irrespective of their sectors of operations are; growth rate of sales, operating profit margin, cash income tax rate, fixed capital, working capital, growth duration and weighted cost of capital (WACC). Since the action of managers influence the performance of each measure, it is important for them to participate in planning to take other management actions to determine which of the value drivers have the most significant impact on EP. A continuous analysis of the value drivers is key to the creation of value; this is especially the case because the analysis helps in prioritizing expense reduction along with other opportunities to drive value (Sharman P. 2001).

3.2.2. MANAGING FOR VALUE

The creation and adaptation of a value-based mindset as well as the identification of value drivers alone are not enough for the success of the VBM approach. Actions and processes must be adopted to inculcate these new strategic propositions into the organizational culture. Tim Koller puts this in a better perspective when he wrote "for VBM to stick, line managers must embrace value-based thinking as an improved way of making decisions". Managing for value in other words refers to the how enterprises can employ management approaches to create, maintain and ensure a continuous rise in this value creation agenda.

Four management processes are very useful in the adoption of VBM which are supposed to be coordinated at the corporate, business-unit and functional levels of companies. The four management processes are: the development of a strategy to maximize value; the translation of the strategies into short and long-term performance targets formulated in terms of value drivers; the development of action plans and budgets to shape the future; the implementation of performance measurement and incentive systems to match performance against targets and holding employees to their goals. (McKinsey Quarterly, No. 3, 1994).

Strategy development

It is absolutely important that the formulation of strategy is based on value maximization and should define how an enterprise will achieve a competitive advantage that will permit it to create value. The development of a business strategy has different responsibilities at various levels of the organization. At the corporate level it is the responsibility of top management to decide what kind of business the company invest in, how the company's resources should be allocated to the various operations and

how to exploit potential co-operations across business units. At the business unit level of the organization, the development of strategy is basically about identifying, valuing and choosing alternative strategies that will provide the highest value for the company. The elements of this strategy should include: Assessing the results of the valuation and the key assumptions driving the value of the strategy; Weighing the value of the alternative strategies that were discarded, along with the reasons for rejecting them; Stating resource requirements; Summarizing the strategic plan projections, focusing on the key value drivers; Analyzing alternative scenarios to assess the effect of competitive threats or opportunities (McKinsey Quarterly, No. 3, 1994).

Target setting

One of the most subjective business processes is target setting, but its relevance and usefulness to the success of any objective can not be underestimated. The setting of targets can bring about mediocre performance, fail to motivate those working towards them or create zeal and determination for success. Targets are the way management communicates what it expects to achieve. For targets to successful in the VBM approach, it is important to observe the following principles: targets must be based on key value drivers including both financial and nonfinancial dimensions; targets must be tailored to the different levels within the organization. This means that there must be targets set for overall financial performance and unit-wide nonfinancial performance for senior business-unit mangers and cost and quality related targets for functional managers; long and short-term targets must also be linked to ensure a continuity and harmony in the operational objectives of the company both in the short-term and long-term.

Action plans and budgets

Action plans should translate strategies to the specific actions an organization should take to achieve its targets, especially in the short term. The plans must identify the steps that the organization will take so that it can pursue its goals in a more organized manner.

Performance measurement

This together with incentive systems monitor the extent to which an organization has progressed in the achievement of its targets. Apart the monitoring it does, it also serves as a way of encouraging employees and management to continue to strive to achieve set targets. Performance measurement under VBM shifts performance measurement from being based on accounting to being management driven. All the same, developing a performance measurement system is relatively straightforward for a company that understands its key value drivers and has set its short- and long--term targets. Some of the key principles that guide this process include: tailoring performance measurement to the business unit, meaning each business unit should have its own system for measuring performance, a system it can influence; Perform-

ance measurement should be based on the business unit's short and long-term targets and not on accounting results since this is the only way to put achievements in the right perspectives; the measurement should include financial and operating perform-ance since this will serve the needs of management in better ways; there should be an identification of performance measures that will serve as early warning indica-tors. The company cannot rely on only financial indicators for warning since they measure only what has already happened in which case management is in no posi-tion to correct or avoid oncoming crisis. Compensation should be designed to pro-vide the incentive to create value at all levels within an organization as well as be based on the contribution of employees to the creation of value.

<div align="center">3.2.3. MEASURING VALUE</div>

Performance measurement is generally acknowledged to be critical to the success-ful operation of any organization. Goals are defined by expected results and described in terms of measures. Measures establish a vehicle for communication with which managers describe expectations to each other and subordinates in precise and under-standable terms. The emphasis in measurement should be on new conditions, future state and desired performance.

There have been a number of criticisms on commonly used profit related measures like the return on investments, return on assets, earnings before interests, taxes and am-ortization of good will and earnings per share. (Gunther 1997; Mills et al. 1998). In a bid to measure the total value of organizations, there have been more proposals of value-based performance metrics recently; whilst others have been carved out of the capital market theory. The value of an organization can be gauged from two different angles. Value-enhancing managers are considered to be those who create value by increasing the company's value relative to the cost of capital at their disposal. In the first scenario, the stock market data provide, the information needed to calculate the value of the com-pany unambiguously. In the other instance, many companies (especially all the non-quoted organizations) estimate the warranted value of their common stock indirectly, using an alternative valuation model. In this way, these performance measures can very well be used to assess divisional performance and to provide information supporting decisions on corporate or divisional level (Ameels et al. 2002). This means in essence that the performance metrics for all companies can be discussed under two broad catego-ries; metrics for the listed companies and metrics for the non-listed companies.

Performance metrics for listed companies

Total shareholder return (TSR)

One of the approaches in measuring the value of shareholders is through the esti-mation of how much the share prices of a company have appreciated plus its divi-dends. This can be mathematically expressed as;

$$TSR = \frac{(P_{t+1} + P_t) + D_{t+1}}{P_t},\qquad(1)$$

where:

P = Share price,

D = Dividends paid.

This approach is considered one of the most useful in the attempt to estimate shareholder value provided it is used appropriately. The logic of this metric is that it calculates investors' economic income for specified time periods. The TSR measure is a useful indicator of performance. It can readily be applied by using appropriate benchmarks, groups of firms, or indexes. As a performance metric, it compares the economic returns to investors in a firm relative to alternative benchmark investments.

This performance metric does not come without any criticisms. First among these criticisms is the fact that, this measure cannot be used to calculate shareholder value at business-unit level or for specific market combinations. Secondly, it will be unfair to measure the performance of managers with this approach because it is driven by a lot of factors which cannot be influenced by the firm's executives. (Bannister and Jusuthasan 1997; Bacidore et al. 1997). In fact, in the short term, differences between actual performance and market expectations and changes in these expectations drive share prices more than the level of performance per se. It is the delivery of surprises that produces higher or lower total shareholder returns compared to the market. (Copeland et al. 2000). None the less, an appropriate calculation and interpretation of this measure lends it much credence.

Market value added (MVA)

This is the difference between the equity market valuation of a company and the sum of the adjusted book value of debt and equity invested in the company. Market value added is said to be unique in its ability to gauge shareholder value creation because it captures both valuation – the degree of wealth enrichment for the shareholders and performance i.e. the market assessment of how effectively a firm's managers have used the scarce resources under their control – as well as how effectively management has positioned the company on the long term (Ehrbar 1998). This can be calculated by the following formula:

$$MVA = \text{Market value} - \text{Invested capital}.\qquad(2)$$

This method also avoids certain problems with accounting principles related with the anticipation of future cash flows and discount rates because it approximates the stock market estimation of net present value (Hillman and Keim 2001). This method is equally criticized for its use of accounting data as well as the fact that most of the factors which input into this measure are beyond the control of management.

Performance metrics of non-listed companies

Single peroid metrics
Economic value added (EVA)
This is defined as net operating profit after taxes and after the cost of capital. Economic value added is a refinement of this concept – it measures the economic rather than accounting profit created by a business after the cost of all resources including both debt and equity capital have been taken into account. Economic value added (EVA) is a financial measure of what economists sometimes refer to as economic profit or economic rent. The formula for calculating EVA is:

EVA = Net Operating Profit After Taxes (NOPAT) – (Capital*Cost of Capital)   (3)

This method eliminates accounting distortions by converting from accrual to cash accounting. EVA and related measures attempt to improve on traditional accounting measures of performance by measuring the economic profit of an enterprise. Claims have also been made that EVA can drive behavioral change by providing the incentive for managers to promote shareholder wealth as the primary objective (Dodd & Chen 1996; Biddle et al. 1997; Brewer et al. 1999; McLaren 1999).

Equity Spread Approach
This measure compares the return on equity (*RoE*) against the cost of equity (k_E) based on future-oriented accounting model. The Market to book value can be calculated by dividing the difference between *RoE* and *g*, and k_E and *g*, when *g* is less than k_E.

$$\frac{M}{B} = \frac{(RoE - g)}{(k_E - g)}; \quad k_E > g \qquad (4)$$

and

$$\frac{M}{B} = \left\{ \begin{array}{l} +\infty \quad \text{if} \quad RoE > g, \\[6pt] 0 \quad \text{if} \quad RoE = g \quad \text{with} \quad k_E > g, \\[6pt] +\infty \quad \text{if} \quad RoE < g. \end{array} \right.$$

This ratio can be used in three circumstances. Firstly, this ratio produces a meaningful quick and dirty valuation. Secondly, it draws out the key relationships between equity spread, growth and the ratio of market value to book value. And finally, the equation can be used to estimate a company's (or a business unit's) value at the end of the planning period (McTaggart et al. 1994). The significant difference between both approaches is that in the EVA approach economic value added is assessed by means of the weighted average cost of capital – and therefore considering both debt and equity – whereas the equity spread approach is interested only in the return against the cost of equity.

Multi-peroid metrics
Cash Flow Return on Investment (CFROI)
This is the annual gross cash flow in relation to the invested capital of the business unit (Lewis in Gunther 1997). The mathematical formula for CFROI is the solution of r in:

$$I = \sum_{i=1}^{n} \frac{CF_i}{(1+r)^n} + \frac{W_{n+1}}{(1+r)^{n+1}} \, , \qquad (5)$$

where:
W = Expected residual value of non depreciating assets,
I = Gross Operating Asset Investment,
CF = Gross Cash Flow.
The CFROI calculation requires four major inputs: the life of the assets, the amount of total assets (both depreciating and non-depreciating), the periodic cash flows assumed over the life of those assets and the release of non-depreciating assets in the final period of the life of the assets (Madden 1999; Young and O'Byrne 2001; Morrin and Jarell 2001). From a methodological point of view CFROI can be determined in two steps (Myers 1996). First, inflation-adjusted cash flows available to all capital owners in the firm, are compared to the inflation-adjusted gross investments made by the capital owners. The ratio of gross cash flow to gross investment is translated into an internal rate of return by recognizing the finite economic life of depreciating assets and the residual value of non-depreciating assets (Ameels et al. 2002).
Shareholder Value Added (SVA).
Shareholder value added (SVA) is defined as the difference between the present value of incremental cash flow before new investment and the present value of investment in fixed and working capital.
SVA = (Present value of cash flow from operations during the forecast period + residual value + marketable securities) – Debt.
SVA can also be defined as incremental sales multiplied by incremental threshold spread, adjusted for the income tax rate, divided by the present value of the cost of capital (Rappaport 1998). In a multi-divisional organization the measurement of selected value drivers at the divisional level could be complementary to value-based measures at group level and eradicate the need to calculate divisional cost of capital.

3.3. THE PLACE OF RISK IN VBM

Risk is one of the concepts that many investors would rather not talk about. Just because enterprises are determined to increase the value of shareholders does not mean, they are willing to do that at any cost. Among the reasons why investors detest the idea of risk is the difficulty in precision of quantifying it. The following words are most valuable when it comes to the measurement and taking of risks by enterprises;

"everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted."(Albert Einstein). There are so many variables which can be estimated and calculated with a certain level of precision but the idea of risk despite its attendant difficulty in estimation is far more important for the success of business.

Companies which adopt the VBM management approach do not shy away from risk since their ultimate goal is the attainment of the highest possible value for shareholders and this comes with a lot of risk. The best way for these companies is not to shy away from risk by to learn how to exploit this risk – risk management. A more improved version of risk management is Value-Based Risk Management (VBRM). This method strikes a balance in the allocation of resources to the four phases of risk management (Identification, analysis, mitigation and control) to produce high quality results with a reduced expenditure of time and resources. "In other words, VBRM optimizes human and financial resources to dramatically improve the risk management process, particularly the highly critical mitigation and control phases" (Curran 2006). These are the principles adopted by business running VBM. The following diagram illustrates the sources of risks and the ultimate impacts it has on shareholder value.
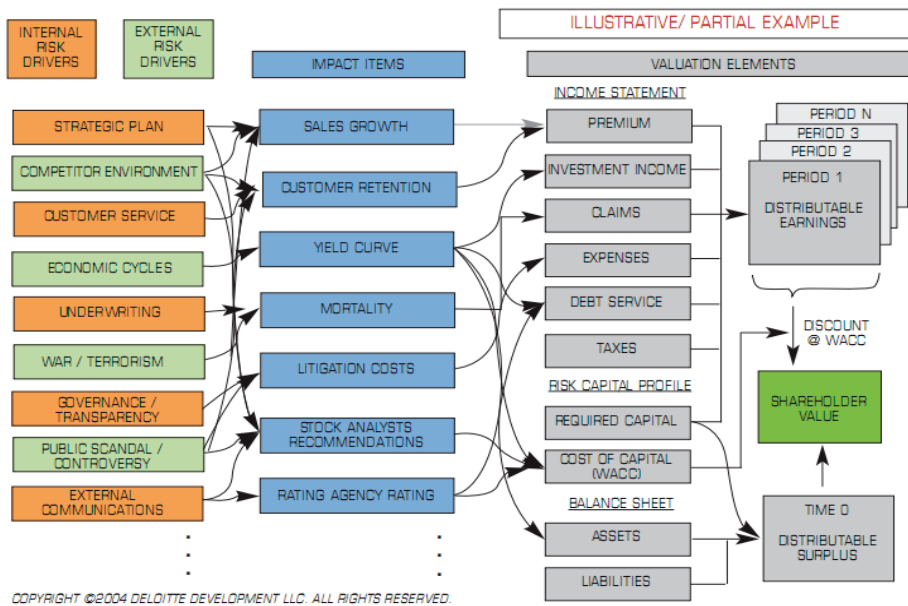

Fig. 1. Value-Based Enterprise Risk Management Model

The Value-Based ERM is a model designed to quantify the enterprise-wide integrated impacts of risk on shareholder value. A simplified example of such

a model is shown in diagram 1 above. The model presents a partial list of internal and external risk drivers (on left of chart) and the items that they impact downstream (moving to the right), ultimately impacting the valuation elements and shareholder value.

The VBM approach identifies and analyses the nature of risks. For example, the EVA metric, uses the WACC variable in which provision is made for the risk that comes with the capital borrowed for investment. This involves careful study of the capital market and risk associated with the various options. All other valuation metrics have an aspect of its computation where the risk is imputed.

The last two phases – mitigation and control – are catered for VBM through its principles which advocate the identification of performance variables which increase the value of the company as well as the phase of managing for value. These two aspects of VBM concentrates on first indentifying items which directly have an influence on the value of the company and making sure that they are managed appropriately. This among other things includes management of sales and positions on the accounting records which are directly linked with capital. Secondly VBM's adoption of management approaches to increase value includes making forecasts and setting long-term objectives. These measures include the study of the opportunities that are available to the company, how it can harness these opportunities and most importantly the risks that come with the opportunities.

The idea of risk as can be seen is very central to the ideals of VBM, because the creation of value comes at a cost and risk is one of such costs. It is only a proper management of this phenomenon that can result in the attainment of value for shareholders.

4. CONCLUSION

This work has among other things explained the concept of VBM, provided up-to-knowledge of this management approach, described the principles on which this approach is based, the various ways of measuring the value of companies and eventually the place of risks in the VBM approach. Despite the short elaborations given in each of these areas, the most important ideas and information were captured.

The VBM approach has proven over the years to be the most reliable management approach in the creation of value for shareholders. This approach unlike many proposed management approaches is based on the involvement of all levels of the organization in the creation of value, making employees understand why and how value should be created and not just taking the approach as a routine process. This approach equally admonishes the identification and management of value drivers as well as an identification and implementation of value creating strategies, objectives and targets. The measurement of the value created is just as important as the creation

and management of that value. This valuation process gives employees and management and idea about the extent to which the set targets, objectives and strategies have been realized as well as the other important aspects of the enterprise that needs attention.

The place of risk in the creation of value for enterprises cannot be under estimated. From the formulation of strategies, through organizational objectives to the achievement of targets involves the continuous identification, assessment, mitigation and control of the various forms of risks. In the VBM approach, companies do not shy away from such risks but rather they examine the avenues for the possible exploitation of those risks to create value and this can be achieved through enterprise value-based risk management. The appropriate management and making of provisions for these risks in the VBM approach ensures the continuous maximization of shareholder value.

This research of the VBM approach could be furthered especially in relation to the management of risk. It is not enough to identify the place of risks in organizations, it is even more important to know the best ways in which these risks can be managed in the value-creation process. Another interesting perspective that could be undertaken by way of research is to investigate into some of the difficulties and inadequacies that companies are confronted with in the implementation of VBM. There also some assumptions under traditional VBM principles which ignore investor expectations, drivers of realized valuation multiples and investor segmentation. Further research could look at how these variants can be incorporated in the VBM approach for maximum value creation.

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COST OF EQUITY BASED ON CAPM

The work presents Capital Asset Pricing Model (CAPM) that can be used in a cost of equity calculation, which is, further, an important factor in a Weighted Cost of Capital (WACC). Calculation of WACC is important, because the level of WACC, being the discount rate, influences the present value of cash flows of investment projects.

In the work the main idea of CAPM is presented and its application in Poland, that is considered as an "emerging market". The author writes also about usage of the model in the calculation of profitability of real investment project. Here, there is a problem with calculation of beta coefficient since the real investment projects are not quoted on the stock exchange and there is no historical data that investor could base his calculations on. In the work the example of beta calculation will be presented.

1. CAPITAL ASSET PRICING MODEL (CAPM)

CAPM is a model that presents dependence between risk and rate of return in an easy and logical way. Assumption of CAPM is that on effective capital market investments with similar risk level should have similar rate of return. It says, that required return on every asset is equal to risk free rate plus risk premium times beta coefficient of a security. There is a linear dependence between expected income from a security (or a portfolio) and risk connected with it. Risk of a portfolio is measured by standard deviation. Risk of every asset in portfolio is measured by beta coefficient, that is also the slope of characteristic line of the asset. We can get beta coefficient value calculating regression of historical income of security and historical income of market index.

Under the CAPM there is an assumption that the cost of equity is equal to the risk-free rate plus a risk premium that is represented by the following formula:

$$k_e = k_{RF} + \left(k_M - k_{RF}\right)\beta , \qquad (1.1)$$

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where:

k_{RF} – risk-free rate,

k_M – return on the market,

$(k_M - k_{RF})$ – market risk premium,

β – beta coefficient.

Risk-free rate

Most often current yield on a 52-week treasury bills is taken as a risk-free rate k_{RF}. Treasury securities are essentially free of default risk.
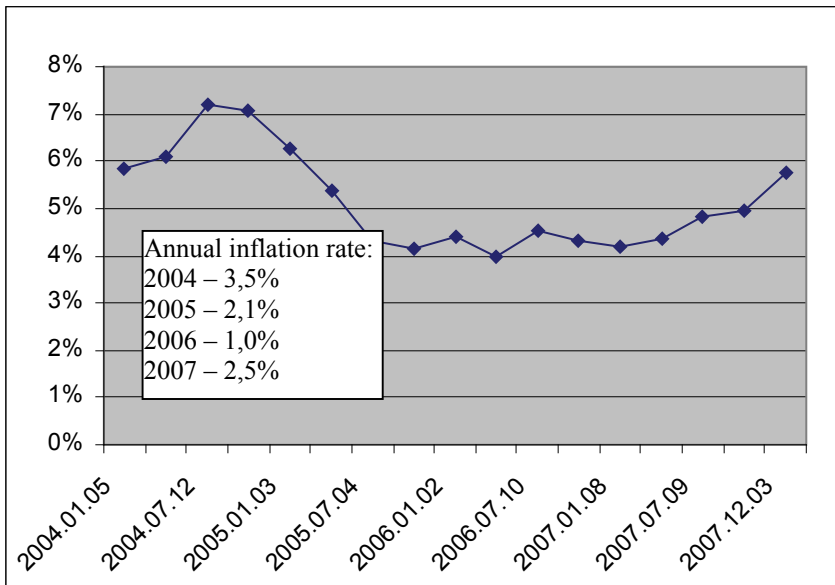
Fig. 1.1. Change of risk-free level – yield on 52-week Polish treasury bills in the period of 2004–2007.
Source: own work

When we consider medium-term investment project (up to 5 years) it seems to be adequate to take yield on a 52-week treasury bills as a risk-free rate k_{RF}. Whereas in case of long-term investments in Poland we have to consider Poland's entering Eurozone. This fact probably will cause decrease on yield on treasury bills. At present profitability of treasury bonds is high, because of the necessity of budget deficit financing and because of investors' perception of the level of risk of running business in Poland. Therefore, we can use profitability of investments in debt securities issued by European Investment Bank (EIB) when determining risk-free rate level. Generally, we can say that maturity date of debt securities that are

taken to determine the level of risk-free rate should reflect the length of time of investment property usage. It is difficult to meet this requirement, because there are no debt securities with the similar to investment project's time horizon. In case of long-term investments we can take interest rate of ten-year bonds, even when we consider 20–30-year investment, because this kind of bonds is not so liquid and according to it rate of return on ten-year bonds includes premium related to its limited liquidity [4].

Market risk premium $(k_M - k_{RF})$ means the return over and above the risk free rate that investors require for bearing market risk. It should reflect how investors perceive investment risk in particular country, Table 1.1. In the process of assessing risk level it is possible to base calculations on rating agencies' data. In USA average risk premium calculated on the base of observations from the period of 1926 to 2001 is 7.1% [5]. According to the guidelines of Commission of the European Communities risk premium level may be equal to the half of risk-free rate level.

Table 1.1. Classification of risk premium by Damodaran

Market characteristic	Premium
Emerging markets with a risk of political instability	8.5%
Other emerging markets	7.5%
Developed markets with a lot of listed companies and high capitalisation	5.5%
Developed markets with limited number of listed companies	4.5–5.5%
Developed markets with limited number of listed companies and stable economy	3.5–4.0%

Source: [3]

Classifying Poland to the group of emerging markets, risk premium should be from 7.5% to 8.5% with the tendency of decreasing its value due to economic development.

Beta coefficient β measures sensitivity of changes of security rate of return in relation to changes of market portfolio rate of return. Beta coefficient reflects total risk of a security of a company, that consists of operational risk resulting from the company's activity and financial risk resulting from financial leverage. Higher leverage increases the variance in net income and makes equity investment in the company riskier. In case of companies that are not listed on a stock exchange it is not possible to empirically determine β. In this case we have to assess average β characteristic for similar companies that are in the public domain, and then we have to isolate financial risk related to financial leverage. In this way β reflects only operational risk of group of analysed companies. We can use the following equation:

$$\beta_u = \frac{\beta_e}{\left(1 + (1-T) * \dfrac{V_D}{V_E}\right)}, \tag{1.2}$$

where:

β_u – unlevered beta of the company (i.e., the beta of the company without any debt),

β_e – levered beta for equity in the company,

T – corporate tax rate,

$\dfrac{V_D}{V_E}$ – debt-to-equity ratio (market value).

As leverage, measured by the debt-to-equity ratio, increases equity investors bear increasing amounts of market risk in the company, leading to higher betas. The tax factor in the above equation measures the tax deductibility of interest payments.

The unlevered beta of the company β_u (also referred to as the asset beta) is determined by the types of the businesses in which it operates and its operating leverage.

The levered beta β_e, which is also the beta for an equity investment in a company, is determined both by the riskiness of the business it operates in by the amount of financial leverage risk it has taken on. The higher financial leverage, the higher company risk.

To calculate cost of equity basing on CAPM historical beta is taken into consideration. The assumption is that future company risk will be the same like in the past. In some case this assumption is not appropriate. From that reason, in the literature [1] we can find modified beta coefficients: **adjusted beta** and **fundamental beta.**

In case of **adjusted beta** we have to begin with pure historical statistical beta and make an adjustment for the expected future movement toward 1,0. The adjustment process involves complex statistics.

In case of **fundamental beta** other fundamental risk variables are taken into consideration like financial leverage and sales volatility. This kind of beta coefficient is constantly adjusted to reflect changes in a company's operations and capital structure. Historical beta (including adjusted one) does not reflect such changes.

It should be also noted that betas can be based on historical periods of different lengths. Different data sets will produce different results. The choice of beta calculation method is a matter of judgment and availability of data.

2. CALCULATION OF COST OF EQUITY BASED ON CHOSEN COMPANIES

Beta coefficient can be estimated for individual companies using regression analysis against a stock market index. A few companies quoted on The Warsaw

Stock Exchange were taken to examine their beta coefficient. Companies represent metal industry. Monthly quotations of WIG index and shares of 6 randomly chosen companies were taken into calculation. Calculations refer to the period of 2006–2010. It's assumed that cost of capital calculation will be based on historical data. Monthly rate of returns of companies' shares and WIG index were calculated on the basis of monthly information about their closing quotes according to the following equation:

$$k = (P_1 - P_0)/P_0 \, , \tag{2.1}$$

where:

k – monthly rate of return,

P_0 – closing quote on the last date of month,

P_1 – closing quote on the first date of month.

Treasury securities are essentially free of default risk. Average yield on a 52-week treasury bills was used as the proxy for the risk-free rate k_{RF}, Table 2.1.

Table 2.1. Average yield on a 52-week treasury bills in years 2006–2010

Year	2006	2007	2008	2009	2010
Average yield on a 52-week treasury bills [%]	4.20	4.64	6.52	4.65	3.91
Average	4,78 %				

Source: own work based on www.money.pl

Monthly rate of return of WIG index is a control variable. Dependent variables are monthly yields on shares of the companies. Statistical dependencies were determined for the period of 5 years basing on 60 monthly rate of returns of shares and WIG index from the period of 2006-2010.

Similar methodology of beta coefficient assessment is used by the world consulting group Merrill Lynch. Theoretically it is not possible to say what is the length of the most appropriate time slot. On the one hand, the number of observations should eliminate random perturbations, but on the other hand, time interval should not be too long, because the company financial situation may be changed.

Value of beta coefficient was calculated basing on regression model connected with security characteristic line (SCL) as follows:

$$k_e = \alpha + \beta k_M + \varepsilon \, , \tag{2.2}$$

where:

k_e – historical (realized) rate of return on a stock,

k_M – historical (realized) rate of return on the market (market index),

α – vertical axis intercept term for a stock,

β – slope, or beta coefficient, for a stock,

ε – random error, reflecting the difference between the actual return on a stock in a given year and the return predicted by the regression line.

Beta coefficient is the slope of the regression line relating the return on the market (the independent variable) to the return on the stock (the dependent variable).

To evaluate SCL Statistica 9.0 software was used. Results received on the basis of historical data presents Table 2.2.

Table 2.2. Beta coefficient of chosen companies

Company	α	β	Determination coefficient	Standard estimation error
Grupa Kęty S.A.	0.0056	1.0165	0.43979810	0.09078
Hutmen S.A.	0.0736	1.3825	0.06468564	0.41600
Impexmetal S.A.	0.5168	2.3325	0.00208665	4.0410
KGHM Polska Miedź S.A.	−0.0023	1.3064	0.44730578	0.11491
Stalprodukt S.A.	−0.0106	1.0827	0.31555482	0.12287
Ferrum S.A.	0.0082	1.0695	0.16226743	0.19229

Source: own work

Security market line (SCL) is plotted on a graph where the y-axis is the excess return on a security over the risk-free return. X-axis is the excess return of the market in general. α coefficient is the y-intercept. It represents security expected rate of return when rate of return from the market is equal to 0. Security's beta is the slope of the security characteristic line. It measures sensitivity of the security rate of return to changes of the market rate of returns. For example, when market rate of return increases by 1%, investor will increase his expectations towards rate of return of Hutmen S.A. shares by 1.38%.

The most popular two statistics evaluating the goodness of fit are determination coefficient and standard estimation error. Determination coefficient measures how well statistical model fits a set of observations. It summarizes the discrepancy between observed values and the values expected under the model in question. It measures how total variability of dependent variable can be described by the model. For example in case of Grupa Kęty S.A. model is able to explain only approx. 44% of the volatility of the share price. Remaining 56% can be described by the factors that were not taken into consideration in the model. Standard estimation error equalled to 0.09078 means that if we forecasted value of dependent value using the model, we would make an average mistake by +/–0.09078.
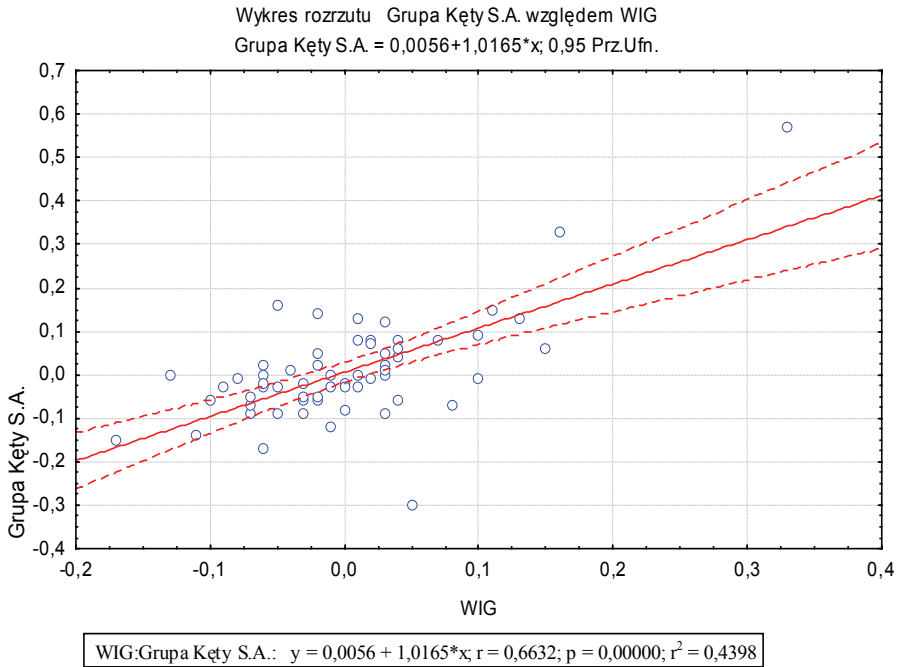
Fig. 2.1. Estimating beta coefficient illustrated with an example of Grupa Kęty S.A.
Source: own work

The value of correlation coefficient (0.66) presents the average dependence be-tween market rate of return and rate of return of Grupa Kęty S.A. security. On the basis of equation (1.1), the results of calculation of cost of equity of chosen companies are presented in Table 2.3.

Risk premium at level of 7,5% was taken into calculations.

$$k_e = k_{RF} + (k_M - k_{RF})\beta = 4.78\% + 7.5\%\beta$$

Table 2.3. Cost of equity of chosen companies (metal industry)

Company	β	Cost of equity
Grupa Kęty S.A.	1.0165	12.40
Hutmen S.A.	1.3825	15.15
Impexmetal S.A.	2.3325	22.27
KGHM Polska Miedź S.A.	1.3064	14.58
Stalprodukt S.A.	1.0827	12.90
Ferrum S.A.	1.0695	12.80

Source: own work

Cost of equity of the above examined companies was calculated according to CAPM. In most of these companies the level of equity cost is dozen or more percent. The only exception is Impexmetal S.A. with its beta equalled to 2.3325. It should be noted that determination coefficient in this case is only 0.00208665 what means that only small part of total volatility of dependent variable is described by that model. At the same time standard estimation error is at the highest level from among analysed companies and correlation coefficient amounts only to 0.0457.

3. APPLICATION OF CAPM IN REAL INVESTMENTS EVALUATION

In case of real investment projects, calculation of cost of equity basing on CAPM is more complicated. It is not possible to implement CAPM directly, because of difficulties of beta assessment in practice. When we analyse the investment profitability on the capital market we use historical stocks returns, whereas operating assets have no quoted market prices. In the literature [1, 3] we can find two approaches for estimating the betas of individual assets:

- the Accounting Beta Method,
- the Pure Play Method.

The Accounting Beta Method is based on regressing company's basic earning power against the average basic earning power for a large sample of companies. Basic earning power can be measured by Earnings Before Interests and Taxes/Total Assets. Using this indicator we can calculate beta for all types of companies (not only publicly owned). It doesn't fully reflect the influence of market risk on the company's activity. According to many studies in this area, accounting-determined betas provide only rough approximations for market-determined betas, market risk and the cost of capital.

The Pure Play Method is difficult to execute in practice, because it needs one or more non-integrated, single-product companies to be found in the same line of business as the investment project under study. When we assume that new investment project is subject to the same risks as those of the other companies, we can calculate betas of these companies using regression process, average betas and use this average as a proxy for the project's beta. There is a possibility of exposing to large evaluation mistakes because of small sample of data. Pure play method needs calculations in the following steps [2]:

- Indicating the company's branch that project refers to.
- Finding companies, in the public domain, that act mainly in this line of business.
- Determining risk parameters for these companies. In case of CAPM usage – calculation of beta coefficient referring to market risk of the companies.

- Adjusting risk parameters depending on differences in financial leverages between compared companies and analysed branch of the company. In case when analysed line of business is not financed with debt, the financial leverage of the whole company must be taken into consideration. It is assumed, that operational leverage is similar within the companies acting in the same business line. In case of different fixed cost level of analysed branch and compared companies beta coefficient should be also adjusted.
- Calculating cost of equity for the given project in the given branch basing on adjusted risk parameters.

4. APPLICATION OF CAPM IN POLAND

Poland is recognised as a so-called emerging market. "The basic problem are poorly developed financial markets and arising from it lack of possibility of direct assessment of key parameters needed to evaluate cost of equity. (...) Results of empirical studies by Kuziak, Gajdka and Wolski show that our market is not stable and mature enough to be well described by CAPM. (...). According to the recommendations of T.E. Copeland and R.W. Westerfield the best method of capital cost calculation on emerging markets is using CAPM in indirect way and basing on parameters adopted from the well developed capital markets. It means applying levered beta coefficients that reflect business risk of similar American companies. Then, the beta coefficients are adjusted to financial leverage of analysed companies and corrected by market premium appropriate for the country and forecasted inflation rate. There is no doubt that the most difficult task is risk premium valuation. It should be underlined that risk premium is problematic not only on emerging markets. It refers to all markets with shorter history than American market and with higher volatility level. Here, we are saying about many European capital markets" [6, p. 31–32].

5. SUMMARY

The Capital Asset Pricing Model is a useful conceptual tool. It seems logical and rational. The problem of CAPM usefulness is, that we only have historical data, not expectational data, available for testing. Inputs should be ex ante, yet only ex post data are available.

A study by E.F. Fama and K.R. French seriously challenges the CAPM. Their study revealed no relationship between historical betas and historical returns. They showed that low-beta stocks provided about the same historical returns as high-beta stocks.

However, the fact that no relationship was found between historical betas and historical returns does not mean that the CAPM concept is wrong. It should be underlined that Capital Asset Pricing Model is purely an expectational model. It represents the way investors who want to maximize returns while minimising risk ought to behave. It is clearly useful as a way of thinking about the riskiness of assets in general.

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DECISIONS ON ENERGY COST
IN POLISH INDUSTRY

The analysis of data from the National Statistic Office shows that consumption of electricity and heat by the Polish industry has been decreasing. The aim of the work is to identify the causes of this reduction. Three possible causes have been subjected to the analysis:

– reduction of energy consumption caused by the need to reduce production costs in the time of economic crisis,
– reduction of energy consumption caused by the need to reduce production costs unrelated to economic crisis,
– increase of environmental awareness.

For this purpose, studies were carried out in two different companies and the data from the National Statistic Office was analyzed. The results allow to formulate an initial hypothesis how Polish companies take decisions aimed at reducing electricity consumption.

1. INTRODUCTION

Electricity has found a wide application in industry. The analysis of data taken from the National Statistical Office shows two conclusions. First, industry is consuming a significant portion of electricity, which makes his actions affect the energy efficiency of the Polish economy. Secondly, at some point there has been a fairly significant drop in electricity consumption (see Figure 1).

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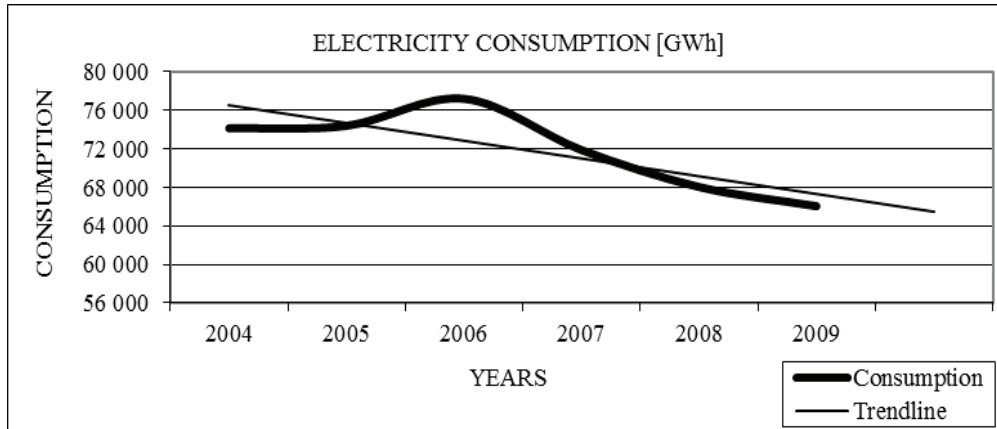
Fig. 1. Consumption of electricity for industry in the years 2004–2009

The analysis of these data shows that electricity consumption in industry in the test period was growing and after that in the 2007 begun the gradual reduction of its consumption. The aim of this work is to identify the causes of reduction the electricity of consumption in industry.

Undisputed is the fact that the growing energy needs and limited energy resources have resulted increases energy prices. In turn, the consumption of energy and materials affects to a large extent on the company operating costs and thus profit from the sale, which consequently has reflected in net profit. Therefore, there is a real need to optimize energy use in industry.

The aim of energy savings, in addition to the abovementioned minimizing costs of production, can also be the concern for the environment. The need for rescue the environment is the challenge of modernity through realizing all possible protective ways.

2. IDENTIFICATION ATTEMP THE CAUSES
OF REDUCING ELECTRICITY CONSUMPTION

Electricity consumption in industry shows a downward trend since 2007. For the aims of this work, factors affecting this trend were divided into external and internal. In the first group of factors is the economic crisis which forcing to more of reducing costs. In the second group of factors that cause reduction of electricity consumption in industry are: the need to reduce the costs of production doesn't connected with economic crisis and increasing environmental awareness.

The economic crisis is defined as a periodic decreasing of activity of economic life which is one of the phases of the cycle[1]. It manifesting in the industry mainly by fall production, the decline in employment and decline in demand.

In turn, environmental awareness is defined as the understanding of the relationship between humans and the rest of nature and the awareness the impact that human activity has on the environment. Awareness means not only an adequate level of knowledge, but also rational and emotional acquire knowledge, which cause making certain decisions[2].

Reduction of energy consumption reduces the operating costs of the company and consequently contributes to the increase in net profit. So, which factor is causing decrease energy consumption in the industry?

To study whether this trend was caused by external factor have been analyzed consumption of petrol and diesel (see Figure 2) in the transport. If today's companies are organized as a supply network doesn't doubt that for the proper functioning must use from the services of transport undertakings. A lot of companies, including described companies use road transport in the Poland.
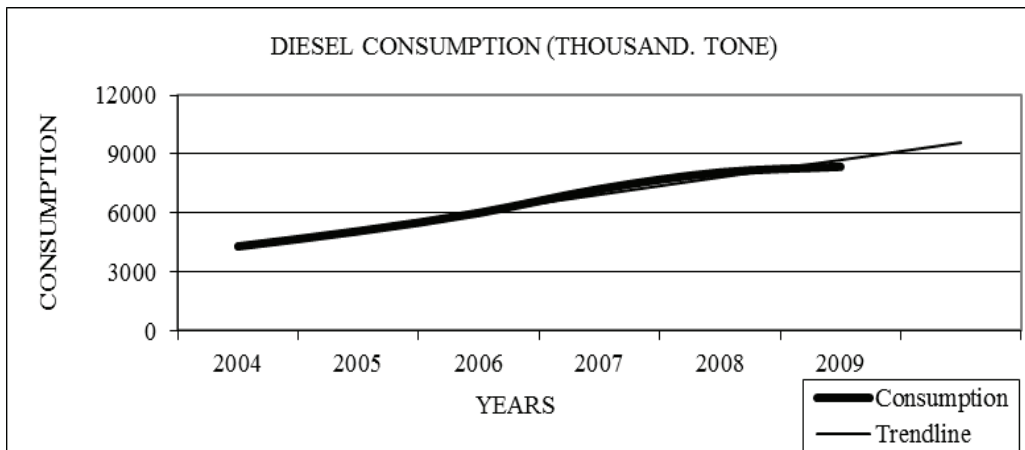

Fig. 2. Consumption of diesel for transport in the years 2004–2009

The figure shows that diesel consumption for transport grew in the years 2004–2009. In 2009, its consumption relative to 2004 increased almost twice. Transport, whereby the individual parts of supply chain connect uses in its opera-

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[1] D. Kalisiewicz (redaktor naczelny), *Encyklopedia Popularna PWN*, Wydanie trzydzieste, Wydawnictwo Naukowe PWN, Warszawa 1999, s. 418.

[2] G. Kobyłko, *Proekologiczne zarządzanie przedsiębiorstwem*, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, wydanie drugie rozszerzone, Wrocław 2007, s. 91.

tions mainly diesel. This increase may be proof that the energy savings in industry is not an external factor caused such as economic crisis. It is clear that crisis means less production which is result from smaller demand. So the dynamic development of the transport and almost constant consumption of petrol can be proof that the reduction of energy consumption is determined solely by internal factors. So, the most important is to finding the answers to the question what managers take into account when they make decisions about saving energy: costings or caring about the environment?

3. CHARACTERISTICS OF STUDIED COMPANIES AND QUESTIONAIRE STRUCTURE

To achieve the aim of this work, questionnaire were done among two companies (X, Y). The companies for the study were selected in such way that they are different and therefore it is possible to identify the decisions which determine the implementation of energy saving projects in the companies.

According to the Polish Classification of Activities both of the companies which have been studied belong to section (D) activities therefore to manufacturing. Here the similarities end.

Company X belongs to a subsection of the DM, i.e. the production of automotive equipment and company Y belongs to subsection DA, i.e. the production of foodstuffs; beverages and tobacco. Company X is located in the Wałbrzych Economic Zone in Poland and is part of an international concern. While company Y is Polish company with more than sixty years tradition of activities and is localized in Poland in Opolskie.

Test method which was chosen was questionnaire consisting of three parts which shall include only the questions enclosed. Important is fact that only employees who work in the office were studied. The questionnaire consisted of 16 questions where respondents pointed to the importance of individual factors using a scale of [0–10].These questions were divided into two parts: questions 1 to 6 relate to economic determinants of reduction energy consumption, and subsequent relate to environmental awareness studied employees of companies. The third part of the questionnaire consists of three questions where answers can be only: "yes" or "no".

4. TEST RESULTS

As a results of studies received 64 questionnaires. Tested were 9 managers, among whom were 5 women and 4 men and 55 employees, among them 25 women and 30

men. The average length of work managers and other employees of the company X is from 2 to 5 years while in company Y length of work management and employees is more than 5 years.

Employees of both studied companies say that the energy consumed in manufacturing processes is important part of total production costs. Responses employees (without managers) in both companies are similar. The situation is different in the case of managers both of companies because difference between their responses reaches almost 100%. Managers of company X claim that the energy consumed in manufacturing processes, and a non-production reaches almost 50% of the total cost in the company, what appears to be too much value. In turn company Y managers claim that energy costs reaches 25% of the total cost. It seems that the cause of these difference cannot be higher energy intensity production of company X because according to the National Statistical Office production of foodstuffs is much more energy-intensive. In this connection, the share of electricity consumed in production processes and non-productive in company X should be less than in company Y, but respondents answers doesn't confirm it.

Does the cost of energy is the main factor to decide about saving energy? How important in making these decisions by managers is environmental awareness? In both companies both managers and rest of studied employees highly assess the readiness to take ecological activity by managers. Managers of company X claim that this is 66%, while rest of employees claim that this is 68%. A similar situation takes place in company Y, where managers assess this readiness at 68% and rest of employees claim that this is 74%. Respondents claim that companies in which they work not only are ready to realize projects of ecological, but continually react to the problems of environmental protection. Managers of company X claim that this situation occurs in 80% of cases, rest employees claim that 75%. In an company Y managers ensure that the company reacts to the problems of the environment also 80% employees claim that at 77%.

In addition, the respondents both of companies highly assess the impacts of environmental activity on the reputation of the company. Managers of company X estimate that such activity contribute to improving the image of companies at 44% and rest of employees that at 60%. In company Y these values are in turn: 78% and 75%. Ecological actions which build image of company are least important for managers X.

After this analysis, can to believe that the cause of the reduction consumption of energy isn't only economic balance but also a high level of environmental awareness of all employees. However, to be able to conclude it's necessary to do deeper analysis. Therefore questionnaire was divided into two parts. The aim of first part is to study the significance of the cost of energy consumption during deciding on save energy and the aim second part of questionnaire is to study the level of awareness of respondents.

More generally, the managers of company X, believe that the main cause of saving energy is costing and they estimate its weight at 52% rest studied employees at 56%. These results are different from received from company Y. These managers assess the action to saving energy at 60%, while other staff 61%. Surprising is the fact that in both cases, the cost is less important to managers than for other employees.

How important are therefore the ecological reasons for save energy? Well, the managers of X company assign for these reasons weight by 69% less than the weight of cost accounting, rest employees by 54% less. The situation in company Y is as follows: managers assign for ecological reasons a weight by 25% less than the weight of cost accounting while rest employees by 13% less.

However, ensure about reacting on environmental problems don't appear to be unfounded at this point, because ecological reasons for save energy don't show a minimum values. Therefore, it's necessary to analyze the response every question from the scope of environmental awareness. These questions begin from indication of the likely level of pollutants emitted by each of studied companies and end of impact assessment of activities studied companies on the comfort of life of local society.

Studies show that the replies of respondents of both companies are quite different. Namely managers who work for company X pay an average of 323%, less attention to ecological consequences of business than managers who works for company Y. Similarly, the results are obtained from professionals and assistants of both companies. Employees who works for company X attach to these issues by an average of 217% less weight than those employed in company Y. So significant differences make that detailed analysis of questions and answers from the scope of the environmental awareness of all employees of both companies investigated is necessary (see Tables 1, 2).

Table 1. The results of the studied conducted among managers of enterprises Y and X
from the scope of environmental awareness

Questions	X	Y
	Managers	Managers
The level of pollutants emitted	22%	58%
The risk of injury to health and life of employees studied companies	16%	53%
The risk of injury to health and life of the local society	8%	53%
Impact on the volume of expenditure on pensions and other benefits	22%	43%
Impact on reduce the comfort of life of the local society	10%	18%

Table 2. The results of the studied conducted among employees (technicians and assistants)
of enterprises Y and X from the scope of environmental awareness

Questions	X	Y
	Other	Other
The level of pollutants emitted	38%	57%
The risk of injury to health and life of employees studied companies	29%	57%
The risk of injury to health and life of the local society	23%	57%
Impact on the volume of expenditure on pensions and other benefits	20%	46%
Impact on reduce the comfort of life of the local society	19%	49%

The results of the study shows large differences in the responses both managers like and other employees both companies. Such a distribution of answers tends to reflect what is not only environmental awareness, but awareness generally. From the psychological point of view, it is defined as the highest level of regulation of human behavior and specific internal ability to know direct environment, yourself and the reaction with environment[3]. From a philosophical point of view, it is defined as a tool to format the fields of cognitive allow for the recognition of elements of the world in a coherent model that reflects the reality.[4] Possibility to direct knowledge of the environment is receiving information from the environment, their processing and transforming, and leaving them again to the environment in the form of a specific behavior. Influenced the results obtained has therefore knowledge. The results of the studies indicate, however, completely opposite trend (see Tables 3, 4).

Table 3. The results of the studied conducted among managers of enterprises Y and X
from the scope of their knowledge

Questions	X	Y
	Managers	Managers
Knowledge of the concept of an external cost	60%	0%
Knowledge of the concept of an external cost	60%	50%
Participation in training from environmental protection	80%	0%

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[3] D. Kalisiewicz, R. Burek, T. Gadacz, J. Wojnowski (Redakcja Naczelna Encyklopedii PWN), *Encyklopedia PWN w trzech tomach*, tom 3, Wydawnictwo Naukowe PWN, 1999, s. 523.

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Table 4. The results of the studied conducted among employees (technicians and assistants)
of enterprises Y and X from the scope of their knowledge

Questions	X	Y
	Other	Other
Knowledge of the concept of an external cost	28%	0%
Knowledge of the concept of an external cost	68%	13%
Participation in training from environmental protection	35%	0%

Study results show that the environment protection is more important for respondents who have never participated in training in the protection of the environment and don't have knowledge in this field. None of the respondents employed for company Y hasn't participated in training in the protection of the environment and doesn't know the concept of the cost of external characteristic of the protection of the environment. These results are differ from that derived from company X, in where participation in trainings with environmental declares until 80% of managers and 35% of specialists and assistants. What is the cause of so different environment perceptions by respondents both studied companies?

5. CONCLUSIONS

Study results indicate that ecological causes of energy saving for respondents are average 40% less important than the cost. This means that the reduction of electricity consumption in polish industry is largely caused by the need to reduce production costs unrelated to economic crisis. Important are differences in the perceived implications of non-organic operations of companies. Managers of the company (X) which is localized in Wałbrzych Economic Zone and is an international concern attaches average by 323% less weight to the ecological consequences of the activities of the company than the managers who works for the Polish company's employee. Analogous are the results obtained from the rest of studied employees in the two of studied companies. This means that the environmental awareness of employees of the company X is much lower than the environmental awareness of employees of Company Y. Taking into account the declarations made by the employees company X about participation in training of environmental and declarations about possession of knowledge about the external cost such a situation should not be possible.

In conclusion, the employees of the company Y despite that have never had trainings of environmental and don't have theoretical knowledge in this area show a much greater awareness of the ecology than the personnel of the company X.

One of the reasons may be insufficient knowledge of not only the protection of the environment, but the business management as a whole. An example is even revaluation the amount of the costs of energy consumption in production processes and non-productive. Managers of X company estimated that the energy costs constitute approximately 50% of total costs, and thus are larger than in Y company. Such trend is contrary of data taken from the National Statistical Office according to which the production of foodstuffs is more energy-intensive than production of automotive equipment.

Another reason may be aware activity of top management whose aim is communication only such information's which are beneficial from the standpoint of the company's strategic targets. Restricting the flow of information, makes that internal capacity to direct surroundings knowledge is low.

Important may also be the location and form of ownership of the companies studied. Employees who works for company Y mainly live in the city where factory is located while company X is located in a place that forces all the employees to commuting for work. Thus, this company should be judged as more burdensome for the local population but don't reflect this results of the study. Therefore seems to be justified theorem that keeping the minimization of pollutants at the place where employees lead a life and simultaneously are working is bigger than in the case of jobs in remote from the place of residence. Form of ownership of Y company can speak in its favor. Employees seek to long-term development company Y, on which has impact environmental decisions taken by management.

It is advisable to develop a decision-making model of energy saving in industry. For this purpose it is necessary to identify causes of energy saving. Only such analysis allows to conclude what are the reasons for low interest to energy saving solutions a greater extent than now. Obstacles may be many: absence of mechanisms conducive to more energy efficient, lack of knowledge, conscious action of international companies.

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THE CONCEPT OF
SYSTEM SUPPORTING RISK MANAGEMENT
IN EUROPEAN PROJECTS

Basing themselves on literature studies and interviews with people who are engaged in European projects authors of this work state that there is a gap in risk management of European projects implemented in Poland. So that the work contains the concept of system supporting risk management in construction projects realized by Polish communes and supported by the European Union.

Risk is considered here as a possible event with negative consequences for the project.

In the proposed system three main project risks are analyzed: project delay, increase in the cost of the project, failure to meet quality requirements. Proposed system based on creating trees in which each treetop a_i ($i = 1...n$) contains risk name N_i ($i = 1...n$) and two fuzzy variables $\widetilde{F}_i^r$ and $\widetilde{G}_i^r$ ($i = 1…n$; $r = 1, 2, 3$) representing two basic risk attributes: the probability of risk and its consequences. $\widetilde{F}_i^r$ and $\widetilde{G}_i^r$ may be expressed numerically (from 0 to 10) or in words (*"high"*, *"medium"* or *"low"*). $\widetilde{F}_i^r$ and $\widetilde{G}_i^r$ values are generated in the tree by using specific decision rules and fuzzy modeling.

The concept of system supporting risk management in European projects is being implemented in PHP language as open for general IT system intended for communes employees. The work presents the main strengths and weaknesses of using it in Polish communes.

1. INTRODUCTION

Companies that carry out many projects and have the industry experience, they try to manage risk. However, in a much worse situation are organizations that do not have such experience. Such organizations are Polish communes, which are faced with the need first to apply for European funds, and the second settlement realization of such

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projects. These organizations do not have great experience in this field, their style of work was also always inherently different from the style of business companies. That is why risk management in such projects is very important, will be different in business projects, and requires the development of appropriate methods. Thus, in this work will be presented the concept of a system supporting risk management in European projects, i.e. projects co-financed by the European Union and implemented by communes. Proposed concept wants to treat the problem comprehensively and force the use of the experience, learning from the mistakes of his own and other organizations that are doing such a project. In this work risk is understood as possible events with negative consequences for the project [1]. So that it is connected with two attributes: probability of risk and its consequences.

2. TREES AND FUZZY RULES

2.1. TREES

In graph theory a tree is a special case of coherent and acyclic graph. That means that we can reach every treetop of the tree from each other (coherent) and we can do it only one way (acyclic). There is a special kind of tree–rooted tree. Graph $G = (V, E)$ is a rooted tree if it is acyclic and if it has one treetop $r \in V$ such that for each treetop v $v \in V$ in G there is a path from treetop $v \in V$ to treetop $r \in V$. On the rooted tree we can define relationships between treetops. Each treetop in a rooted tree has zero or more *child treetops*. Treetop $v_i \in V$ is a child of treetop $v_j \in V$ if there is an arc leading directly from $v_i \in V$ to $v_j \in V$. A treetop $v_j \in V$ that has a child is called the child's *parent treetop*. Every treetop has at most one parent. Treetops that do not have any children are called *leaf treetops*. [3]
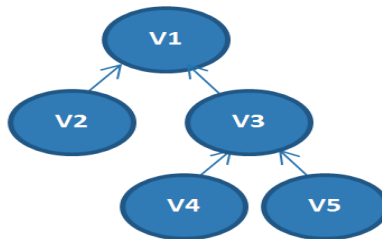

Fig. 1. Example of rooted tree

A simple rooted tree is presented in fig. 2. In this tree, the treetop labelled $V3$ has two children, labelled $V4$ and $V5$, and one parent, labelled $V1$. The root node $V1$, at the top, has no parent.

2.2. FUZZY RULES

In fuzzy set theory fuzzy rule is defines as a conditional statement in the form:

IF x is X THEN y is Y

where:

x, y – linguistic variables,

X, Y – linguistic values determined by fuzzy sets.

Example:

Let x − vehicle speed, y − noise in vehicle and $X =$ {"very high" „high", „medium", „low"}, $Y =$ {"high", „medium", „low"} then we can create such rules as:

IF *vehicle speed* is *very high* **THEN** *noise in vehicle* is *high*

IF *vehicle speed* is *high* **THEN** *noise in vehicle* is *medium*

etc.

Above there were shown rules with one criterion. However, by using the operators "AND" and "OR" it is possible to create rules in the form of multicriteria:

IF x_1 is X_1 **and** x_2 jest X_2 **and** ... **and** x_n is X_n **THEN** y is Y

IF x_1 is X_1 **or** x_2 jest X_2 **or** ... **or** x_n is X_n **THEN** y is Y [4].

3. CONCEPTION OF FUZZY TREE

Based on [5] authors of this work proposed to use probabilistic trees to risk management in European projects in Polish communes. But they were criticized by commune employees because quantitative assessment of risk probability consume a lot of time. That is why it was decided to offer risk management system that will use the trees, but the evaluation of risks will not have to be done only by numbers, but it can also be used verbal expressions: "low", "medium", "high".

In proposed fuzzy tree every each treetop a_i ($i = 1…n$) contains risk name N_i ($i = 1…n$) and its two attributes: the probability of risk and its consequences represented by two fuzzy variables $\widetilde{F}_i^r$ and $\widetilde{G}_i^r$ ($i = 1…n; r = 1, 2, 3$) which may be expressed numerically (from 0 to 10) or in words (*'high', 'medium'* or *'low'*). The structure of treetop is shown in fig. 2.
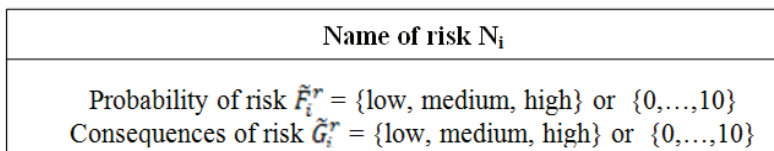
Name of risk N_i
Probability of risk $\widetilde{F}_i^r$ = {low, medium, high} or {0,…,10}   Consequences of risk $\widetilde{G}_i^r$ = {low, medium, high} or {0,…,10}

Fig. 2. Structure of treetop

$\widetilde{F}_i^r$ and $\widetilde{G}_i^r$ values are generated in the tree by using specific decision rules. To explain how rules are created let consider configuration of treetops consists of treetop N_i and its two children N_{i+1} and N_{i+2} as in fig. 3.
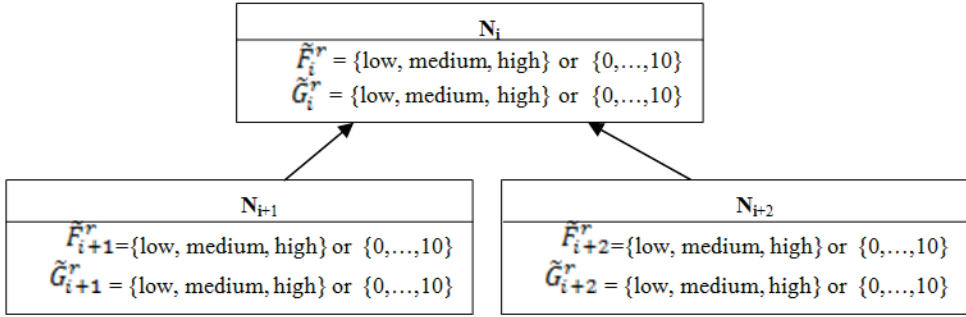

Fig. 3. Configuration of treetops

In the case of leafs, i.e. treetops without children (in fig. 2 – treetops N_{i+1} and N_{i+2}) probability ($\widetilde{F}_{i+1}^r$, $\widetilde{F}_{i+2}^r$) and consequences ($\widetilde{G}_{i+1}^r$, $\widetilde{G}_{i+2}^r$) are estimated by experts, i.e. commune employees engaged in project. Whereas in the case of parent treetops (in fig. 2 – treetop N_i) estimation of probability and consequences is based on decision rules. Set of rules is generated for the project type T_i ($i = 1...n$), the project phase F_i ($i = 1, ..., 5$) and project risk R_i ($i = 1, 2, 3$) based on past projects.

Then the rules can be written as:

IF $\widetilde{F}_{i+1}^r$ ∈ *{low, medium, high} or* $\widetilde{F}_{i+1}^r$ ∈ *{0,...,10}* **AND** $\widetilde{F}_{i+2}^r$ ∈ *{low, medium,* *high} or* $\widetilde{F}_{i+2}^r$ ∈ *{0,...,10}* **THEN** $\widetilde{F}_i^r$ ∈ *{low, medium, high} or* $\widetilde{F}_i^r$ ∈ *{0,...,10}*

IF $\widetilde{G}_{i+1}^r$ ∈ *{low, medium, high} or* $\widetilde{G}_{i+1}^r$ ∈ *{0,...,10}* **AND** $\widetilde{G}_{i+2}^r$ ∈ *{low, medium,* *high} or* $\widetilde{G}_{i+2}^r$ ∈ *{0,...,10}* **THEN** $\widetilde{G}_i^r$ ∈ *{low, medium, high} or* $\widetilde{G}_i^r$ ∈ *{0,...,10}*

Trees that have been completed in the past are searched and examined what were the rules for a given risk, the type of project and project phase. After analyzing all the rules from the past, it is counted how many times the rule repeated itself, and the one that occurred most often is chosen . Repetition frequency of rule will be called "power rule" (PR_i, $i = 1...n$). So that it is calculated $max(PR_1, ..., PR_n)$. If we reach the same maximum power rule of at least two different rules, the expert decides which rule to choose.

However, if in the earlier projects there were not the same configuration of rules, we search for all similar configurations in past projects, then calculate the degree of similarity for each configuration ([2]) and finally choose a configuration in which the sum of the similarity degrees of each treetop is the highest.

This process is repeated to create rules for each configuration in the treetops, leading to the generation of a whole tree.

4. CONCEPT OF SYSTEM SUPORTING RISK MANAGEMENT IN EUROPEAN PROJECTS

Conception of fuzzy tree has become an inspiration to create system supporting risk management of European projects in Polish communes.

Let us suppose the commune is currently dealing with a certain project and wants to use the system for the project risk management. User of the system starts by selecting the type of project, which he will be analyzed. Based on interviews with commune employees the authors of the work created a list of the most popular European projects in communes, presented in the tab. 1.

Table 1. Most popular types of European projects in communes

Most popular types of European projects in communes
1. Road reconstruction
2. Water supply reconstruction
3. Training for commune employees
4. Retrofitting public buildings
5. Fitting the centre of the village/city

The user can select the project type from the list or add a new type of project. After determining the type of project, the user must choose a specific project. There are also two options: choose to analyse an existing project in the commune, so that one from the list of projects in the system or add a new project. The next step for user is to select the phase of the project. Based on literature studies and interviews with commune employees in the system we proposed five phases of the European project in communes: project initiation, project planning, application for donation from EU, project realization, project ending. In the next step the user selects the risk, which he/she wants to analyse in the particular project. The proposed system provides an analysis of three main risks: project delay, increased project costs, failure to meet quality requirements. However, system users are also able to add risks they would like to analyse, but in this case they must themselves make a tree of risk. After performing previously described steps all trees for selected risk and project phases which have been created for past projects in the commune and belonging to the same type of project what project analysed by the user are displayed by the system. User selects the tree most similar with respect to the treetops and parenthood relationships. The selected tree can be modified by the user – by removing existing

treetops or by adding new treetops. After creating the proper treetops and parent-hood relationships of the tree (adding and removing the corresponding treetops) user goes to the assessment of probabilities and consequences of risks included in the individual treetops. In the case of vertices located at the lowest level of the tree, i.e. those who do not have their children, which means we cannot get for them the probabilities and consequences values by means of fuzzy rules, the user can accept the values proposed by the system (based on past projects) or independently assessed risks by entering the number of natural (0...10) or linguistic variables (*'high'*, *'medium'* or *'low'*). The way of writing and displaying values of risk probability and consequence (numbers or words) depends on the user's preferences because based on membership function defined by the user, the system can automatically convert the numeric expressions in verbal expression and vice versa. A proposal for such a function is shown earlier in fig. 4.
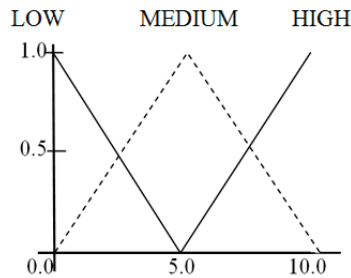
Fig. 4. Membership function

However, in the case of parent treetops risk probability and consequences are determined automatically by the system using the decision rules which were described in Chapt. 3. If user accepts values offered by the system automatically, it saves them. Otherwise, he/she may independently evaluate risk probability and consequences. After completing all treetops the tree is finally saved and the system displays the probability and consequences of the analysed project risk in a particular phase of the project.

Described above, the concept of risk management system has been implemented in PHP language as open for general IT system intended for communes employees. The system can use every person who signs up and then log on *www.ryzyko-projektu.pl* (in Polish).

5. EXAMPLES

The proposed system supporting risk management in European projects realized by Polish communes has been tested in a selected commune on several projects of the

same type – "Road reconstruction". Thanks to it we can see how gained experience has influence on risk assessment The analysis was made on the example of trees for risk "Delay of the project" in the phase of project realization.

Figure 5 shows the structure of tree filled for the first realized project in commune which belongs to the type of project "Road reconstruction".
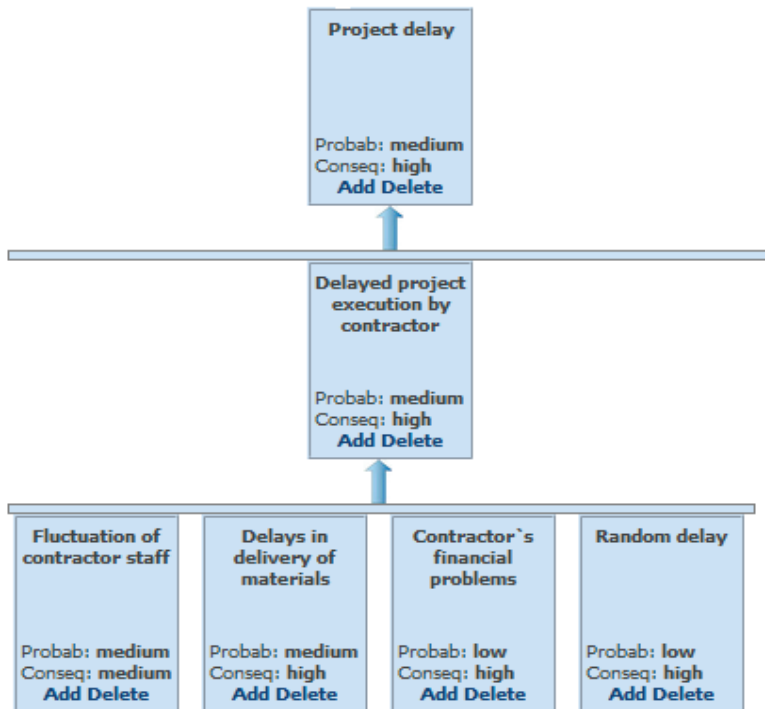

Fig. 5. First tree for risk „Delay of the project" in the phase of project realization

Based on tree presented in fig. 5 to the set of rules following rules are added:

R1: IF *'probability of fluctuation of contractor staff' is 'medium' AND 'probability of delays in delivery of materials' is 'medium' AND 'probability of random delay' is 'low' AND 'probability of contractor`s financial problems' is 'low'* **THEN** *'probability of delayed project execution by contractor' is 'medium'*

R2: IF *'probability of delayed project execution by contractor' is 'medium'* **THEN** *'probability of delay of the project' is 'medium'*

Rules above will be used to create tree for the next project. Fig. 6 shows the structure of tree filled for the second realized project in commune which belongs to type of project "Road reconstruction".
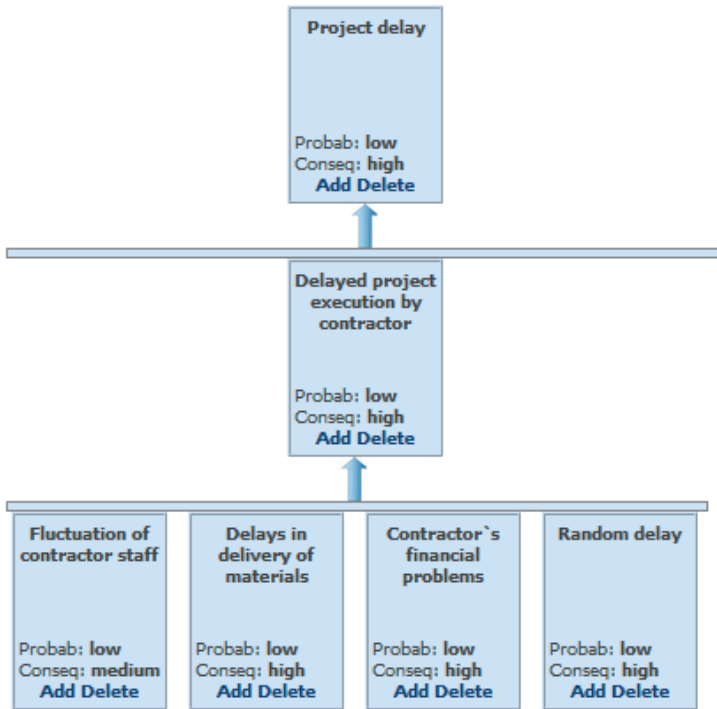
Fig. 6. Second tree for risk „Delay of the project" in the phase of project realization

As shown in Fig. 6, probability of delayed project execution by contractor has been decreased to "low". It happened thanks to choosing new contractor. After the first project commune has done research to get knowledge about it which contractors are reliable and which not. Choosing a right contractor reduced the risk of project delays. In this case new rules were added to the set of rules:

R3: IF *"probability of fluctuation of contractor staff" is "low" AND "probability of delays in delivery of materials" is "low" AND "probability of random delay" is "low" AND "probability of contractor's financial problems" is "low"* **THEN** *"probability of delayed project execution by contractor" is "low"*

R4: IF *"probability of delayed project execution by contractor" is "low"* **THEN** *"probability of delay of the project" is "low"*

Therefore during realization of the third project there is a question about it which rules to choose (R1 or R3), because they have the same "power rule" ($PR_1 = PR_3$). As it was written before in such case user decided by himself which rule to choose.

In the analyzed example commune employer who filled in the tree chose rule R3. Choice was correct and wasn`t changed during realization of the project. That is why during realization of next (4th) project we will have $PR_1 = 1$ and $PR_3 = 2$. Then

$max(PR_1, PR_3) = 2$ so that system automatically will propose values of risk probability according to the rule R1.

In the same way probability of risk „Delay of the project" in the phase of project ending was decreased. Figure 7 shows structure of the tree for the first evaluation of the project (tree in frame with dotted line) and structure of the tree after the completion of several projects like "Road reconstruction" (tree in frame with solid line).
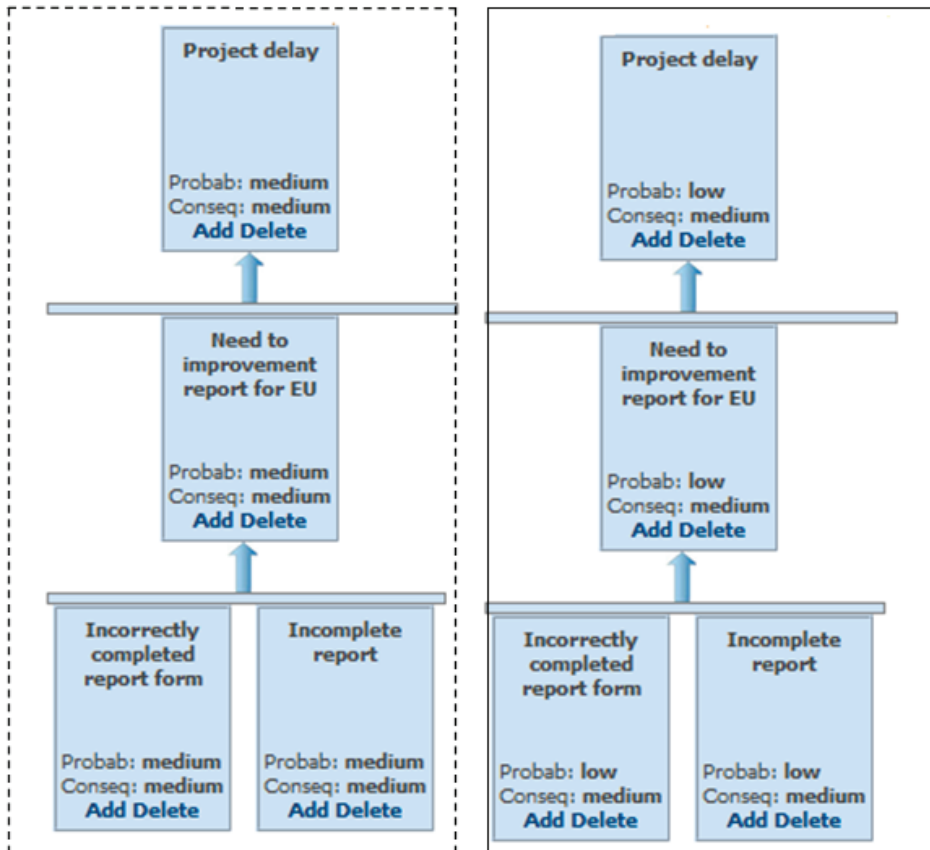

Fig.7. Changes in trees for risk „Delay of the project" in the phase of project realization.

Based on fig. 7 we can observe that probability of the need to improve the report for European Union was decreased. Thanks to realizing more projects commune employees have gained experience in filling report for EU and know what they need to pay attention to avoid any problems with report.

6. CONCLUSIONS

The present paper proposes a system supporting the risk management in projects realized in Polish communes, based on the learning principle. The examples which illustrate the idea of the system show that the gained experience influenced the assessment of the risks in projects. The positive thing is that the probabilities and consequences of the risks in consecutive projects were getting lower. This shows that the commune learns from its own experience and the system has turned out to be useful. But it is important to complete the database regularly and unfortunately it is difficult to mobilize workers to extra work. Therefore the proposed system needs to be easy to use, intuitive and transparent. Besides it should be noted that due to the fact that the database is constantly changing, there may be difficulties in a proper operation of the algorithm. Therefore the proposed system ryzyko.pl is only a preliminary proposal, which certainly requires further improvements.

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OFFERS MODELLING
IN COMPLEX TRADE PROBLEMS

As distinct from traditional, simple markets, in complex trade problems, e.g. multi-commodity or/and infrastructural markets, offers matching problem becomes quite serious, mainly due to difficulties in commodity matching. A commodity is described not only by its kind (usually expressed by a name), but also by its location in an infrastructural network, and – especially in a case of non-storable or perishable commodities – by its availability in a time structure. Matching of the sell and buy offers can be even more difficult, when commodities must be bundled to be traded simultaneously, when a transported commodity changes its localization in the infrastructural network, or when a stored commodity changes its time of availability, possibly together with its quality or quantity.

In the work we propose to decompose these difficulties into some pieces which we call "levels". We show, that problems encountered in these levels are of different nature, so they need different means to be solved. We also present related aspects of our formal model M^3 (Multi-commodity Market Model), designed to represent such complex trade problems and to enable an effective communication between trade parties. We go beyond the standard modeling of the utility function, which usually is limited to price function of commodities in the bundle.

1. INTRODUCTION

An attractiveness of offers is a key to successful trade – this is a well-known rule. In traditional, simple markets, an attractive offer means that an offered commodity is in demand, and a price is profitable. In these markets, there is usually no problem of commodity matching, or the problem is fairly easy.

In complex trade problems, e.g. multi-commodity or infrastructural markets, offer matching problem becomes quite serious, mainly due to difficulties in commodity matching. A commodity is described not only by its kind (usually expressed by a name), but also by its location in an infrastructural network, and – especially when

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non-storable or perishable commodity is taken into consideration – by its availability in some time structure. Matching of the sell and buy offers can be even much difficult, when commodities must be bundled to be traded simultaneously.

1.1. MULTI-COMMODITY TRADE IN INFRASTRUCTURAL NETWORKS

Infrastructural aspects, functional and real-time requirements make incentive for multi-commodity solutions. In complex market mechanisms many commodities emerge. Some commodities can be related to transmission services in infrastructure network or commodities conversion. Some of them can be related to time structure – when a commodity placed in a different time slot becomes another commodity. This is especially important in the case of storable and/or perishable commodities. For instance, a perishable good turns out to be different trade commodities when it is offered in different periods. Both, the quantities or quality can change in the consecutive time slots. Of course, the offers in this case are tied together – e.g. the more "fresh" commodity is sold, the fewer commodity with worse quality can be sold later.

Rich commodity structure can serve building rich functionality for market participants and helping them to express their preferences. But not only richness of commodities structure is important. The key is to be able to model and consider relationships between the commodities. Multi-commodity mechanism allows formulating new, sophisticated models and solutions, which reflect decision situations in a better manner.

Many examples of such complex trade problems may be taken from the electricity market, where electric energy, as a non-storable good, must be sold/bought in specific time slots, in concrete localizations in transmission network, and must usually be bundled with some services, e.g. transmission rights or power reserves. When a transborder trade is taken into consideration, or in case of a trade of innovative goods, semantic problems may also occur, caused by uncommon names, different languages, or – what's worse – by logically different concept systems.

Another example of commodity matching problem can be taken from the fruits market. Fruits are perishable commodities, they can be stored, but in short time intervals. Moreover, the fruits lose its value with storing, as well as with transporting. We can also consider the reassignment of fruit (change the commodity type) during storage. At the beginning the fruit is intended to be sold as fresh fruit, but with the storage, their purpose changes, for example for the juices production.

1.2. M^3 – MULTI-COMMODITY MARKET MODEL

In order to integrate various market solutions and to ease mappings between various market data applications and systems, an open Multi-commodity Market Model (abbr. M^3) was proposed in [3]. M^3 is a formal information model that may be used in

designing open information systems for bidding, balancing and clearing of the market processes, in the context of multi-commodity trade in various network infrastructure sectors. One advantage of using the M^3 model is an easy exchange of all the data between various market entities and complex market balancing processes, within the XML-derived information interchange specification, based on proposed M3-XML dialect.

1.3. OFFERS IN MULTI-COMMODITY MARKET

In the case of infrastructure and real-time requirements, expression of entities' preferences by simple offers is not satisfactory. In the combinatorial auctions [5] the complex preferences are modeled as the bundles of commodities. Moreover, the OR, OR*, AND, and XOR offering mechanism was proposed. Such offering mechanism allows also for formulating sub-additive and super-additive offers. Nevertheless, this mechanism often does not meet functional expectations [2]. Thus we propose the multi-commodity offering mechanism, which allows not only for simple and bundled offers, but also allows for expressing complex relationships between the offers.

Bundled offers allow for submitting offers for packages (bundles) of different commodities simultaneously. Then multi-commodity mechanisms allow to allocate the resources according to some fixed proportions declared in the bundled offer[1]. A participant submitting a bundled offer has to specify (i) proportions in which the particular commodities are supposed to be bought or sold in the resulting portfolio; and (ii) unit price of the set of bundled commodities in the portfolio. There is one offer price for the bundle. The market value of bundle is calculated as a sum of market prices weighted by a share factor. Since acceptance of bundled offer depends only on market value and offer price of the whole bundle, there is no need for providing separate price for each product in the bundle. The M^3 mechanism may accept the bundled offers partially, or entirely.

In a real market much more complex requirements and relations between posed simple or bundled offers can exist, e.g. technical constraints of a machine which produces some kind of commodity, or specific requirements resulting from complex preferences. Grouping offers mechanism, introduced in [3], allows for incorporating such constraints into the decision model, so the decision can be performed under more realistic assumptions. Grouping offers mechanism is a powerful tool in the multi-commodity trading that gives an extraordinary flexibility for market participants. The grouping offer submitted by an individual participant links a set of elementary and/or bundled offers, and provides specific constraints, such as resource require-

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[1] Mathematical formulations of some of multi-commodity mechanisms can be found in [7].

ments, between them. It allows to formulate individual constraints, or to bind elementary and/or bundled offers. A grouping offer i defined by a participant l is a tuple $g_i = (O_l^{s,b}, \phi_i, d_i)$, where

- $O_l^{s,b}$ is a set of simple and bundle offers of participant l,
- ϕ_i is an offer operator defined for volumes space of offers from set $O_l^{s,b}$,
- d_i is a vector of admissible values for $\phi_i(p_o)$.

Grouping offer i assures that allocation will satisfy the following constraints:

$$\phi_i(p_o) \in d_i,$$

where p_o is a vector of accepted volumes for offers from $O_l^{s,b}$.

Clearing with grouping offers can be realized in such a way that the total surplus is maximized under the condition, that all the grouping constraints are satisfied [2, 3].

1.4. OFFERS VERSUS PREFERENCES

Preferences express the market entities requirements, and usually they are private information. In the case of infrastructure and real-time requirements, expression of entities preferences by simple offers is not sufficient. Also, mechanisms known, for instance, from combinatorial auctions, do not meet all functional expectations. The rich offering mechanism can serve building rich functionality for market participants and helping them to express their preferences. Also, in the case of the rich commodity structure on particular markets, the relationships between the commodities are an important issue. It allows formulating new, more sophisticated models and solutions, which reflect decision situations in a better manner. The agents present their preferences to the market mechanism or other agents through offers. To evaluate the language they use, two issues should be considered. First is language expressiveness: what preferences can be expressed in the language. The second is the need to express the preferences in a concise way.

2. THREE-LEVEL OFFER MODEL

As stated above, in complex trade problems an offer matching process encounters various difficulties. We try to separate these difficulties into some pieces, we call "levels". We show that problems encountered in these levels are of different nature, so they need different means to be solved.

It is clear that offer representation, to be usable, must address problems stated in Section 1. In Section 3 we sketch our approach to offer notation, which is able to manage these problems.

2.1. PRICES/QUANTITIES LEVEL

In simple trade the main problem which must be solved to close the deal is to reach (e.g. in negotiations) an agreement concerning prices and quantities. In complex trade the same problem occurs, of course, but its formulation is usually more complicated, as price may concern a bundle of goods rather than a simple commodity, and quantities apply both for whole bundles, and for proportions of goods in a bundle. Also methods used to come to terms are usually more sophisticated, with use of balancing/optimization processes [7].

As prices and quantities must always be determined before concluding any contract, we distinguish a price/quantity level as the basic level in any offer. In offer matching process, a match in this level is usually done after a statement, that the offers to be matched are compatible on higher levels: they deal with the same commodities, offered in compatible time periods and localizations, and conforming to given constraints.

2.2. COMMODITY/TIME/LOCALIZATION LEVEL

The sell and buy offers to be matched must deal with the same commodity. In the simplest case only the kind of the good is taken into account, which is usually expressed by a name. So, if the offers concern the goods of the same name, they potentially can be matched (see next subsection for the discussion of semantic problems).

In simple trade problems, a time of delivery is of course an important factor, but it is usually defined only for the worst case – a delivery before agreed deadline is regarded as correct. When we deal in a non-storable or perishable commodity, the rigour must be much stricter: an exact time period, when the commodity is available for delivery, becomes an important part of the commodity definition. Commodities of exactly the same kind, and localized identically, but available in different time periods, are regarded as different and are either not exchangeable or less valuable due to possible loss in quality or quantity. No less significant issue is storing both non-perishable and perishable goods. The time for availability of stored commodity changes, and, in the case of perishable goods, the quality and quantity can change [1].

In traditional trade, a localization of the commodity is usually a second-rate factor: a delivery cost must be taken into account (but it can simply be included in a commodity price), and it has of course some effect on possible time of delivery. But, in general, goods of the same kind, though localized differently, are usually regarded as equivalent. When a trade in an infrastructural network is taken into consideration, localization becomes an important part of the commodity definition – a commodity is characterized not only by its kind, but also by its localization in the network. Commodities of exactly the same kind, and available in the same time periods, but local-

ized differently, are regarded as different and are often not exchangeable. Good example of such a commodity is an electric energy [6]. Produced in one location, it is mostly purchased in other. The service – called transmission right – is necessary, that provides "conversion" of the energy localization.

Sometimes, especially when a trade in an infrastructural network is taken into consideration, a more complex requirements, e.g. some constraints, must also be expressed in an offer.

As localization and time period(s) of delivery/availability have very different significance in various models of trade – from being very secondary to become a critical part of a commodity definition – we decompose a specification and matching of commodity/time/localization (along with constraints) as a separate level: very simple in simple trade problems, but rather complex in multi-commodity trade in infrastructural networks. In offer matching process, a match in this level is usually done after a statement, that the offers to be matched are compatible on a higher level: they deal with the commodities of the same kind.

2.3. SEMANTIC LEVEL

In the distributed information environment for the multi-commodity trade, some parameters of the trade are expressed as references to open vocabularies. The vocabularies are mostly defined for each trade segment independently, or there is no formal vocabulary at all. The same or similar objects, e.g. commodity kinds, can be named differently due to various persons' understanding of the concepts, and due to different levels of generality used. The terminology can be non-conventional, customary and confusing, due to different languages, terminologies, habits, or taxonomies. The example of such situation can be, for example, an e-Bay online auction system, where the same product can have dozens of different names.

The semantic level is the most complicated and the least recognized area of commodity matching. It provides the possibility of comparing identical or similar objects which are named differently. On this level, it is worth to apply an ontology, especially when the vocabularies are defined in more or less formal way.

3. OFFERS IN M^3

In this section we present related aspects of our formal model M^3 (Multi-commodity Market Model), designed to represent such complex trade problems and to enable an effective communication between trade parties. We show that this model may successfully be used to facilitate solution of problems in all the levels.

3.1. PRICES/QUANTITIES LEVEL

M^3 model assumes notation of quantitative level values as the number in case of price (`offeredPrice`, Listing 1, line 1), and as the number of minimal and maximal values in case of set of admissible values (`minValue` and `maxValue`, Listing. 1, line 4). The notation provides an easy matching of particular values.

```
1 <m3:Offer id="ex:o12345-67" offeredPrice="-140.00">
2    <m3:description>Buy offer</m3:description>
3    <m3:offeredBy ref="ex:Buyer"/>
4    <m3:volumeRange minValue="0" maxValue="100"/>
5    <m3:ElementaryOffer>
6       <m3:offeredCommodity shareFactor="-1"
7          ref="ex:energyOn2007-04-09-Warsaw"/>
8    </m3:ElementaryOffer>
9 </m3:Offer>
```

Listing 1. Exemplary offer expressed in the M3-XML language

3.2. COMMODITY/TIME/LOCALIZATION LEVEL

Commodity kind, time and localization of a commodity is notated as the reference to previously specified entries, so called vocabularies. Agreed vocabularies have to exist (worked out at the semantic level, as it is discussed later).

```
1 <m3:Commodity id=" ex:energyOn2007-04-09-Warsaw"
2    dref="op:ElectricEnergy" minBalance="0.00" maxBalance="0.00">
3    <m3:description>
4       Electric energy on 9th April 2007 in Warsaw
5    </m3:description>
6    <m3:availableAt ref="node:Warsaw"/>
7    <m3:CalendarScheduledCommodity ref="ex:day-2007-04-09"/>
8 </m3:Commodity>
```

Listing 2. Exemplary commodity expressed in the M3-XML language

The reference to commodity named `ex:energyOn2007-04-09-Warsaw` occurs in Listing 1, line 7. In the commodity definition (see Listing 2) further references exist – to the localization (`node:Warsaw`, Listing 2, line 6), and to the time of availability (`ex:day-2007-04-09`, Listing 2, line 7). These references also have to exist.

More complex requirements, e.g. network constraints, can be represented at this level as grouping offers, which can also be expressed in M3-XML.

3.3. SEMANTIC LEVEL

As stated above, agreed vocabularies have to exist. Unfortunately, the problem is the lack of central management of such vocabularies. The vocabularies can be created by local industries (e.g. the production of LCD), or on the national level (e.g. for the electricity market). Nevertheless, the semantic problems often occur. The problems could emerge from uncommon names, where the same or similar product has different names, or from the same dictionary names, at different properties or characteristics. The logically different concept systems are the most problematic.

One of the solutions in the semantic level is an application of ontologies, and reasoning based on them. An offer description expressed in M3-XML can be easily related to an ontology in OWL, by using OWL identifiers (URI references) as M3-XML identifiers of concepts, e.g. kinds of commodities.

```
1 <m3:Commodity id="ex:energyOn2007-04-09-Belchatow "
2   dref="op:ElectricEnergy" minBalance="0.00" maxBalance="0.00">
3   <m3:description>
4      Electric energy on 9th April 2007 in Bełchatów
5   </m3:description>
6   <m3:availableAt ref="node:Belchatow"/>
7   <m3:CalendarScheduledCommodity ref="ex:day-2007-04-09"/>
8 </m3:Commodity>
```

Listing 3. Commodity offered for sale in the Bełchatów

```
1 <m3:Commodity id="ex:FTR-Belchatow-Warsaw "
2   dref="op:TransmissionRights" minBalance="0.00" maxBalance="0.00">
3   <m3:description>
4      Transmision rights from Bełchatów to Warsaw on the 9th April 2007
5   </m3:description>
6   <m3:availableAt ref="egde:Belchatow-Warsaw"/>
7   <m3:CalendarScheduledCommodity ref="ex:day-2007-04-09"/>
8 </m3:Commodity>
```

Listing 4. Transmission service from Warsaw to Bełchatów

Typical ontology-based reasoning may, however, be insufficient, as not only strictly semantically, but also more specific, e.g. network-dependent relationships must often be taken into consideration. Let us consider the offer presented in Listing 1. The bidder is willing to buy the 100 MWh of energy at Warsaw, on the 9th April 2007. Let us assume that another offer, for selling energy at 9th April 2007, exists (definition – see Listing 3). However, such an offer has different localization – Bełchatów. Thus, an appropriate transmission right service, from Bełchatów to Warsaw, at 9th April 2007,

is needed (definition – see Listing 4). Let us assume, that such service is offered, thus the buyer can obtain the energy in given time period. Nevertheless simple offer matching does not bring about the energy to buyer. The appropriate reasoning is needed to match such offers.

3. PREFERENCES IN COMPLEX TRADE MODELS

Offers are some kind of representation of the bidders' preferences reported to a trade mechanism. Usually, it is assumed, that agent preferences can be expressed by utility functions. Let C be a set of divisible commodities. A bundle b is a $|C|$-vector $b = \{b_1; b_2; ...; b_{|C|}\}$, where b_k, $k \in C$ is a quantity of commodity k offered in the bundle. The bidders' preference for buying/selling bundle b is defined by the valuation $v(b)$.

The offers are a method for expressing the valuations $v(b)$. The quality of different bidding languages is often considered in the context of its expressiveness, that is, what class of utility function can be stated in a given bidding language. Simple and bundle offers can be used to express linear utility functions (with continues, non-continues or discrete domain of b_k).

Grouping offers allow to express more complex utility functions. Any operator can be used for grouping and grouping can be arranged in multi-levels manner. In effect, functionality of bidding language known from combinatorial auctions can be easily achieved, e.g. OR, XOR, OR* languages. However, grouping approach is more general and goes beyond the combinatorial auctions [2].

Typically, it is assumed that set of commodities is well defined and known for each party. In practice in the valuation process, the commodities can be labeled in different way. Moreover, even if labels are compatible, the problem with abstraction levels of notions describing the commodities can still appear, e.g. electrical energy is more abstract notion than a green electrical energy. Moreover, even if a semantic of offered commodities is agreed, a problem of localization on infrastructure set and time slots compatibility appear.

The problem decomposition into three levels, described in the work, enables to consider more complex and rich preferences models, which take into account also issues related to commodity agreement (time, localization and semantic). It enables to consider important elements during showing up the valuations of entities to the market. Thus the model goes beyond typical formulation of utility function.

4. SUMMARY

In complex trade problems, like multi-commodity or/and infrastructural markets, an offer modeling becomes quite difficult; however precise offer formulation is a key

to success, as it is necessary for efficient offer searching and matching. Proposed three-level offer model addresses most of issues encountered on complex markets, e.g. on the energy market. Decomposition into levels orders the offer matching processes, dividing them into stages related (bottom-up) to the levels: (a) on the semantic level a general match must be done, which checks whether a buy and a sell offer deal with the same kind of commodities, though possibly expressed quite differently; (b) on the next level the offers must be checked whether they fit with respect to time, localization and constraints fulfillment; (c) last, on the top level, a most traditional work is done: a prices and quantities are agreed, e.g. in negotiations or as a result of some balancing process.

Our M^3 market model, along with its M3-XML notation, enables relatively simple, precise and easy to process representation of offers on complex multi-commodity or/and infrastructural markets, and is able to express all the above-mentioned issues on all the three levels.

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ACQUISITION OF COST INFORMATION AT ONE OF THE FACULTY AT WROCŁAW UNIVERSITY OF TECHNOLOGY – CASE STUDY

This work explores the role, which costs play in achieving operational success, determine their continuous analysis as well as control. In practice, an influence estimation of various factors on the economic performance is particularly significant. This requires the usage of applicable methods, which allow to obtain information, that can form fundaments for economic decision making processes. In the contemporary circumstances, the key tasks of management of universities involves assuring the continuity of the university and its future development. What becomes, therefore, of a paramount importance, is the effectiveness of carried out processes within the university. In order for businesses to survive and operate in the marketplace, they must internalize the best management solutions available. Making the right decisions often leads to compilation of a various decision outcomes, which incorporate a statement of expenditures and results. Such insight constitutes the fundamentals for economic activity control. The university costs are, as a matter of fact, a reflection of its imperative values as well as its strategies. Their effective management provides the extension of university's existence into the future.

1. INTRODUCTION

The financial audit determines a financial effectiveness of an university. For the expert's task is expressing an opinion and making a report, which consists of various financial indicators – dependable on the assessor, which institute about the effectiveness of activities of an university. To make these indicators reliable for the receivers of an opinion, data based on which, these indicators were calculated must be reliable.

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There are many definitions of effectiveness. Praxeology defines effectiveness as a characteristic of activities giving some positive outcome, without a consideration for activities' deliberate (...), or not deliberate nature. The main aspects of efficient activities are effectiveness, lucrativeness and economical value. Other forms of efficiency (frequency, preciseness and reliability) have an additional meaning [5].

Effectiveness is defined in the most simple terms as a degree, with which a desired result was achieved. Definition of effectiveness can, at the same time, serve as its measure – taking under consideration the collection of activities, the more we approach to the situation considered as a target, the more the degree of effectiveness becomes reached. Whereas, activities on their own, can be divided onto effective and ineffective. An effective activity is understood as a state in which, even when the result was not achieved, one gets closer to the final goal. An ineffective activity is considered as an activity, which does not bring about any positive effects, and it maintains only as a plan. One can also distinguish another type of activity, namely, an anti-effective activity. It's understood as an activity, that move away from the desired goal. Lucrativeness is a difference between a serviceable value and costs of the activity: [3]

When these two conceptions are connected , it will be possible to talk about:
- efficient activity, which is both effective and lucrative;
- efficient activity, but not lucrative, in which the serviceable result and costs of the activity are lower than 0;
- inefficient activity but lucrative, in which a goal was not attained and side effects of such activity were evaluated as positive inefficient activity and not-lucrative, is an activity that is inappropriate, that should not be undertaken.

Another aspect of efficient (effective) activity is an economical value. The activity has an economical value, when the relationship between useful results and costs of this activity is higher than 0.

Lucrativity and an economical value as measurements of criteria selection for an activity can occur separately, even though they belong to the same group of terms. However, not always the activity, that is most lucrative is also the most economical. As an efficient activity we can accept a range of other measurements, which play a subsidiary function. Among those, we can mention preciseness,- reliability, energy, cleanness, defines, simplicity, solidity, assurance, rationality. [5] All of these terms play a big part in evaluation of activity's effectiveness, because the more factors we take under consideration during the evaluation of activity's effectiveness, the more the activity is efficient and thus effective.

Multi criteria evaluation is defined by J.M. Pennings and P.S. Goodman. According to these two authors, the mark of effectiveness is based on: targets, conditions to fulfill and standards [5]. As a priority, authors consider, appointed state of matter assign by the management. Besides targets, the organization should fulfill a range of conditions, dependable on the type of the business. Standards are accepted

numerical indicators, marking out the level of targets and conditions to be fulfilled. Expansion of such an opinion is the definition of M. Bielski. According to him effectiveness of the organization is a multi-dimensional term and to its evaluation, there should be many criteria and various, used to within these criteria, measuring instruments or indicatory devices bearing both numerical and descriptive charac-terization. [1]

2. THE EFFECTIVE COST MANAGEMENT CONCEPT

Subject literature defines cost management as an activity based on the im-provement of actual costs on the grounds of the acquired information with a view to achieve the objectives set by the organization. Such type of the management is to verify costs up to a preset level by improving in-company economic processes with special reference to activities and decisions taken by the managers, on the basis of all of the information available from various sources (for example accounting systems). Cost management theories originate from Japanese industry practices. According to Japanese concepts, cost management may be defined as a process analysis of incurring costs and of a possibility to lower them in various phases of this process. Jarugowa defines cost management as a process of continuous improvement, which supports the development and application of an appropriate board policies and code of conduct procedures and requires construction of information input system based on significant costs. The author also stresses that such an approach ensures the effectiveness of ongoing processes within the company. For Sobańska cost management term implies all control activities and relationships as well as cause-effect relationships, which serve an early and anticipative deep influences on the cost structure of universitys and lead to a reduction in the level of operating costs of the organization.[6] However, Kaplan and Cooper, specify that this term refers to a system that combines the measurement and calculation of the cost with the effectiveness of the business control processes in an university [2]. Nowak points to Horngrenm Datar and Foster for one of the most interesting definitions of cost management. They assumed that cost management includes management actions in the form of systematic monitoring and continuous cost reduction in order to achieve customer satisfaction. The authors pay special attention to raising the awareness of the managers of the consequences of their decisions regarding costs.

From the bill of costs as a separate information system is required to pursue a variety of features [4].

Key features include a bill of costs [7]:

1. the registered function:
   - approach to registration in the different sections of data on costs and results,
   - development of a database,

2. function of information – statistical:
   - providing flexibility in addressing information, speed,
   - develop, transfer, use of information
   - the use of aggregation and statistical procedures mandatory,
3. optimization function:
   - exclusion of decision-making calculus of elements,
   - laying the foundations of the tasks and means of implementation,
   - accounts execution optimization,
4. analytic function:
   - study of cause effect relationships (ex-ante, in tempora, ex post),
   - evaluation of the action and its results,
5. pricing function:
   - to determine (estimate) the cost of products,
   - the calculation of prices,
6. control function:
   - to control an ex-ante, in tempora, ex post,
7. planning function:
   - the determination of elements in the ex-ante,
   - the application of measures of cost in the planning,
8. evidentiary function:
   - the collection and verification of document, to ensure the reliability,
   - accuracy, and completeness of evidence of cost.

The breakdown of the destination information in the literature is also distinguished by external and internal cost accounting function [9].

External function costing information is geared to provide cost information to tax authorities, statistical, stock exchange, banks, owners, contractors, etc. It is based on generating reports based on evidential procedures, registration and record-classification costs [8] .

Implementation of the internal functions of cost accounting information is to provide cost information for internal cost management and other areas of the business.

The main objective of cost management, which results from the definitions aforementioned, is to improve financial results of the business university by undertaking continuous improvements of business processes taking place within the university, as well as efficient use of its resources. Cost management is the process of planning, monitoring, analysis and allocation of cost structures, as well as maintaining them at a particular level. Companies must perform their activities more effectively than their competitors. According to the definition on the effectiveness aforementioned, an effective activity is believed to be the one which brings optimum results from the approved effectiveness evaluation indicators point of view. When examining the given definition, one may be led to the conclusion that it does not

provide information about what gives evidence of the effectiveness of the process implementation. For the cost management process to be perceived as measurable, it is vital to define the effectiveness determinant of the implemented process. To achieve the above, we need to introduce the concept of effective cost management By the concept of the effective cost management, we shall have in mind the process of planning, monitoring, analysis and allocation of cost structures, as well as maintenance of costs at their expected level, which allow for future growth and development of the business university.

3. AN EVALUATION OF EFFECTIVE COST MANAGEMENT

Under certain conditions, companies financial results may, therefore, provide indicators assessing "quality" of cost management. Please note that the assessment of the size of financial performance from the perspective of cost management can't be made through the prism of one period only. The costs born in a particular period may pose a significant burden on the result and yield higher returns in future periods. Furthermore, the financial results are effected by multitude of management areas. So, when conducting an evaluation of cost management of an university, it is important to remember this. In assessing the cost management of the university, one should pay particular attention to the desirability of the costs incurred, "awareness" of the university during bearing the costs and on the realization of the process itself, which is an effective cost management.

3.1. CASE STUDY

"Wrocław University of Technology belongs to the best technical universities in Poland – over 32 000 students study here under the guidance of 2000 academic teachers, at the 12 faculties and the Department of Fundamental Studies, as well as in the 4 regional branches (Bielawa, Jelenia Góra, Legnica, Wałbrzych). It rates high in the annual rankings of Polish universities. Recently, it has been announced the best technical university in Poland for the second consecutive time in the oldest Polish ranking of higher education schools carried out by the "Wprost" magazine (in 2006 and 2007). Also, the university ranked first in the modern technologies group (disciplines: computer science, electronics, materials science) of the *Where to study?* ranking" (www.pwr.wroc.pl, 2011).

In this work we would like to focus on one faculty. Let's called this faculty "W". Faculty "W" is divided in two institutes and faculty administration (dean office, financial specialist etc.). Every institutes are consist of administration (e.g. secretary, financial specialist) and few smaller separated group of scientists.

Faculty is responsible for every process and action connected with education. Institutes are rather responsible for research and development area. It is assumed that almost every costs connected with didactics and teaching students are on faculty side. Money for this aim comes from subsidy from Ministry of Science and Higher Education. Financial resources for research and development are in institutes. So almost every cost connected with research and development area is on institute side. It is believed that faculty is responsible for teaching students but institutes are responsible for research and development. That's why financial resources obtained for research from industry, European Union, Ministry of Science and Higher Education and special public agency are located in institutes. Every grant has his own separated subaccount where the costs are recorded.

3.2. ACQUISITION OF INFORMATION COST

At Wrocław University of Technology there is central administration, that is responsible for all financial and accounting field of all university. Furthermore at faculty or in institutes there is a person or group of people responsible for financial side of each entity. We can say that there is a feedback between people from central administration and from each entity. The platform where people from each entities can look after and control disbursement of funds and find accounting information is HERA system (internal computer system). Access to this platform have only authorised person. People can see every information of their own department or institute. The information in HERA system is very often not full and usually demand very profound analysis. Some information you can find in HERA system, but some not. Usually a lot of important and necessary for decision-making process financial information are obtained from central administration as a document on work. You can't find it and analyse in HERA system.

3.3. ACQUISITION OF INFORMATION COST FROM THE FACULTY POINT OF VIEW

In HERA system there are three main group of costs: Didactics, Costs of every single grants, Indirect costs of entity (faculty, institute). At faculty or in institutes there are every three category of costs pointed above. Faculty is responsible for education so the biggest group of costs is didactic, next one indirect costs. The amount of grants located at faculty is really small. There are usually grants connected with education and teaching students.

Institutes are focused on research and development area so the main group of costs is located in second category (costs of every single grants). Really important group is didactics because every scientists are employed in institutes and their salaries are paid from didactics. Because of big amount of specialist laboratory using in research and development process indirect costs are very high too.

In institutes there are usually long list of different grants . We can share them on few categories according to the source of financing. There are grants financing from European Union funds, grants financing from industry, grants financing from Ministry of Science and Higher Education and other public institution.

The financial specialist from faculty can see every costs spending on education from subsidy from Ministry of Science and Higher Education For the faculty this is the biggest pool of money.

Every grant has their own number and their own assignment costs. So in the system you can see a list of grants and you can see every accounted costs for every single grant. The costs are accounted in many subaccounts. Below we would like show only few of them, these the most important. At faculty side there is not a lot of grants, only these connected with education.

We can put every grants in two other categories – small grants and big grants. The grant is small when his budget is beneath 20 000PLN. At faculty or in institutes there are two categories of all costs (independent of these 3 categories) : direct costs and indirect costs. Indirect costs is divided in two categories: indirect costs of central administration and indirect costs of entity where the grant is located. Direct costs are accounted in many subaccounts.

Main indirect costs at faculty, based on data from three last year are:

- Costs of energy and water.
- Costs of salaries (salaries of security and service of cloakroom).
- Costs of access to internet and server.

And other small costs like garbage disposal, costs of correspondence, costs of phone, consumable, equipment, depreciation

It is assumed that salaries of faculty administration is paid from didactic, because their official duties are connected with servicing of didactic.

Indirect costs for institutes are:

Costs of energy and water for the rooms that are used by institutes workers and the space where the laboratories owned by institute are located. These costs are really high because in this category are costs of energy and water used in laboratories for research.

Costs of salaries (salaries of security and service of cloakroom and administration).

Depreciation, and other indirect costs of institutes

The main costs in didactics at faculty are:

- Salaries of personnel.
- Scholarships for PHD students.
- Other costs like costs of travel, conference, equipment for didactic, and so on.

The costs in both institutes are really similar. The biggest costs are salaries because research and development personnel, technician personnel is employed in institutes not at faculty. In two institutes is about 150 workers so the amount of salaries is really high.

It is assumed that every grants are in institutes. Every grants have their own specific so the costs are different. In some grants the biggest costs are salaries, on the other hand in other grants costs are focused on equipment. But globally in every grants the main costs are: salaries, equipment, consumable, travel costs, conference costs and indirect costs. Indirect costs in every grants are counting as a percentage of direct costs.

3.4. MAIN PROBLEM WITH ACCESS TO COST INFORMATION

Faculty and institutes obtain money from different sources. The main source at faculty is subvention from Ministry of Science and Higher Education for teaching process and usually small grants connected with didactics. In institute there are three main sources: statutory grants from Ministry of Science and Higher education for research and development, order from industry and different projects granted from different institutions (e.g. from European Union, polish public institution etc.). Every projects has their own number and their own subaccount in HERA system where expenses are recorded. Rules of accounting aren't clear for financial specialist from entities (faculties, institutes) of Wrocław University of Technology because one cost sometimes is recorded in category "X", the other time in the same kind of cost is recorded in category "Y". There are a lot of different subaccounts and the procedures of accounting every single costs are well – known but only for central administration not always for financial specialist from faculty or institute. So they get some information and they have big problem with interpretation because the rules are unknown. Sometimes it is even very hard to find a person who can answer a question connected with costs accounting. Workflow and circulation of information is very often unclear and it is very hard to find a person who is responsible for some activities and process.

At Wrocław University of Technology indirect costs are counted as a percentage of direct costs. This percentage is divided in two groups: indirect costs of central administration of Wrocław University of Technology and indirect costs of institute or faculty. Indirect costs are costs of energy, telephone, water, administrative costs etc. One of the main costs in institutes are indirect costs because institutes are in possession of big laboratories with big equipment and these laboratories used inter alia a lot of energy. The big problem especially in projects is with indirect costs, like costs of usage of energy and water. Our university get only one invoice for all usage of energy and water. Then these costs are divided into every entities at university. So our faculty "W" and its institutes get from central administration information about usage of energy and water but for all entity. So this is very hard to make estimation how is the real usage of these indirect costs in each project, when faculty or institute have them more than one. Moreover the energy and water is used in didactics process and by workers in their rooms. Let's take into account for example cost of energy in one

project. This is research and development project and in this project studies are made on three stands situated in one laboratory. In this laboratory beside these three stands are another five, that are used in other project. For this one project it's impossible to estimate real usage of energy. Institute get only information about usage of energy but for all laboratory (for every eight stands). So the project can be charge for energy only in proportion to all usage in laboratory. To summarise, when in one big laboratory there is a few different research places. Each place is using in different projects but there is no possibility to determine how much energy this stand used, in which period of time and in which project. That's why indirect costs are counted only as a percentage of direct costs.

Usually in different projects there is a possibility to charge indirect costs like a percentage of direct costs. But increasingly the projects impose to charge indirect costs in the same way as direct costs. This is a big problem for institutes who can show indirect costs only like percentage of direct costs.

Every information about costs, people from institutes and faculties can see in HERA system after one-two months. So the delay in system is so high that they can't control the financial situation correctly.

Every research and development personnel are employed in institutes. They are responsible not only for research and development area but for teaching students too. These costs are treated like didactic costs (even if these personnel is not only responsible for teaching) and accounting in these group. If they participate in projects they can get additional salaries directly from these grants. The next group of workers are technician. If technician is responsible for service during laboratories for student they are paid from didactic but when they are responsible for service in laboratories but during research and development process they salaries are paid from indirect costs. If technician is employed directly to one grant this person is paid from this grant. The next group is administration. When administration duties are connected with didactics (for example people from dean office) they are paid from didactic at faculty. People in administration in institutes are paid from indirect costs of this entity.

4. CONCLUSIONS

Because of huge change in polish legislation in high school field every universities in Poland should evaluate to adjust to new reality. In these work we wanted to show from faculty point of view (because case study part based on interviews with faculty workers and financial information got from them) that a lot of process with accounting and acquisition of information costs need to be change. As we pointed in the first part of this work only the effective costs management provides the extension of university's existence into the future. At Wrocław University of Technology there are a lot

of changes now. First of all, there are changes in didactic field. As a first university in Poland they bought one integrated computer system for servicing students and didactic at every faculty. Secondly, begun to make changes in organizational structure in central administration. These changes allow for the purchase of new computer system for accounting and acquisition of information. The audit show that the processes of workflow and almost 70% of procedures are useless, out of date and need to be change and adjusted to new reality. The Wrocław University of Technology is one of the biggest university in Poland so the process of change need a lot of time and people efforts and can't be execute overnight, it is rather slow and careful process.

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THE POINT OF METHOD, MEASUREMENT AND ASSESSMENT OF COMPANY'S FINANCIAL CONDITION

Managing a company requires, among other things an ongoing assessment of company's financial condition. Measurement and evaluation of company's financial condition should provide information to overcome current difficulties and in long-term perspective gain a competitive advantage over competitors. The aim of this work is to collect basic information that will help organizing the knowledge of a financial condition of a company, in particular the terminology used to define this concept as much as the essence of research, measurement and evaluation of company's financial condition.

1. A TERM: FINANCIAL CONDITION

A term „condition" is derived from Latin word: *conditio*, which means an agreement, a condition. In general usage, this term is referred to as a state of one's physical abilities, form, state of health, social status, location or existential conditions [8].

After studying literature it is easy to conclude, that a majority of authors, who deal with a subject of company management, identify the term of financial condition of a company with a financial situation of a company. To sum up, we can say, that from the point of economy under the term "financial condition of a company" we can understand a financial situation of transactors.

According to basic regulations, evaluation of financial situation as well as wealth of an enterprise should be based mostly on financial statements. These basic regulations are covered in The Accounting Act, which is in force from 1 January 1995 in Poland and International Accouting Standards (IAS) [5]

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However, in these documents we will not find the exact term „financial condition of an enterprise". One of the main purposes of financial statements is delivering required information in respect of a situation of a particular company, its results and all information regarding changes within the enterprise. This knowledge can be useful in decision making process by a management. It is possible to notice, that in modern economy a term: "information" is treated as one of the most important and vital assets an organization or a transactor can have. As all assets, it is a subject of management, which means, at first we need to gain it, then such asset is subject to allocation (planning) and thirdly such information should be used in appropriate fashion. Siemińska notices, that information is treated more and more as a product with an appropriate price to gain it. It is also vital to remember, that the value of information itself has a relative characteristic and to a large degree it is dependent on its perceived value, which means: how is this information important to interested parties. Information is vital only when, it can form future actions. From a practical standpoint, a management of information is very difficult by dint of the fact, that it is basically very difficult to obtain important information. Just gaining information has a little value, when such information is wrongly used. Often enterprises, encounter disinformation, either deliberately or not. Valuable information should be properly processed and kept. In an era of Internet, a problem is not gaining information, or availability to information, but how can one, in so called information overload, pick out those which are truly valuable for the company and which can bring benefits to the company.

2. THE PITH OF THE EVALUATION OF FINANCIAL CONDITION OF THE ENTERPRISE

Siemińska, under the term "financial condition of a company" understands the situation of a financial position of a company, which resulted from economic decisions made by the company and related to them perspectives. According to the author, object scope of this term depends mainly from the main purpose of measurement and evaluation of company's financial situation by interested parties, inner and outer, availability of vital information in terms of quality and completeness of this measurement and evaluation [8]. When observing proposed definition by Siemińska we notice that condition can be understood in two ways.

Firstly, it can be treated as a result of widely understood financial management of a company, in respect of financial decisions connected with gaining capital and investing decisions, which involve orientation in allocating available resources.

Secondly, a financial condition can be understood as vital determinant of managerial processes. Therefore, it can be concluded, that, between financial

condition and financial management there is a feedback. It is clear that finances are a reflection of any kind of monetary economic events occurring in the transactors, that can be intended, as well as unplanned. These events can also be seen due to the nature of time – short-term and long term. What distinguishes these two terms, is the fact that, when we think of financial condition we think about a current moment, a concrete moment, whereas financial management is a ongoing and dynamic process [7].

In publication „Financial analysis in enterprise management" Bednarski and Waśniewski identify the term of financial condition with financial position of economic entity. They specify, that of the highest importance is evaluation and identification of areas that were wrongly or inadequately managed. These areas can constitute potential threats for functioning of a company. The authors believe that through the use of financial statements and relevant information from the outside it is possible to make a proper assessment about the financial condition of the company. It can be concluded that, according to the authors the concept of "analysis of financial condition" and "financial analysis" are identical. The authors present the instruments that are used to assess financial situation of a business. They emphasize on this occasion the importance of ratio analysis, which is in their view a part of the financial analysis of the enterprise [1].

Waśniewski and Skoczylas created a joint development of a synthetic assessment of the financial situation of the enterprise. In these works they interchangeably used the terms "condition" and "financial situation". They give four criteria, by means of which a financial condition of companies can be described, namely:

1. profitability,
2. risk,
3. liquidity
4. financial independence.

In her study Sierpińska identifies the concept of "financial standing" with the term "financial situation" of companies. It is easy to notice that this view is similar to that presented earlier by other scientists. The author points out that financial condition issues are placed in widely understood economical analysis. She also draws attention to the preliminary and further analysis of financial statements, revenue sources and directions of their allocation, the analysis of financial result and factors influencing it and examining the financial condition primarily in terms of liquidity, debt, profitability, performance efficiency and assessment of market value of shares and capital of the company.

It is valuable to notice Cebrowska, who believes that four basic criteria define financial condition. They are: profitability, liquidity, risk and financial independence. You may notice that this view is similar to Waśniewski and Skoczylas statement. Additionally, the author points to financial analysis as a tool for assessing the financial condition of the enterprise. According to her, this analysis includes[2]:

- evaluation of property-financial situation (business evaluation),
- research on capacity to generate profits (profitability analysis, causal analysis of financial results),
- evaluation of liquidity (analysis of ability to pay),
- research on financial independence (analysis of the financial position).

The author believes that the financial condition is determined by resources at the disposal of the business, the ability to generate profits, and by functioning in the environment. Cebrowska says that the greatest impact on the transactor has an environment, which at the same time is an important element in strategic management. Continuing review of the nature of the term "financial condition" it is recommended at this point to present Jerzemowska's views.

She identifies the concept of the financial condition with the financial situation of economic entities. The author believes that the basic measure of financial condition is the market price of assets of the company.

At the same time she states that the financial condition is a kind of touchstone, a barometer, indicator of business prospects for market development, expected by the directors of these entities. It is easy to notice that in views of Jerzmanowska there is a strong relationship between problems concerning the financial situation of transactors and the theory of signals. The author believes that the importance of theory of signals will only grow as the increase of the stability and efficiency of the Polish capital market and the competence of bodies involved in the analysis [4].

Hozer, Tarczyński, Gaziński, Wawrzyniak and Batóg similarly express their opinion on the financial condition of the company. According to them, indicators used in financial analysis are essential to describe company's financial condition. The scope of this analysis is used to determine the strengths and weaknesses of the enterprise and emerging opportunities and threats that transactor can encounter.

Assessment of financial condition is based on the measurement of debt, liquidity, asset management, profitability and market value.

Dębski has a slightly different take on what financial condition of an enterprise is. He identifies this concept with the capacity to pay and the ability to generate surplus of financial means. Such means could be effectively managed. The author believes that the data concerning the financial condition are the result of the analysis of property and financial state of a business. The author puts emphasis on information as a source of good management.

He believes that the information must be fast and reliable, and subjected to various types of analysis.

The purpose of this information is providing a strong basis for making any decisions for managers of the company. As a result, the company should quickly develop a competitive advantage, which is intended to lead to the creation of conditions for a sustainable existence on the market.

Stasiukiewicz concept "financial condition" uses interchangeably with the concept of financial standing.

The author believes that the analysis of financial statements in the context of liquidity and profitability of the economic unit constitutes an assessment of current business and therefore assessment of financial condition.

Rutkowski also identifies the financial condition with the concept of company's financial situation. He believes that ratio analysis is the main tool for assessing the financial condition of a company. The author pays particular attention to measurement and analysis of liquidity, which in his opinion significantly affects a financial situation of a company.

Nowak takes the stand that "...the issue of assessing the financial condition of enterprises is a complex issue, involving many aspects that can be unambiguously characterized. (...) Backing the assessment methods of the financial condition of the enterprise almost exclusively on the information contained in financial statements does not give neither a full nor an objective picture of the company" [6]. The author believes that the assessment of financial condition in a situation of market economy should be based on a study of market value of the business.

This value should be the result of the level of financial, non-financial performance and business relationships with the environment.

Bien uses the term "Standing of an enterprise" interchangeably with the term "financial condition". The author understands this term as a competitive position of companies in the market, its credibility and economic power that shapes the level of trust of contractors to reliability of their partner and a general opinion about their partner. He believes that the financial situation of a company largely affects aforesaid situation.

3. THE PITH OF METHOD OF
EVALUATING THE FINANCIAL CONDITION OF THE ENTERPRISE

Given the nature of the financial condition, the most of transactors often conduct an evaluation of their financial situation using different research methods. These studies should provide the conditions needed for making economic decisions. Under the term "method" can be understood conscious, consistently and systematically applied method of choice of action. In the most general sense, this term can be used to describe a particular course of action. To explain this term differently, you can say that this is a panel of purposeful activity and useful means to an end. Given the scientific point of view, the term "method" may be defined as a set of general rules, guidelines and research principles applied in a specific scientific investigation [3]. In other words, this is the way of scientific study of things and phenomena.

The term "method" can be specified within the framework of empirical science, and thus in economy, stating that it is general, typical, repetitive way of collection, compilation, processing and interpretation of empirical data on the results and financial position of the enterprise [7].

The concept of measurement can be very often identified with examination or measuring something. Speaking of measurement, it is vital to remember that it takes place by means of specific tools and methods. This term refers to activities designed to determine a measure of a certain size. The measurement is the final effect of measuring, which means a set of data that are obtained during measuring of the phenomenon or object by means of suitably chosen set of metrics.

According to Kaplan and Norton only reliable measurement through the use of appropriate instruments that describe the environment and examined objects, is the starting point to assess their status on the basis of adopted system of evaluation, classifying analysed phenomena [8]. The term "evaluation" can be understood as an assessment, an opinion expressing a positive or a negative attitude of the researcher who evaluated the object. This object may be a person, object or a phenomenon which is a subject to assessment. To say otherwise the term "evaluation" is a concept that determines the material value of something, assessment and valuation. At this point it is worth paying attention to the term valuation. Under this term hides issuing an opinion or judging someone or something. Usually the assessment is determined by comparing two states: the actual of tested object and a predetermined reference point, which was adopted by the evaluator as a model. In order to express the assessment it is necessary to determine the strength and direction of discrepancies between the states. The consequence of this can result in positive or negative judgements or assessments of evaluated entities or phenomena. At this point we cannot forget, however, that the assessment is determined by, among others psychological factors, social and evolution over time. Very important to the substantive point of view is the fact that an assessment cannot be made each time using the same, unchanging, timeless evaluation systems, as they can and usually undergo evolution. This state should cause the search of applications of evaluation systems towards tested objects currently adequate to the currently prevailing conditions. Sometimes, the term "evaluation" is used interchangeably with the concepts: control, economic analysis and economic diagnostics.

It is worth to clarify the concept of analysis, despite the three already presented concepts. The analysis is a tool used to evaluate the company. Many people often see analysis as a study aimed at understanding the characteristics and structure and internal dependencies. For this purpose, are used: partitioning, which means breaking down the components of a complex whole, elements, and testing individual characteristics, characteristics of the phenomena or object. The analysis is sometimes understood as a research method, that relies on distribution of chosen entirely on the simplest possible components and their separate consideration in order to assess its entirety.

Such perspective may be typical in frameworks of the economic sciences, and on its basis we can say that the essence of analysis is [7]:

- to determine the relationships and cause-effect dependencies that occur between components,
- determine the effects of previous activity (ex-post analysis),
- establishment of guidelines and ways to improve further activities (ex ante analysis).

The economic analysis can be dedicated to the analysis of economic phenomena. Objects of economic analysis may be phenomena that occur throughout the national economy, its industries, sectors and individual business entities. Economic analysis can be divided into macro and micro. The second will concern the analysis of business enterprise. Taking the body of research under consideration, the economic analysis can be divided into: technical and economic analysis, financial analysis and strategic analysis.

Table 1. Stages of analysis and assessment of financial standing

Process	No.	Phase	Activities
1	2	3	4
Analysis	1	Identification of researched objective	Obtaining information such as management, decision-making or for monitoring the implementation of established plans for the financial situation of the enterprise for internal or external users
	2	Defining the object of research	Example: level of profitability in the enterprise, the accuracy of financial liquidity or cash management, the level of the market value of the company
	3	Choice of measurement to measure the subject of actions	Adoption of the measurement describing the economic characteristics of studied phenomenon, here: the financial standing
	4	Selection of criterion for assessing the behaviour of tested object	Determining desired changes of studied phenomenon, i.e. its increase, decrease or stabilization
	5	Determination of the reference database	Establishment of proposed, standard point of reference for the actual level of studied phenomenon (e.g. standards, competition results)
	6	Choosing an appropriate method (methods) of research	Selecting and defining algorithm for proper analytical conduct
	7	Proper analysis of the researched problem	Determining research hypothesis and its verification in the course of structural and cause-effect analytical operation, measurement of researched problem, establishing the direction, level and rate of change of deviation between actual and desired state and other important characteristics of studied phenomenon

1	2	3	4
Evaluation	8	Selection of a valuing system	Establishment of eligibility rules in the analysis from the results obtained (the adoption of appropriate weights, classes ranking studied phenomenon)
	9	Assessment of the analyzed object	Publishing an opinion, judgment valuing examined phenomena on a basis of adopted evaluation system, classification gained from the analysis (e.g. ranking of the level of deviation set by the respective classes or weights)
Decision-making	10	Conclusions and decisions	Deciding on the directions of adjustment of existing measures or decisions in respect of directions for future action

Source: *Siemińska E., „Metody pomiaru i oceny kondycji finansowej przedsiębiorstwa”, Wyd. Uniwersytetu Mikołaja Kopernika, Toruń 2002, p. 41.*

Siemińska developed a table (Table 1), which contains a synthetic basic stages of work, both analytical as well as evaluating economic phenomena on the example of company's financial condition.

4. SOURCES OF DATA FOR MEASURING FINANCIAL CONDITION

The financial situation of the company largely depends on controlled resources, financial structure, liquidity and solvency and on adaption to changes in the environment. A statement that the assets, liabilities and equity are the components directly related to establishment of the financial situation of the transactor is indeed true. Therefore, the balance sheet, which includes aforementioned features, is the main source of data regarding company's financial situation. The balance sheet reflects the state of assets and their funding, as well as sounding of the transactor measured by the share capital or liabilities. The system of balance sheet is standardized by the Accounting Act. Large enterprises must have an extensive and detailed system, while small and medium may use a simplified system. The balance sheet is standardized by the Accounting Act. Large enterprises must have a system of extensive and detailed, while small and medium may use a simplified system.

All information regarding the company's activities are included in the income statement. This report is casting a light on how was the shaping of financial performance and which factors had a significant impact on its final amount. You can say that the income statement (also known as the profit and loss account) is the main source of information about company's ability to generate profits. In Poland there are two major forms of income statements: comparative and imputed.

In the third of the basic financial statements, which is the cash flow statement, you can find information about ongoing changes in the financial situation of the transactor. This bill contains important data on the entity's ability to generate cash. Under the Law on Entrepreneurship, large enterprises are obliged to prepare such reports. Cash flow statement allows you to get important messages due to the fact that their informational value is not dependent on applied accounting principles. Cash flow is not affected by estimated values, such as write-downs, reserves, accruals and balance sheet valuation. Therefore, it is recommended that cash flow was also conducted for internal purposes in small and medium sized business organizations.

The main users of financial statements may be present and potential investors, employees, creditors and government agencies. For this reason, enterprises are required to submit annual financial statements in the court registry. In accordance with the Accounting Act, enterprises are required to make available their reports to the public. The financial statements of individual transactors can be found in the Polish Monitor Series B.

5. SUMMARY

After citing the opinion of the scientific studies you will find that most financial condition is most commonly identified with company's financial situation. The authors believe that based on the analysis of financial statements it is indeed possible to assess financial condition. Most of the authors mentioned in this work express the view that this analysis should be a starting point to predict the future development of the financial situation of the transactor and the search of causes of a current financial state of an enterprise. It may be noticed that the financial condition in most cases is rather determined statically, which means that dynamic positions can complement the description of its financial condition.

In summary, it can be concluded that the main purpose of measuring and assessing the financial condition of companies is to provide reliable information as soon as possible, by means of which difficulties can be easier coped with and in long-term perspective could increase the competitive advantage in the sector. Undoubtedly one of the main tools for this is financial analysis.

In practice and theory, you can find many different methods that have been extracted from a large number of classification criteria.

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THE COMPARISON OF
INTERNET MORTGAGE MARKETS
IN SELECTED EU COUNTRIES

The work presents the description of Internet Mortgage Market in selected European Union countries. It starts with brief introduction to the concept of creating a fuzzy model representing Polish Internet Mortgage Market. Then, for better understanding of the complexities of this kind of market functioning the comparison is made between mortgage markets in Poland, Estonia, Germany and The United Kingdom (UK): The UK as the European leader in e-banking and the best developed mortgage e-market, Estonia as the best developed e-country in the world, and Germany the neighbor and the Polish biggest trade partner. It is assumed that some processes occurring on the markets selected for comparison can also influence the Polish Internet mortgage market functioning, which is the reason of the analysis that is presented. The work concludes with the description of possible upcoming trends and developments on this studied market. In the future research the process of building fuzzy market model will be continued, including trends presented in this work.

1. INTRODUCTION

The ability of transforming past information and especially an experience into knowledge, and then to use it in the decision making processes, contributes in a substantial way to the general concept of "intelligent support systems". This idea seems to be useful in the current financial processes. This work is part of current research that concentrates on creating a tool which would help to support decision making on the Polish internet mortgage market. First, a brief introduction to the current work is provided. Then, the presentation of internet mortgage markets in selected European Union (EU) countries is made.

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2. THE CURRENT STATE OF FUZZY MODEL DEVELOPMENT

In the initial approach to the problem of developing a proper prediction mechanism for the Internet mortgage market a dedicated rule based model was created. The model, which was developed and embedded in times of fast growing economy, did not work properly in the times of financial crisis that came later, so it was necessary to introduce some changes to this model. Due to the specific character of the mortgage market there are several variables which influence the market that can't be described strictly in numbers (for example general feelings about current market situation) It was necessary to try a different method that's why the fuzzy modeling was suggested.

In the process of fuzzy model development the rule base was used consisting of 81 production rules.

Example of Production Rule:

IF Commission is *small* **AND** Interest rates is *small* **AND** Advertisingis *small*
AND WIG is *small* **THEN** Selling mortgage in the Internet is *small*   (1)

After defining the membership function with its fuzzy values for membership numerical degrees we can proceed with the process of formulating the mapping from a given input to fuzzy output. This is called fuzzy inference and provides a basis from which decisions can be made, or patterns discovered.

2.1. FUZZY INTERFERENCE

The fuzzy inference process takes a fuzzy set as input and follows the model logic to arrive at the output.

To develop and train the inference engine for our case it is necessary to specify values of output variables for the existing 81 production rules. As it was not possible to automatically generate these output values, the expert market knowledge was applied for this purpose. Below we present illustrative examples explaining some parts of this process:

Example 1
The lower the value of variable 'interest rate' is, the higher the value of 'selling mortgage in the Internet' should be. All other variables in the model (money spent on advertising, WIG, commission) work in the other direction: the higher values indicate increase of the output.

Whenever expert knowledge and heuristics are applied, it is necessary to provide justification and verification of such application. As this work establishes technicali-

ties and formal stages of the proposed fuzzy approach to mortgage market modeling, the verification aspect is left for further stages of this research.

2.2. DEFUZZIFICATION

Defuzzification as the process of producing a quantifiable result is the last step in fuzzy logic based modelling process, and it delivers crisp output values. The Height Method (also know as Max-membership principle) was used in this step [4], [5]. This method has numerous advantages, the most important of which is the fact that the shape of the membership function has no influence on defuzzification and that it does not require complicated calculations.

The main purpose of applying the three steps of fuzzy modeling process illustrated above (fuzzification, fuzzy inference, defuzzification) was to test the possible applicability of purely technical aspects of the process. It was necessary process as the application of fuzzy modeling in the area of internet mortgage market has never been tested and reported in literature before.

3. THE COMPARISON OF THE MORTGAGE MARKETS IN ESTONIA, GERMANY AND THE UNITED KINGDOM WITH THE POLISH MORTGAGE MARKET

The idea of creating a model for the Polish internet mortgage market (presented in the previous section) needs to take into consideration the changes that will take place on that market in the nearest future. Due to this fact three other European markets were researched as it is assumed that some processes occurring in these markets would be later observed on the Polish Internet Mortgage.

3.1. ESTONIA

Estonia is known as one of the most IT (Informnation Technology) developed countries in the world – it was the first country in the world to introduce online voting in the parliament election in 2005. Situated in northern Europe this small country has the population of 3 of which less than 66% are Estonians (25% of the population are Russians).

In the first quarter of 2010 75% of Estonians were using Internet[1], 62% were using e-banking (November 2010). Currently 18,4% of buildings in Estonia have been fi-

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[1] M. Laar, *Estoński cud*, Warszawa 2006, p. 190.

nanced by mortgages, mortgage loans represent 41,94%[2] of country's GDP (in comparison with 19,05% in Poland). Taking into consideration a high GDP (gross domestic product) growth (3,6%[3] in 2011) there is a high potential of growth in the number of sold mortgages.

Estonian's internet market is well developed, which includes also internet banking. After two financial crises (1993 and 1997) Estonian financial market was completely changed, modernized, and made 100% private. The leading players in Estonian financial market are Scandinavian financial institutions representing the region that was first reached by internet banking in Europe (1995, first internet bank in Europe was established in Sweden[4].). The mix of pro-internet origin of banks and highly e-society and proper law for internet services creates one of the most interesting markets in Europe for internet banking[5] and were the factors for the market to grow.

It is important to notice that the size of the country, which also means the size of the market (only 7 financial institutions – all private) is much smaller than in Poland but there are similarities: financial situation (growing market), origin (Eastern European countries, joined the European Union in the same year) and similar financial institutions (e.g. Nordea Bank and SEB group which owns SEB Eesti Uhispank).

3.2. GERMANY

The German market is well known for long-time rental instead of buying houses tendencies. This trend is popular especially among young people (35 and younger – the group of people who are most likely to take mortgages), it is one of the facts that influence the ratio of German GDP to the total amount of mortgages which is only 38,75%[6]. It is much smaller than western European countries of a similar economic level (e.g. in Holland it is more than 72%). Germany is one the fastest growing economies 5,2% GDP (4,4% in Poland) growth in the first quarter of the year 2011[7] and the biggest polish trade partner (20% of Polish international business is made with Germany).

In November 2010, 41% of German citizens were using e-banking (internet banking)[8].

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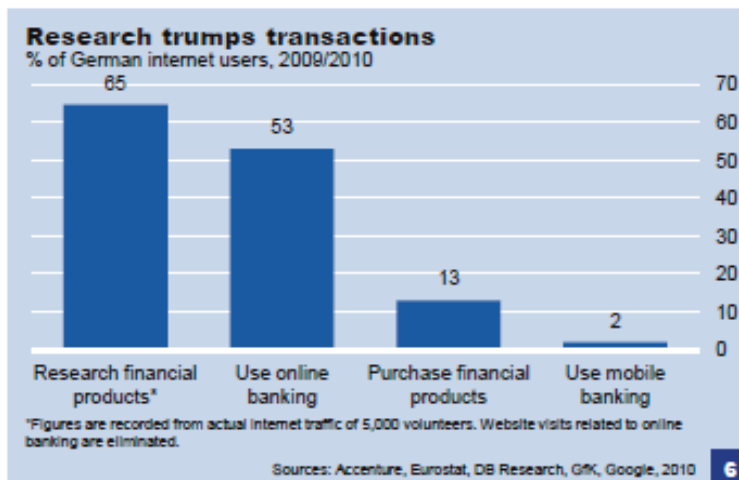
[7] <http://wyborcza.biz/gieldy/0,101258.html>, 31.05.2011.

[8] *Bankowość elektroniczna w Europie*; <http://www.deutsche-bank-pbc.pl>, 01.06.2011.

Fig. 1. Source: *Retail banking via Internet*, >http://www.dbresearch.com<, 01.06.2011

13% of German customers purchase financial products online (mostly credit cards) but the potential to growth is high, more than 50% of customers use online banking (only 21% in Poland[9]). On the other hand more than 60% of customers research financial products online whereas only 13% of them buy these products there.
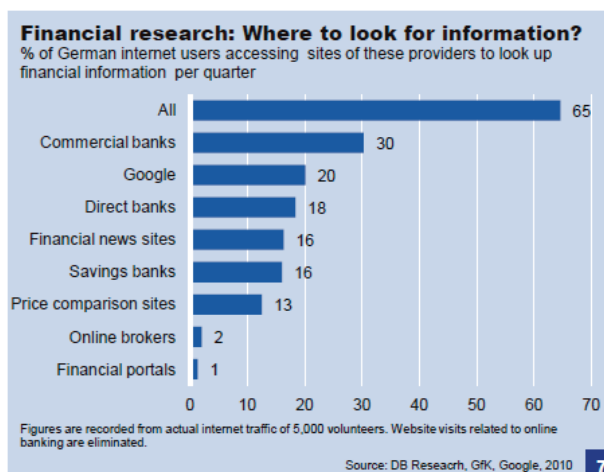

Fig. 2. Source: *Retail banking via Internet*, >http://www.dbresearch.com<, 01.06.2011

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[9] *Sprawozdanie o wykorzystaniu technologii informacyjno-komunikacyjnej w przedsiębiorstwach sektora finansowego*, GUS, Warszawa 2006.

It is typical for Germany that customers mostly use bank web pages, the role of brokers and partner web pages is small (fig 2). Surprisingly, the number of direct visits to bank's web pages is high, which means that customers are well informed and know the direct internet addresses of bank web pages. In all other European countries customers use first the web search (mostly Google[10]) and later are transmitted to the proper web page of the bank.
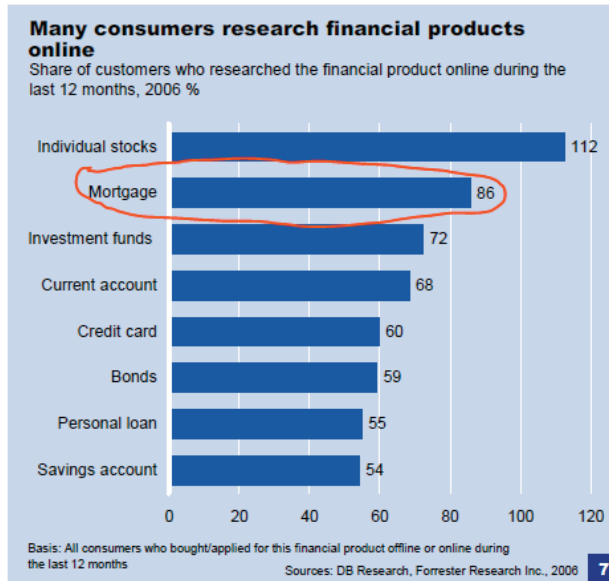
Fig. 3. Source: *Retail banking via Internet*, >http://www.dbresearch.com<, 01.06.2011

Taking into consideration the fact that the number of financial products bought online is rather low (Fig 1) it seems important to know which categories of financial products customers might be interested in. Mortgages were the second most popular financial products for which people were looking in the Internet which might be the perspective of the future product sale in the Internet. However it requires better law in the country (to allow making some steps of mortgage procedure 100% online) and most of all, social trust in the serious financial decisions which might be made online.

Demographic indicators also seem to have an important role in the market. The predicted number of German citizens will drop from 81,3 million in 2010 to 77,6 in

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[10] <http://www.google.com>, 01.06.2011.

2030 and 70,8 in 2050. Taking into consideration the fact that the percentage of people aged 60+ (the group which is the least interested in taking mortgages) will grow from 25,7% in 2010 to 36,1% in 2030 and 38,1% in 2050[11] the perspectives of growth for German mortgage market are rather pessimistic.

3.3. THE UNITED KINGDOM

The United Kingdom is one of the best developed markets in Europe both in general and in the internet market products. In Europe, the UK's market is the closest one to the US market.

The ratio of UK's GDP to the total amount of mortgages is 68,95%[12] with a predicted GDP growth in 2011 on the level of only 1% (a completely different situation than in Poland).

The structure of the Internet mortgage market in the UK is similar to that in Poland as it consists of 3 parts (banks, brokers and partner web pages) but the British internet market is much better developed (83% of UK citizens are internet users[13]) than in Poland.

19% of British citizens buy financial products online (UE average is 6%[14]), which is the highest level in Europe.

The level of UK's internet mortgage market development is reflected by the number of web pages which are concentrated on the subject of mortgages:

1. 106 000 000 results in Google search engine for the phrase "mortgage uk",
2. 17 000 000 results for the phrase "mortgage online" limited to the United Kingdoms area[15].

The British internet mortgage market has one very specific feature. Due to very good law and high acceptance of people to enter their personal data on the Internet the procedure of mortgage verification can be made 100% online [16]. This makes the United Kingdom the only European country in which a considerably part of mortgage procedure can be automised and, as a new kind of services, done online. On the other hand, the new technology, which is very useful for banks (as it is cheaper and faster than traditional verification) was too modern for existing bank systems. Each application, which was sent by a user, is notified by UK's intra banks system

[11] A. Sosnowska, *Procesy demograficznej „starej" Europy*, [in:] S. Kluza, P. Plotzke, Z. Sirojć (red.), *Procesy demograficzne, a kapitał społeczny*, Warszawa 2007, p. 44.

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as "verification of credit balance". When there are too many verifications made the customer is marked as the person with lower trust level. Customers usually fill the applications to more than one bank because they try to find the best mortgage for them. Due to these facts some of British internet brokers advertise their products as "the ones that are not verified online", which is in fact a step back in technology development.

The demographic indicators are not optimistic for the internet mortgage market (percentage of people aged 60+ will grow from 23,4% in the year 2010 to 34% in 2050) but the immigration, which is relatively high in the United Kingdom, should help. Immigrants create a need for new houses which are later rented for a long time periods or bought for "owner occupancy".

4. CONCLUSION AND FUTURE WORK

The first part of the work presents the current state of the fuzzy mortgage model development. Next the need to predict the possible changes on the market is described, as they are needed for the purposes of further model elaboration. Three European markets : Estonia, Germany and the United Kingdom were researched as these countries represent different kinds of markets and cultures. The results (presented in section 3 of the work) of this three countries research produced several conclusions which would be useful in future works.

Based on the situation in the presented countries the important role of following indicators should be noticed and taken into consideration while thinking about the growth of the market in Poland:

- **Law in the country** as it approves the tools that might be used to confirm business and market agreements made using the Internet platform. In Poland the e-signature (digital signature) was used. The first e-signature was developed in Utah, USA in 1995. The main goal of e-signature is to be used in signing contracts online and to provide lawful decisions online[17]. Poland provided e-signature law in the year 2001 (Dz.U. 2001, nr 130, poz. 1450[18].) but it has never become widely used mostly because of high costs. Also, according to Polish bank law, it is necessary to use traditional signature on the mortgage documents. This aspect will be omitted in the model because it seems to be stable in the mid-term future.

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[17] M. Marucha Jaworska, *Podpis elektroniczny*, Warszawa 2002, p. 10.
[18] S. Wojciechowska-Filipek, *Technologia informacyjna w usługach bankowości elektronicznej*, Warszawa 2010, p. 73.

- **The role of trust & safety,** the key indicators for the development of new services in the Internet. Their role and importance is perfectly presented by eBay, one of the leading worldwide e-service company. eBay has Trust & Safety v-ce president, one of three v-ce presidents next to the financial v-ce president and the development one. People will use advanced e-services (which means financial ones and the ones in which it is necessary to use personal data) only when they can trust the owner of the web page (it depends on the state of law in the country) and when they feel safe in the internet (which is connected to their experience in using the Internet – the longer people use it, the less afraid they are).
- **The usage of the internet in the society** is generally the indicator that consists of two sub-indicators: the percentage of people in the society who use the internet and the role of the internet in the society. The first sub-indicator is a typical crisp value which is published by the country's Statistical Office (GUS in Poland). The second one stands for the importance of the internet in the country – the higher it is, the greater the possibility of selling advanced financial products online (e.g. mortgages) is.

Based on the information gained from the research made on European's markets it seems to be necessary to add an extra variable to the current existing model that will represent important facts that were mentioned in this work. It is suggested to create a new variable "attitude to internet services", which will include the role of trust and general usage of internet in the society. It will be a fuzzy variable with linguistic variables: bad, moderate, positive.

The future works will concentrate on building a fully developed fuzzy model. The data which were collected from the countries mentioned above will be added to the already gained data from other sources and used in the model tuning.

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PART II

PROCESSING MANAGERIAL INFORMATION

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APPLYING SIMULATION MODELS IN BUDGETING

The goal of the chapter is to gather and discuss the key factors, which are both the most important in the process of planning and developing the financial models in spreadsheet and in running and interpreting the simulation experiments as well. The work was inspired by two selected example models originally developed in different simulation packages or presented as assumptions of exercises in textbooks. After developing models and transferring them into spreadsheet environment we discussed the issues concerning investing in projects in which the sales revenue, profit margin, marketing expenses were described by uncertain variables changing over time. These parameters shall be identified by means of complex random distributions (conditional distributions with density function where the changes in graph increments are described by the angle of inclination), taking into account the situation of the past and the forecasts for future prosperity

1. INTRODUCTION

In the chapter we focused on implementations of simulation models, mainly the Monte Carlo type, in spreadsheets. In the literature one may find many examples and illustrative exercises to help the reader in learning the skills of using a simulation approach to solve different managerial problems. It is however difficult to find the attempts at the grouping and generalization of problems described or the proposal for the "templates" for the examples given. This chapter, due to the limited volume, concentrates only on the selected classes of cases, originally described elsewhere.

The significant part of textbooks on operations management and decision modeling covers the issues related to the coordination supply chains, inventory models, planning and control in material requirements planning systems, queuing analysis, decision analysis, project planning, capacity planning. Many of these issues are

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suitable for the simulation approach and the results of experiments are given directly in terms of finance and budgeting. Some of the examples and tasks require however the calculation modules of costs and revenues to be built to meet the requirement of applications in budgeting. Let us consider only one [1] of the textbooks [1, 2 , 3, 4, 5, 6]: *cost analysis of the queuing system*: decision on the number of cash registers in the store, the size of the central store during harvest, number of clerks to take orders in telephone sales department, number of crews unloading trucks in a warehouse shop floor; *analysis of expected profit or costs*: profit estimation from running the shop with car parts with selling prices, cost per piece and profit margins changing according to random distributions, and with constant fixed costs, estimation of the costs of storage policies at constant order costs, where stockout costs are proportional to time, holding cost are given per piece, and demand changes according to random distributions to find the optimum combination of fixed reorder point and fixed order quantity; *revenue management problems*: finding the most optimal use of capacity (a measure of resources) when the reported need for their use is described by random distribution, for example in airplanes, football stadium or hotel rooms reservations (modelled categories: overbooked, vacant and short costs of rooms or places); *modeling and analysis of uncertainty in a project management problems*: the goal is to estimate the probability of a certain net sale revenue assuming a fixed margin and a random distribution of demand, to estimate the probability of negative balance on personal account with a random distribution of revenues and expenses on a monthly basis.

To conclude this introduction, we remind principles of Monte Carlo simulation methods. In the area of business, this method allows the inclusion of uncertainty in the market and other factors of uncertainty in decision-making models, including optimization. This method is algorithmic. It consists of 5 steps [7].

1. Construct a model of the binding results and a set of input parameters (to formulate the function).
2. Generate the input values using a random distributions.
3. Run calculations and store the results for each iteration (replications).
4. Repeat "Step 3" the appropriate number of times.
5. Analyze results using statistical calculations such as maximum, minimum, average, standard deviation, confidence intervals, draw graphs – for example histograms, and find the optimal solution.

2. BUILDING THE ENHANCED FINANCIAL MODELS WITH MANY RANDOM DISTRIBUTION

The first broad class of problems concerns the issues of selecting one strategic option which either maximizes or minimizes the goal function. The illustrative very sim-

ple example is given in [6] as problem number 7 from page C29. The money is saved on the monthly basis in one of the two investment funds: low risk fund A and high risk fund B. The first simulation experiment helps to find the solution which enables to reach the goal with the minimum risk. The second experiment maximizes the end balance in the selected fund assuming the possibility of high risk of the investment decision.

2.1. THE PROBLEM AND THE ASSUMPTIONS

The following, more complex model is inspired by the series of examples from [5], originally developed in the simulation package Extend 5. These models relate to investing in projects in which the sales revenue, profit margin, marketing expenses are described by the random variables changing over time. The values of the parameters are estimated taking into account the situation of the past and expected prosperity. These parameters can be determined by complex random distributions (distributions conditional density function of the graph changes slope only at certain points).

The following information needed to start the modeling procedure must be defined:

1. Revenue in the period preceding the start of the simulation experiment.
2. Number of phases understood as a change in the characteristics of the random distribution of essential features of the model or the characteristics of the economic situation.
3. List of the possible states of the economic situation and their probabilities in a particular phase of the run.
4. Relation between economic situation and the distribution of random changes (increase or decrease) of income. The better the economic situation the higher the revenue.
5. Registration and use of information about changes in income in the previous period (simulation step).
6. The relationship between the previously known "change of income" and the distribution of random changes (increase or decrease) of the amount of profit margin. The better economic situation, the higher the profit margin and the greater part of the proceeds may be retained in the company.
7. The relationship between the change in revenue and selling, general and administrative costs. Usually the fall in the revenue will need to incur higher costs, for example, of advertising and promotions.
8. Income tax rate and discount rate to take into account the factor of time in calculating the present values and net present values.

2.2. THE MODEL AND THE OUTPUTS

The original model (in Extend 5) of investment in marketing sunglasses was rebuilt into MS Excel and was positively verified – the results of both models and tools are similar (with regard to randomness). The model was then extended. Fig. 1 and Fig. 2 show the interface of the model and the selected output.

Present (Year=0) annual revenue in   dollars

$20,00

Length of experiment (number of steps)

5

Year of economic change (phase of situation)

4

Anticipation of the sales growing before the change (Phase 1)

Situation	Probability	Lower limit of sales growth	Upper limit of sales growth
Good	10%	6%	9%
Common	70%	3%	6%
Bad	20%	0%	3%

Anticipation of the sales growing during and after the change (Phase 2)

Situation	Probability	Lower limit of sales growth	Upper limit of sales growth
Good	30%	3%	8%
Common	0%	----	----
Bad	70%	-3%	3%

Profit margin when the sales (demand) is growing

Margin	Probability	Lower limit of margin	Upper limit of margin
Highest	40%	40%	43%
Higher	50%	37%	40%
Common	10%	34%	37%

Profit margin when the sales (demand) is declining

Margin	Probability	Lower limit of margin	Upper limit of margin
Highest	10%	40%	43%
Higher	30%	37%	40%
Common	60%	34%	37%

Selling, General and Administrative costs

Situation	Costs in m dollars
Sales is growing	$4,00
Sales is declining	$4,40

Tax rate (const)

34%

Interest rate (const)

7%

AR: Annual Revenue
SG&A: Selling, General and Administrative costs, expenses, taxes and other factors
EBT: Earning before taxes
FCF: Free Cash Flow
PV : Present Value
NPV : Net Present Value

Fig. 1. Configuration of input data to the financial model – model interface

	Trial (Run)	1	2	3
	Previous Annual Revenue	$20,00	$20,00	$20,00
	Number of year	1	1	1
	Phase of situation	1	1	1
	Random 1	0,653	0,968	0,966
	Sales type of behaviour	Common	Bad	Bad
	Random 2	0,710	0,114	0,864
	Sales growth	5,13%	0,34%	2,59%
	Current AR	$21,03	$20,07	$20,52
YEAR 1	Random 3	0,208	0,651	0,964
	Margin type of behaviour	Highest	Higher	Common
	Random 4	0,027	0,862	0,228
	Profit Margin	40,08%	39,59%	34,68%
	Gross Profit	$8,43	$7,94	$7,12
	SG&A	$4,00	$4,00	$4,00
	EBT	$4,43	$3,94	$3,12
	TAX	$1,51	$1,34	$1,06
	FCF	$2,92	$2,60	$2,06
	PV	$2,73	$2,43	$1,92
YEAR 2	**Previous AR**	$21,03	$20,07	$20,52
	Current AR	$21,69	$20,88	$21,46
YEAR 3	**Current AR**	$22,57	$21,90	$22,36
YEAR 4	**Current AR**	$22,10	$23,36	$21,99
YEAR 5	**Current AR**	$21,60	$22,92	$22,15
TOTAL	**NPV**	**$11,13**	**$11,60**	**$12,04**

Fig. 2. Part of the results of simulation experiment on the worksheet.
Four random numbers is generated for each year (step) simulation

2.3. THE GENERAL CONSTRUCTION ISSUES

The credibility of the models is heavily based on the proper assessment of some cru-cial random-type variables, of which the most important are the sales revenue, the profit margin and the marketing expenses. All of them are of uncertain nature changing over time and shall be identified by means of complex random distributions (conditional dis-tributions with density function where the changes in graph increments are described by the angle of inclination), taking into account the situation of the past and the forecasts for future prosperity.

Financial simulation models developed for the long-term projects have to solve the issue of the time changes. Usually the approach used here is similar to the approach applied in system dynamics models, i.e. the fixed time step increments are incorporated into models' structure. The time line requires the concept of present values, net present values, future values and discounted cash flow analysis to be considered.

We found that most important information needed to construct the model and the key parameters required to carry on the simulation experiments are as follows:

1. The number of periods and replications and frequency of calculations in the ex-periment simulation (time step is constant).

2. The amount (value) of income in the period preceding the start of simulation experiment.
3. The number of phases of one run understood as a change in the characteristics of the random distribution of the essential features of the model or economic characteristics (situation).
4. List of states of economic situations and their probabilities in a given stage of the course of the run.
5. The relationship between economic situation and the distribution of random changes of the income (increase or decrease). Usually, the better the situation, the higher revenue.
6. Declared the actual (or simulated) changes in the size of income in the previous period (in the simulation step).
7. Relationship between a formerly known change in income distribution and the random distribution of changes (increase or decrease) of the profit margin. Usually, the better the situation, the higher the profit margin and the greater part of the proceeds may be retained in the company.

3. EMPLOYMENT OPTIMIZATION

3.1. THE PROBLEM AND THE ASSUMPTIONS

The problem of finding the optimal number of employees is one of the most important in human resource management area. Authors of [4] describe the model which assists in investigating the proper number of agents employed in loan mortgage firm. The insufficient number of agents would lead to the low quality of service, while too many workers would generate the high costs of the business.

There are two types of loan agents currently employed in the firm: loan agents for initial review (first phase) of credit applications and loan agents for second review of the failed (in first phase) credit applications. It shall be noticed that the second review controls if the failed credit applications were properly verified. This phase assumes the contact with the applicant and the analysis of the additional financial documents.

The changes in the employment structure concerns the unification of employees. They are fulfilling the more universal activities now. Depending on the current needs they are able to work with the first or second phase. Probably some number of people who were employed only with the second phase, would now have to be dismissed. On the other hand, more versatile and better paid workers would be needed for the modified job positions.

The parameters used in the current model are as follows:
– Approximately four to eight credit application applications (and most likely six) arrive every hour (triangular distribution),

- It takes 12 to 16 minutes to complete the first review (uniform distribution),
- About 20 percent of the applications fail the first review,
- It takes 25 to 35 minutes to complete the second review (uniform distribution),
- About 50 percent of the applications fail the second review.

Authors of [4] suggest the assessment of the decision options to be based on the agents' utilization, average and maximum waiting time and the total time spent in the system for 5 day (40 hours) simulation. In the modified variant tested by the simulation model, loan application allocated to the agent in the first phase stays with this agent during the second phase.

3.2. THE MODEL

The main model is divided into two modules: first one to generate the number of credit applications coming to the system in the beginning of the hour (see Fig. 3) and second one to service the credit applications (see Fig. 4).

The most important details of the original solution (see Fig. 5) are as follows:

- Every credit application is given the servicing agent based on the simple rule: model allocates the agent who has finished the previous assignment,
- When the agent is becoming „free" then the time of last finished job is re-written,
- For activity based costing scheme we have to calculate the queuing time and to remember the service time,
- The value of type „flag" has to be calculated in order to continue the calculations for the credit applications which arrived during the 40 hours of the simulation run and to take into account the registered costs, (40*60 = 2340 minutes).

hour	number of applications	test run	from	to
1	5	5	1	5
2	7	7	6	12
3	8	8	13	20
4	8	8	21	28
5	6	6	29	34
6	7	7	35	41
7	7	7	42	48
8	7	7	49	55
9	7	7	56	62
10	6	6	63	68
37	7	7	242	248
38	6	6	249	254
39	7	7	255	261
40	6	6	262	267

Fig. 3. Example of generating a credit application number.
Note the "from" and "to" columns

number of credit application	hour	minute of arrival	time of first review	which agent?
1	1	0	26,598	2
2	1	0	25,479	1
3	1	0	33,251	1
4	1	0	31,773	2
5	1	0	31,794	2
6	2	60	31,973	1
7	2	60	26,647	2
8	2	60	34,937	1
9	2	60	34,388	2
10	2	60	34,444	1
11	2	60	27,726	2
12	2	60	30,509	1

Fig. 4. Example of credit application arriving time generating.
Note the five rows representing five credit application
in first hour, seven rows representing seven credit applications in second hour

which agent?	time of begin of review by agent A	time of complete review by agent A	time of begin of review by agent B	time of complete review by agent B
1	-	29,054	0	0,000
2	-	29,054	0,000	26,954
2	-	29,054	26,954	60,326
1	29,054	54,484	26,954	60,326
1	54,484	80,840	26,954	60,326
2	54,484	80,840	60,326	86,451
1	80,840	109,356	60,326	86,451
2	80,840	109,356	86,451	112,377
1	109,356	144,199	86,451	112,377
2	109,356	144,199	112,377	146,503

Fig. 5. Part of model sheet (from other run) concerning time of begin
and completing each credit application calculating
during first review ("Original solution")

Below are the most important details of the modified (proposed) solution (see Fig. 6):
– Time of the beginning of the service for the second review is equal to the time of finishing the first review.
– Time of the beginning of the service for the first review is calculated as the maximum of two values: arriving time of credit application and finishing time of second review for the last serviced application by this agent.

which agent?	time of begin of review by agent A	time of complete review by agent A	result of first review	time of second review	time of complete second review by agent A
1	-	34,615	1	0,000	34,615
2	-	34,615	1	0,000	34,615
1	34,615	61,449	0	34,043	95,492
2	34,615	61,449	1	0,000	95,492
1	95,492	126,460	0	32,615	159,075
2	95,492	126,460	1	0,000	159,075
2	95,492	126,460	1	0,000	159,075
1	159,075	184,297	1	0,000	184,297

Fig. 6. Part of "Modified solution" model – during first and second review for Agent A

3.3. THE OUTPUTS

The results of the simulation experiments (utilization) are comparable (see Fig. 8, right side). In the modified solution there are only two agents, so the Agent C is not visible in the output table. The total cycle time is greater than in the first experiment (with three agents) by about 1.5 times, (see Fig. 8), left side. In order to select the better solution we propose to calculate costs according to activity based costing approach. We added assumptions (Fig. 7). Cost coefficients are of the same values for both models. The simulation gave the following results (see Fig. 8): average cost of credit application handling and the average cycle time are lower for the current solution.

3.4. THE GENERAL CONSTRUCTION ISSUES

Information needed to build the discreet-event service systems may be grouped into following classes:
1. Time characteristics of the moving objects (loan applications): schedules (single or repeatable) stating the time of arrival and the number of arriving objects. The schedule may be of deterministic or random distribution type. Random type may concern both the number of incoming entities and the time between arrivals.
2. Internal structure of the process. These issues concern the rules for selecting the servicing utility and for choosing the pathways between them. The spreadsheet columns which have to be defined in the model include: time of arrival to servicing agent (time of taking place in the queue), time of starting the service, servicing time distribution, time of leaving the servicing agent, the next servicing agent (pathway direction).
3. Output statistics gathered during the simulation process: time spent in the queues, total time spent in the system, time of utilizing the agent. In the end of the simulation run the average values will of these statistics will be calculated.

4. *Cost coefficients* defined according to activity based costing approach.
5. *Availability coefficients* of the servicing resources.

Specification	Present	Modified
cost of item handling at first review ($)	1,5	1,5
waiting cost at first review ($/min)	0,5	0,5
cost of time of item handling at first review ($/min)	0,15	0,15
cost of item handling at second review ($)	4	4
waiting cost at second review ($/min)	0,1	none
cost of time of item handling at second review ($/min)	0,25	0,25

Fig. 7. Assumption consistent with the activity based costing approach

Original solution - results

	Costs	Cycle Time
Total	98793,36	202902,10
Average	379,97	780,39

Utilisation: original solution - results

	Agent A	Agent B	Agent C
Total time	2325,972	2337,381	927,1263
Utilisation	0,994005	0,998881	0,396208

Modified solution - results

	Costs	Cycle Time
Total	153285,70	308199,63
Average	589,56	1185,38

Utilisation: modified solution - results

	Agent A	Agent B
Total time	2339,437	2330,177
Utilisation	0,99976	0,995802

Fig. 8. Simulation results from both solutions

4. CONCLUSIONS

Our efforts involved clustering, categorization and structuring of the selected financial management problems, in order to solve them using spreadsheet simulation and budgeting approach. It should be noted that such an action could enable the development of tools supporting the construction process and the analysis of the results. It is also possible to develop the model generators similar to those attached to the simulation packages. The whole process solution structure is described in [2]: "Problem"; "Solution Strategy"; "How To Build this Spreadsheet Model". In this chapter, we propose the following structure for the presentation of the issues discussed above:

1. Presentation of the extended assumptions from educational examples and the development of the financial modules.
2. Presentation of the model (screenshots) in MS Excel.
3. An attempt to generalize.

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THE RESEARCH OF
PUBLIC INVESTMENT EFFICIECY

The work reads about the research of public investment efficiency. The peculiarity of the chosen domain is connected with the proper selection of efficiency assessment methods. Public investment are thought to be unprofitable because of their type. Their proceeding is a duty of Local Government Units, not to get benefits from the realized project but as a common property. In the work there are main theoretical issues connected with public investment as well as basic and most common methods of investment project efficiency calculation. The theoretical reflection is widened by a final results presentation of application the investment efficiency assessment methods.

1. THEORETICAL CONCEPTION OF PUBLIC FINANCE

The starting point of doing the research of public investment efficiency is to standardize and understand the concepts connected with public investment efficiency assessment. Human needs are responsible for creation the public property. Because of their character, some human needs can be only met collectively so the government had to create finance that composes public finance section.

1.1. PUBLIC FINANCE

The sole propertiorship is divided into private and public because of the property criteria. The first one applies for enterprises running and working as well as natural persons. On the other hand, public propertiorship is connected with public sector working. Such criteria allows to state that: „the issues of public finance are phenom-

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ena and processes, connected with public money creation and distribution, guarantee public sector working"

The efficient public finance section working is possible because of setting up the appropriate rules, principles and criteria that determine order in the country. The efficiency of that section working should be also provided by setting duties range as well as indicating people responsible for the accomplishment. A local government, which basic unit is called a municipality, was created to accomplish common duties at the local level.

1.2. THE FUNCTIONS OF PUBLIC FINANCE

The profit is an element that differ the public and private economy. On the contrary to private economy, the main activity cause of the government is working for the people and society good and not gaining the profits. Because of that, the functions of public finance are[3]:
1) allocation function,
2) redistribution function,
3) stabilization function,
4) control function.

Allocation function concerns public finance as a device to dispose goods, according to citizen needs. The function is also connected with hiperdiversity of society income, which could limit the access to several goods for some parts of the society if they would have been allocated by market rules (education, medical care) [8].

Redistribution function concerns taking some parts of primary income (fiscal part) by the budget and then distribution the collected funds for financing public tasks (distributive part) . In other words, there is a transfer of income, derived from production section, into non-production section. [8].

Stabilization function is connected with fiscal and monetary policy instruments used by government to appease the fluctuation of economic situation (economy stabilization) and simulation of economic growth[7].

Control function allows to monitor the course of economic processes, which is possible to record cash flows.

1.3. THE STRUCTURE OF PUBLIC FINANCE

Collection and distribution of public funds is done by both the group of transactors and the highest level executive and legislature powers, that are still realizing public

income and outlay. The structure of public finance can be shown in several grounds. Taking objective intersection into account, we can distinguish such elements as [8]: central level legislature powers (the parliament), intermediate level powers (local councils) and municipality level powers (town councils), executive powers, control authority – acting on behalf of constituent powers, the machinery of treasury (financial), entities (units), which are funded form public funds.

Taking institutional intersection into consideration, public finance consist of [8]: national budget, basic or higher level municipality budget, social security funds, other public funds, public foundation.

Considering instrumental intersection, public finance system relates the tools such as; central taxes, local taxes, fines, duties, public property income, social security fees, subventions, grants, state credits and public loans.

Considering Public Finance Act (as at 30 June 2005), in public finance section, there are [12]:

1) Public Government Organ,
2) Municipalities, districts and voivodeship councils (known as Local Government Units – LGU),
3) Budget units,
4) State and council intentional funds,
5) Public universities,
6) Research and Development units,
7) Health Maintenance Organization,
8) State and council cultural institutions,
9) Social Insurance Institution and Agricultural Social Insurance Fund,
10) National Health Fund,
11) Polish Academy of Sciences.

2. INVESTMENT PROJECTS EFFICIENCY CALCULATION

Investments are very important indicator of each economy. For this reason, investments are: "economy expenditures done in order to create or extend capital assets. The capital assets expansion as well as better and better usage of them, allow to enlarge national income and meet public needs better" [4]. On the other hand, investment are: "assets (expenditures) of defined appropriation which means they aim to gain new objects of durable property or enlarge them" [6]. However, the term made by Hirschleifer reads: "Investment is an actual sacrifice for future profits. Although the present is relatively known, the future is a mystery. So, the investment means to sacrifice safe for unsafe profit" [10]. To avoid ambiguity

of investment term, I change it into investment business, which is understood as the set of actions that combine relatively huge financial assets for determined purpose [6].

2.1. INVESTMENT PROJECT

Investment project and investment business are connected with investment term. Investment business, according to Marcinkowski, is "a group of planned and correlated actions that aim to create or modernize fixed assets determined by material, financial, location and time" [5]. Briefly, investment business is: "comprehensively conceived financial range of investment, realized in previously set purpose, time and location"[1] [9].

Investment project can be conceived as a single idea which is separately funded or for which separate methods of assessment are used and considered, because of future profits. Investment project was described by Listkiewicz as: "intentional involvement of determined resources into realization of prepared agenda, which completion should cause benefits in the determined future" [2]. These definitions mean that investment project and investment business are characterized by usefulness, complexity and time-location. So, the terms "investment project" and "investment business" can be treated as synonymous because of their similarity.

2.2. THE ISSUE OF THE BUDGETARY FINANCING CAPITAL

The core element, which should be mentioned, is the issue of budgetary financing capital of investment businesses. Considering the definition of budgetary financing, available in the literature, it can be said that budgetary financing capital of capital venture is a plan of incomes and outlays of particular investment projects on the basis of which the investment decisions are made.

The process of budgetary financing is the core element of decision-making connected with investment businesses. It allows to research, analyze and assess the proposed businesses, which makes the choice of the most suitable and rational business easy. Budgetary financing capital is a technique that supports long-term decision-making. It allows to determine investment possibilities and helps to make choice. The

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[1] "comprehensively captured material investment range, realized in previously set aim, location and time".

point of budgetary financing capital of non-financial investment is the assessment of both economical efficiency and investment risk [9].

2.3. INVESTMENT PROJECT EFFICIENCY

The efficiency of a project given can be assessed from the economical and financial point of view. The efficiency is a result of taken actions, which is described by a relation between achieved effects and incurred expenditures. The financial occurs when the sum of profits is higher than costs connected with expenditures. In turn, economical efficiency depends on optimum usage of outlays and many other factors such as external conditions and accuracy of decision-making.

The criterion of economical efficiency is not fault free because simple cost aggregation and project profits do not consider the influence of a project on the social groups, that differ by the level of earnings. It is so-called distribution effect and means that a project-provided benefit is more valued by the group of people with lower salary. On the other hand, the profit evaluation by richer people is lower. Considering outlays, it can be explained that, for richer people, the expenditures seems not very high, but for people who earn less, the outlays can be really high. In that case, the efficiency criterion was introduced. It is also known as Bergson criterion. In the criterion, project net profits are calculated by the importance for particular social groups [1].

3. THE METHODS OF INVESTMENT PROJECTS EFFICIENCY CALCULATION

The available methods, that are necessary in the analysis, should be used to assess the investment business efficiency. Within the framework of different methods, mathematic formulas – based on comparing effects and expenditures – are used. Decision proceeding, supported by available and known method and aimed to assess the business, will be conducted in a proper way. The quality of assessment will be properly interpreted and the decision will be accurate.

Taking the conditions of realization and subject range as a classification criteria, we can distinguish:
1) single businesses and investment programs,
2) deterministic (certainty) and non-deterministic conditions.

By joining these four elements together, four classes of methods of investment projects efficiency calculation are reached, which is shown in the Table 1 below[6].

Table 1. The classification of investment efficiency methods [6]

Research subject / Established conditions	Single investment businesses			Investment programs
Deterministic	I			II Classic attitude from capital theory
	Calculation	Micro economical	Macro economical	
	Financial	a) Static methods b) Dynamic methods	Cost and profits analysis	
	Non-financial	Utility value analysis		Combined models solved by methods of linear optimization
Non-deterministic	III Correcting methods Sensitivity analysis Risk analysis A decision tree			IV Sensitivity analysis CCP Portfolio method

Dynamic and static methods of investment efficiency research are most common. The difference between these methods is connected with considering money value variation in time of calculation. Moreover, the analysis of public investment uses the analysis of costs and benefits. So, the work reads only about these methods.

3.1. STATIC METHODS

Static methods are used for preliminary selection of considered investment businesses. The characteristic for this group is non-considered time factor, which means that compared calculation elements are not brought into one period. They are used mainly for small investment projects assessment with short-time realization. There are in the group [9,11]:

1) Comparative costs calculation – basis on analysis and comparing costs of examined investment businesses, mainly used to assess modernizing investment which do not change incomes. The criterion of choice is set by the lowest expenditure that can be reached as a result of realization and exploitation of the particular investment business.

2) Comparative profits calculation – combines incomes and costs, the average values for the first years are used in this method. It is established that they will be the same in the further years.

3) Profitability calculation – also called Return on Investment (ROI), it is a quotient of average profit on the time unit to average capital, multiplied by one hundred per cent. ROI cannot be lower than the required minimum, which is nominal interest rate.
4) Static amortization calculation – broadly speaking, in the calculation we set the time after which the outlays are back, assuming the static costs and incomes during the whole period.

3.2. DYNAMIC METHODS

Dynamic methods are also known as discount methods. The name comes from discounted calculation, on which the methods from this group bases. In most cases, the projects are realized during a few months – even years, so considering money value variety in time is necessary to assess their efficiency. It is possible by using discount calculation, in which all expenditures and incomes can be brought to one comparative period. Among dynamic methods, there are [6, 11]:
1) Method of discounted rebate period assessment – calculated as a static method of amortization calculation, but first discounted cash flow values must be determined, assuming established discount rate and then accumulated values can be calculated.
2) Method of net present value – the summation of discounted net profits (net cash flows) created by an investment for the whole project life-time. Discounting means to aim to standardize their value in time.
3) Method based on profitability index – allows to assess the profitability of capital used in the investment. In this indicator, present project incomes value is set to preliminary expenditures. It is used mainly to assess investment projects with different capital expenditures.
4) Method of property accumulated amount – in the method, it is assumed that the business capital value at the end of the accounting period equals the final object property value.
5) Method of internal return rate – using IRR method, the analyst wants to get the information about discount rate for which the investment project is still effective. So, it is such an interest rate for which net present value equals 0 (NPV = 0). It can be said that IRR shows the business profitability.
6) Baldwin method – the sum of investment expenditures and net incomes. Summed expenditures should be first discounted to the beginning of the investment and before the summation, net incomes should be interest-paid at the end of exploitation period. Next, it should be found the interest rate, for which the sum of discounted investment outlays equals the sum of interest-paid net incomes.

3.3. THE ANALYSIS OF COSTS AND BENEFITS

The analysis of costs and benefits is classified as a basic tool for public projects assessment. The analysis allows to look at multifaceted project effects, both positive (benefits) and negative (costs) ones. Additionally, by costs and profits analysis, the uniform assessment criterion was introduced to project assessment through bringing cash assessment to all project effects.

This method is used to set up the efficiency of economical and business region, from the point of view of the whole population, not only an investor. In the analysis, identification of project-connected subjects and social groups is needed.

The analysis of profits progresses on several levels. The first one concerns the establishment of market prices deviation of investment costs, operating costs and delivered goods from economical value. In the second level, the mentioned elements are assessed in the cash dimension, which defines their economical value by using dual prices. In the next level, the examination is conducted to establish if expenditures usage is not connected with the creation of external effects. The further one is the benefits and costs evaluation in cash values, as a result of external effects and public property. The following step is to establish economic rate value of the discount. It is possible because of market interest rate deviations used to calculate discount coherent in financial efficiency analysis. The last step is connected with setting economical net present value of the project (ENPV). The mechanism of ENVP calculations differs from NPV by the discount rate, which is the economical discount rate. In this level, it is possible to calculate other economical efficiency indicators e.g. Economical Internal Return Rate (ERR) and the relation between Benefits and Costs (B/C) [6].

4. THE RESEARCH OF PUBLIC INVESTMENT EFFICIENCY

The methods and issues presented in the work were related to real business investment conducted in the Lądek Zdrój municipality. The researched investment project concerned the renovation of underground fire waterway that conducts water of Karpiowski Torrent[2]. The research was conducted ex post. Realized investment was done in 2006 and 2007. The object of the project was to renovate the engineering installation which is the waterway – tunnel. The ceiling used to cover regulated torrent banks, was dissimilar in structure. In 1997 flood, the waterway was damaged. The investment proceeding was connected with the need to secure

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[2] Research conducted together with Ryszard Chlebowski, MA, as a company constitutional action of employers.

safety for citizens and health resort visitors as well as avoiding losses, that can be caused by a possible flood. It was estimated that by underground waterway renovation, possible flood effects are half reduced. Moreover, the investment realization aims to protect the historical part of Lądek Zdrój health resort. The project was funded by municipality resources, government budget and European Regional Development Fund.

The realized investment was non-profitable, but all area inhabitants reached the profits, on the ground of running new infrastructure element and the situation will not change long time after the project realization. The running of waterway, because of its specific character, does not allow to assess neither present nor future costs, as a result of a lack of proper documentation, concerning waterway value, in the record. For its entire financial value, the incurred costs on the project realization are assumed.

4.1. NPV – THE RESULTS PRESENTATION

The analysis was conducted during 2004 and 2007. The discount rate was assumed as 6%, which is in accordance with European Commission for projects co-financed from European Union grants. As it was mentioned before, the investment had been non-profit, so the sum of discounted differences between costs and expenditures of the investment project, calculated on a time of the beginning, was a negative value. From the point of analysis, the business should be numbered as unprofitable because of really high negative result of NPV (–863 421.57). It should be added that the NPV function in the discussed case, considering negative cash flows, does not cross the profit axis. So, this was impossible to indicate IRR. From the financial point of view, the project has the disadvantageous financial factors. Considering, that it would not generate extra socioeconomic benefits, it should have been rejected. But the investment proceeding was necessary, so the method considering social benefits should be used.

4.2. THE ANALYSIS OF BENEFITS AND COSTS – RESULTS PRESENTATION

Elevating the infrastructure level and the access to the natural recourses (e.g. water) of the examined municipality, the easy terms are created and they attract investors to the municipality area. The discussed investment improves spatial order and comfort of developed area, which influences positively on utilitarian quality and welfare. The damaged waterway – tunnel lower the municipality outlays on keeping routes and garden suburbs of Park Zdrojowy. If the investment had been rejected, the part of the health resort would have been flooded because of construction collapse. The estimated losses would reach 1,600,000 zlotys. The whole costs, the

municipality would have born on giving up the investment project, are estimated on 2,200,000 zlotys. According to calculations of economical cash flows, the investment is profitable with the efficiency 195,918,81 zlotys of the benefit. EIRR indicator was 7%. The economical value of the flows was calculated as NPV, including the costs the municipality would have born on investment project rejection. In other words, the costs are not subtracted because their value is a saving for us, which means the flow. The ENPV value (calculated from the real outlays) was 1 682 076.99 zlotys and ENPV indicator = 8%, because the real outlays (15% from the municipality) on the investment was 299 941.90 zlotys. They are higher than the costs that would have been born when the investment would have been rejected. The additional cost efficiency assessment rate could be the efficiency rate and the measurement of the result. The result measurement equals the number of municipality inhabitants, so the population, taking advantage of the project proceeding, is 9339 (in 2007). The cost efficiency rate (outlays/number of users) is 446.936. ENPV calculations indicates the project recommendation as beneficial.

5. CONCLUSION

NPV value calculated by net present value method, assuming that the interest rate is 6%, turns out to be negative. According to the method of the project assumption, it is non-profitable considering finances. Benefits and costs analysis is used mainly to assess the public investment businesses efficiency because it considers both financial aspects of the investor as well as social and economic of the area, where the investment is located. The main task for each local government unit, which means the municipality as well, is to fulfill the group needs of the inhabitants. So the research of project efficiency, carrying out by Local Government Units, should be proceeded considering methods that include "external results", which is costs and benefits analysis.

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ENTERPRISE SYSTEM ADOPTION: HOW TO BUILD THE PROJECT TEAM TO ACHIEVE SUCCESS?

This study's goal is to investigate and better understand issues connected with the project team building within the context of enterprise system (ES) adoption. Enterprise systems evolved from MRP, MRP II and ERP systems and currently are very complex software packages having capabilities to integrate the whole company and also provide the company with the possibilities of inter-organizational integration with their customers and suppliers. The adoption of the ES is usually a lengthy and complex process and in order to achieve success the company has to involve many stakeholders from within the organization and also the representatives of external partners. This study starts with the discussion of ES characteristics and its adoption process considerations. Next, it explains the importance of the project team for successful ES adoption and its unique characteristics resulting from the ES adoption context. The study discusses important issues connected with the project team composition, describes tasks and responsibilities of the team, and elaborates on the influence of time on the project team-related considerations. Next, it discusses relationships between the project team and other stakeholders during ES adoption. The work closes with the discussion of further research and concluding remarks.

1. INTRODUCTION

Enterprise systems (ES) are complex software packages that integrate all areas of the company. They are large scale IS projects which span the whole organization and extend over a long time. In consequence, traditional project team management approaches are often not sufficient to support a team during these long, organization spanning projects [8]. Essentially, the effective ES adoption is about a transformation involving clarifying business strategy and objectives, and designing integrated processes, technologies, information systems and skills to deliver on these [24].

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The careful selection of team members is especially critical for the ES adoption projects since projects of this kind are costly, complex and diverse in nature [19]. Specifically, effort put into team building during the early stages of the project is essential for effective knowledge integration later [13]. Further, good teamwork requires from the project team good performance in six areas: communication, coordination, balance of member contributions, mutual support, effort, and cohesion.

Due to the length of time and commitment that enterprise system adoption requires, end users are more involved in ES implementations than they are in more traditional IS implementation projects. The users have to understand how their tasks fit into the overall process, and they must understand how their process fits with other organizational processes [9].

2. ENTERPRISE SYSTEMS CHARACTERISTICS AND EVOLUTION

Enterprise systems evolved from Material Requirements Planning (MRP) and Manufacturing Resource Planning (MRP II) systems. Therefore, they started as the support for a variety of transaction-based back-office functions (at which time they were called Enterprise Resource Planning (ERP) systems). However, they further evolved to include support for front-office and even inter-organizational activities including supply chain management, customer resource management, and sales force automation [20]. They started to offer solutions in an attempt to seamlessly link front-office (e.g. sales, marketing, customer services) and back-office (e.g. operations, logistics, financials, human resources) applications to enhance competitive advantages [3]. Enterprise systems are described in the following ways:

- identified with ERP systems, which are defined as a packaged business software systems that allow a company to: (1) automate and integrate the majority of its business processes, (2) share common data and practices across the entire enterprise, (3) produce and access information in a real-time environment [4],
- commercial software packages that enable the integration of transactions-oriented data and business processes throughout an organization [12],
- packaged software solutions that seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture, ... with a development objective of mapping all processes and data of an enterprise into a comprehensive integrative structure [10],
- complex software packages that offer the potential of integrating data and processes across functions in an enterprise [2].

Enterprise systems are the result of the evolution of ERP packages towards supporting various activities between organizations and supporting inter-organizational

collaboration over company functions. The introduced functions or systems include CRM, SCM, business intelligence, data warehouses, etc. Contemporary enterprise systems are often called ERP II systems. This term was originally invented by GartnerGroup in 2000 who defines ERP II as a business strategy and a set of industry-domain-specific applications that build customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational and financial processes [1]. Therefore, ERP II is a "componentized" ERP supporting e-business and collaboration in the supply chain.

3. PROJECT TEAM COMPOSITION

3.1. PROJECT TEAM CHARACTERISTICS

In the context of large scale, enterprise wide systems adoptions there is a need to create a "multiskilled" project team. Organizations should dedicate their resources to assembling a team that is knowledgeable in both organizational and technical aspects [16]. Project managers face the problem how to create hybrid team cultures that integrate a diversity of backgrounds, experiences, perspectives, cultures and goals brought in by project members. In order to facilitate collaboration, project managers must overcome the biases that various team members bring to the project [8].

The project team diversity is important since in the case of teams with high complexity tasks, the project team performance is positively influenced by high diversity for teams which may be explained by a greater creativity or a wider range of thinking processes [6]. The project teams should be chosen so that their members should have a mix of knowledge and capabilities in order to ensure team diversity and representation. This requires from the project team appropriate knowledge, skills and expertise [13].

The team should have multidisciplinary and interdisciplinary nature [19]. First, it should contain users and management staff from key areas of the organization, and their commitment for their participation should be obtained. Second, there are various roles in the team defined according to the types of general and specific tasks that would need to be accomplished. Each individual team member needs to have skills than enable him/her to assume a specific role and a specific set of tasks and responsibilities within the project.

The project team should be multifunctional [24]. The project team should include full-time, high performing users, IT specialists, and people with good interpersonal skills. If needed, the project team should include external IT staff and knowledgeable users/managers. The project team should be made up by people who joined the group on the basis of expertise or passion for a topic. The passion, commitment, and identifi-

cation with the group's expertise holds the members together. The group's purpose is to develop members' capabilities and to build and exchange knowledge. The project team's breadth of experience may be a necessary requirement for all researched aspects of ES success, i.e. support of organizational activities, stakeholder satisfaction, and system acceptance [16].

3.2. TEAM COHESION

Cohesion is connected with the ability of a group to work together, is a function of the extent to which individual members view the group goals as their own and is correlated with communication and conformity to group norms [16]. The project team cohesion is a characteristic which deserves special attention due to the fact that high group cohesion positively influences ES implementation success [23]. There are positive relationships between group cohesion and both willingness to participate and commitment to learning of the team members. Overall, the group cohesion of an ES project team is important to the attainment of organizational benefits of the project.

Cohesion, apart from breadth of experience and empowerment, is one of the most critical attributes of the project team. Rothenberger et al. [16] conducted case studies in 5 companies and investigated the influence of these attributes on project success represented by three measures: support of organizational activities, stakeholder satisfaction, and system acceptance. Breadth of experience is connected with team members having multiple skills, enabling them to perform a variety of tasks. Empowerment is connected with self-management which refers to the level at which project team members perform traditional management activities which were previously the domain of supervisors or middle managers.

The results indicate that the project team's breadth of experience may be a necessary requirement for all researched aspects of ES success, i.e. support of organizational activities, stakeholder satisfaction, and system acceptance. However, on the other hand, the authors illustrate that project team empowerment may only be necessary for support of organizational activities, and project team cohesion may only be essential for system acceptance.

4. PROJECT TEAM TASKS AND RESPONSIBILITIES

The project team is the key organizational body within the enterprise system adoption comprised of people from various functional areas in the organization and a set of consultants who have product knowledge of the enterprise system package. These people together lead the decision making about how the company's processes will be

mapped and reconfigured to take advantage of the integrative functionality of the enterprise system [21]. The first task of the project team is to map existing "as is" organizational processes [13].

In general, a multifunctional implementation project team is created to configure and implement the ERP system. It is important to divide tasks within the project in a way that creates interdependence between the project team members [13]. This is connected with the fact that collective knowledge within the project team is generated through interaction and communication, not only between members of the project but also between the project and others within and outside the company. Further, communication and exchange within the project team can create novel associations and connections and in consequence yield new meanings and insights [13].

Within the context of the ES adoption, a project team is essentially tasked with integrating distributed knowledge [13]. Enterprise system adoption teams usually face a four-part information sharing problem, which is connected with the presence in the project team of both functional experts from within the organization and external implementation consultants. First, the functional experts share information about organizational processes and norms with each other and with the implementation consultants. Second, they must also learn about the enterprise system software from the consultants. Third, these two inputs combine in a learning process and in consequence decisions about how the system will be adopted are made. Fourth, information about the decisions made and the enterprise system functionality are shared with other members of the adopter organization [21].

There are two main aspects of the effective use of social capital within the project team. First, within the project team, members need to develop strong bonds with each other so that they have a shared sense of purpose and some common understanding. Second, team members should use their so called social capital bridges in order to access dispersed organizational knowledge that is going to help them complete the project objectives [13].

5. PROJECT TEAM BUILDING AND MANAGEMENT

Jones [8] on the basis of 4 case studies conducted among large American companies in the energy industry proposed a four-pronged approach to project team building in large scale IS projects. She suggests that there are two levels of interventions to overcome obstacles to effective teams: interpersonal and structural. Also, the author posits that obstacles may arise out of what the team members bring to the project (i.e. external obstacles) and what occurs as the project progresses (i.e. internal obstacles).

The four-pronged approach, based on two perspectives defined above, includes the following steps [8]:

- Build the team – when the team is formed, use interpersonal interventions, such as formal and informal team building exercises, to overcome external obstacles that may carry over to the team.
- Equalize the team – employ deeper, structural initiatives to further overcome external obstacles in order to put team members on an equal footing. The employed activities consists in rewarding all team members equally or removing hierarchical distinctions on the team.
- Structure the team – use structural initiatives to alter the team workspace in order to minimize physical or social obstacles within the team.
- Tweak the team – monitor employed interventions, if any interventions begin to fail, take appropriate action to restructure, re-equalize, or rebuild the team's foundations and re-establish collaboration.

6. PROJECT TEAM-RELATED CONSIDERATIONS IN TIME

Enterprise system adoption projects are typically larger and the project lasts significantly longer than traditional information system (IS) projects. As a result, it is difficult to sustain a consistent and cohesive project team environment, since over time the project team experiences a significant rotation of its members. Further, due to the scope and long duration, large scale projects are more prone to mid-project problems than smaller projects. This is due to the fact that the initial circumstances change, such as goals or team members, and the initial commitment weakens due to factors such as declining enthusiasm or reduced resources [8].

In consequence, project team managers must not only focus on initial team building, but they also must continually monitor the team for changes that may undermine initial collaboration. Further, they should be aware that obstacles to collaboration arise out of both the what team members bring to the project (external obstacles) and from within the team itself (internal obstacles). Both interpersonal and structural initiatives are required to build and sustain long term collaboration on large scale projects [8].

Project team members experience various issues connected with emotions during the project run. Specifically, in the case of very long projects, project team members may experience burnout after a few years of the project run. In general, research on IT project team emotional dynamics indicate that teams begin projects with higher positive emotions, however, certain negative emotions grow over the life of a project [14]. This is especially important since negative emotions and, interestingly, passive positive emotions may negatively impact project success [15]. Simultaneously, team members' intelligence has a positive impact on team

processes which, in turn, together with trust reveal positive impacts on project success.

7. RELATIONSHIPS WITH OTHER STAKEHOLDERS

Enterprise system adoption requires the involvement of many stakeholder groups from within the adopter organization and also representatives of external organizations, such as the implementation services provider. The project team members have to collaborate with all involved people who represent all company areas affected by the ES adoption project and hold various positions within the company's organizational hierarchy. The project team members need to network with a range of other individuals in order to make sense of both organizational processes and the enterprise system [13]. They should pay special attention to three stakeholder groups: users, project leaders/supervisors, and the provider's representatives.

User participation starting from the early stage of the project is crucial for the adoption project success. The ultimate success of the implementation project is greatly dependent upon the immediate "buy-in" of the users [19]. Further, user involvement in the adoption project and the ability to have an input result in positive feelings of the outcome of the implementation project. In consequence, it is suggested that managers should involve as many of affected workers as possible in the planning and implementation stage. Bringing together users and project team members should help to avoid potential conflict and assure the success of the entire ES adoption project [19].

Project team members and project managers should pay special attention to system users. They should bear in mind that users have little formal control over the implementation team [5] and within this relationship they should be the active side. Managers should investigate the motivational needs of ES users and adapt change management strategies accordingly. Managing relationships with users is all the more important as dissonance or misalignment between users' expectations and managerial actions could lead to user resistance against system usage [11]. The involved user expectations may be connected with the following issues: lack of improvement in company's operational performance as a result of ES utilization, lack of rewards for voluntary ES users, and fear of dismissal as a consequence of ES adoption. The implementation team should be responsive to user requests and clarifications. Members of the project team can show responsiveness to users in two main ways: on-site presence and quick turnaround of problems [5].

Project leaders form one of the most important stakeholder groups and usually are grouped in the steering committee. Essentially, strong and committed leadership at the top management level, at the project management level, and of the IS function must be given significant priority throughout the life of an enterprise system adop-

tion [17]. The role of the steering committee is to support the project team, validate the emerging solution, ensure that financial and human resource issues were adequately addressed, convey the project team's final recommendation for final approval [19].

ES adoption leaders should demonstrate more charismatic behaviors in order to establish the project team members' cohesiveness and, thus, improve team performance [22]. Further, ES project leaders should consider informal controls as an important managerial intervention to make ES work successfully [7]. In general, the leadership skills of IT project managers may be as important as their project management skills. It is important for project managers to recognize the leadership behaviors that their counterparts value and connected with a range of soft skills that facilitate collaboration and cooperation within the project [18].

Finally, representatives of the system and implementation services provider form an external stakeholders group supporting internal stakeholders. Specifically, implementation consultants help adopter companies to configure and derive value from an ES package, providing both product knowledge and process guidance [21]. Suppliers can perform an important "fill-in" role and routine, easily defined tasks within the project can be outsourced. The most effective way of using the provider's resources is to bring them in to work under in-company direction and control [24].

The provider's representatives are involved in relationships with a number of internal stakeholders with a special focus on the project manager and system key users. In particular, manager from the ES provider's side should be dedicated as their customer manager to liaise with the project manager from the adopter's side. Further, in order to help the project team to progress, it is essential to ensure constant and intense communication between the key users and the ES provider specialists. In general, the use of the provider's consultant can help greatly to reduce knowledge barriers [21].

8. CONCLUSION

This study investigates issues connected with project team building in the context of wide-scale enterprise system (ES) adoption projects. The performed analysis illustrates that ES adoption project team requires constant attention over the whole ES adoption lifecycle. This is imposed by the project complexity, its deep impact on the adopting organization, and many stakeholders involved during the project run. The ES adoption project should begin with the arrangement of a competent and balanced project team involving both internal and external stakeholders. These stakeholders should represent both business and IT-related areas. The results imply that during the project run the project team should be carefully managed and supported by the project supervisors representing the company's top management. The project team members, in

turn, should advance relationships with other stakeholders within the company, such as system prospective users, and with external stakeholders representing the system and implementation services provider.

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DEVELOPING PROGNOSTIC MODELS
OF ORGANIZATION EVOLUTION

The work focuses on the problem of measuring evolution of IT organizations. Changes in business influence functioning of the IT organization. IT departments or companies must ensure that the needs of their parent company/customers will be met. Therefore they must constantly evolve. Following question can be raised: is it possible to support process of changes the IT organization to run it smoother, faster, easier but with reduced risk level and under full control as well? Many organizations succeed in such projects, but the knowledge about it is usually incomplete, dispersed and not recorded in any formal way. The goal of the authors is to build a prognostic model for supporting knowledge-based prediction of the maturity of IT organizations. The proposed solution is expected to help in orderly and formalized acquisition and processing the knowledge about all internal processes of the organization with the use of intelligent systems

1. INTRODUCTION

Nowadays organizations meet difficult conditions – increased competition and economic weakness. Therefore efficiency of the business requires special attention. At the same time business processes are strongly based on information technologies, so effectiveness of IT appears to be crucial issue. Investments in IT domain should generate the greatest possible economic value. Therefore the role of IT organizations/departments has changed. The parent organization is an internal customer for IT and does not have demands regarding technology anymore. Customers expect IT to support their business processes by delivering IT services. This new model of organization is called IT Support Organization.

Such shift in the functioning of the IT organization is a necessary condition to ensure that the needs of the parent company will be met. However the change must be

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done in evolutionary way – step by step – as this is very complex enterprise. Following question can be raised: is it possible to support process of changes the IT organization to run it smoother, faster, easier but with reduced risk level and under full control as well? Many organizations succeed in such projects, but the knowledge about it is usually incomplete, dispersed and not recorded in any formal way.

This work aims to show the possibilities of building prognostic model of organizational development which would allow its quantified description. On such basis quantitative objectives could be determined. Organization would be able to measure changes in its various process areas and improve each named process. The authors propose a model for supporting knowledge-based prediction of the maturity of IT organizations. Such solution is expected to help in orderly and formalized acquisition and processing of knowledge about the internal processes of the organization with the use of intelligent systems (expert systems, agents, ontologies).

2. DEVELOPMENT OF THE ORGANIZATION
IN THE PROCESS APPROACH

2.1. ORGANIZATION MATURITY ASSESSMENT METHOD

The concept of the IT organization evaluation based on the model of its development requires first selecting or working out an adequate assessment method. The assessment method is understood as some consistent standard of assessment of the organization, allowing the expression of its states and changes in a quantitative scale. The authors have made here the key assumption: organization development has been identified with a controlled process of its maturity level expansion. It derives from the authors' experience gained during cooperation with IT companies. It was decided to treat such companies as a target group for the proposed solution. The basis for this assumption became numerous interviews that helped to understand main principles, priorities and goals in their functioning.

Although there are no common, global standards for evaluating all organizations, authors attempted to adapt for their research existing standards that has been developed for IT industry.

2.2. COBIT AS ASSESSMENT METHOD
FOR DEVELOPMENT OF IT ORGANIZATION

For the construction of predictive models for IT organization there was selected COBIT as the most adequate assessment method.

COBIT (*Control Objectives called for Information and Related Technology*) is a set of best practices (framework) regarding IT management which was developed by ISACA and the IT Governance Institute in 1996. COBIT covers all areas of management – administrative and operating – in IT. COBIT is a comprehensive standard for the implementation of control mechanisms and good practices in IT. Using COBIT neither preclude the use of other standards nor replace them. Moreover, in order to build a well functioning and transparent IT organization, it is advisable to reach for a more detailed description of the process of good practice. COBIT helps, in a prominent manner, indicate what mechanisms and how should be implemented, although it rarely may be the ultimate solution. Therefore, it is often referred to as an integrator, which "spans" all the other good practices and assessment methods used in the organization [1].

With COBIT any IT organization can be described from the perspective of its maturity. For this reason it was chosen as an assessment method for subsequent experiments which were supposed to verify the model, as described later.

3. A MODEL FOR THE ACQUISITION AND PROCESSING OF KNOWLEDGE IN MANAGING A IT ORGANIZATION

The proposed model of managing knowledge on the development of a IT organization is based on the concept of decision support systems (expert systems). Expert systems are used in many fields of human activity. Most reported implementations carry out decision support in the realities of technical systems.

Technical systems are characterized by the high availability of data, which can be easily processed into knowledge. This data usually comes from measurements or calculations, hence it is objective and unequivocal. The functioning of technical systems is clear and well defined. For the acquired and processed knowledge, data constitutes a complete base relying on rules and/or facts. In contrast to technical systems, social systems are not fully recognized and are therefore difficult to describe. Very often the available knowledge is imperfect. It may not be possible to obtain knowledge which is certain or sufficiently precise. It is also rarely complete.

Organization management is carried out in mixed conditions. Necessary decisions should take into account both the knowledge resulting from objective sources of information, as well as all the "soft" aspects which are hard to measure. Therefore, in accordance with such classification, an organization (a company) is a socio-technical system.

The authors present a model for decision support in the management of organizational knowledge which takes problems arising from its social nature into account. They identify these problems in two areas: the acquisition and the processing of knowledge. Because of this division, separate sub-models can be distinguished in the Model of Knowledge Acquisition and Processing (fig. 1):

- the Sub-model of Knowledge Acquisition,
- the Sub-model of Knowledge Processing.
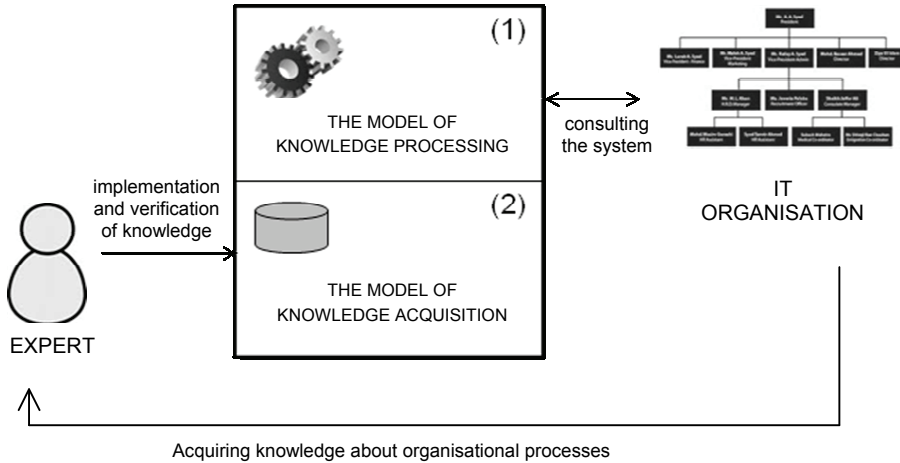
Fig. 1. The general Model of Knowledge Acquisition and Processing [2]

2.1. THE SUB-MODEL OF KNOWLEDGE ACQUISITION

Knowledge in expert systems is usually represented by facts and rules. In technical systems, a complete model of knowledge is required in which the base of rules includes a description of all possible states arising from the number of combinations of input variables. Physically, there are usually two types of structure – the base of facts and the base of rules.

In social systems, such a division of knowledge proves to be too simple. The knowledge of rules may come from different sources, which leads to potential inconsistencies. It may transpire that it is partly uncertain (an expert can express their doubts in certain aspects). According to the criteria used in technical systems, such knowledge should be rejected. In management, however, it may prove to be a valuable reference for a policymaker, therefore, it should be retained.

Nevertheless, it is important to appropriately differentiate between knowledge of different "ranks". Assuming that both types of knowledge will be used, one in the desired form (certain, full), as well as the imperfect one, priorities must be established for both of them. The machine for drawing conclusions should always make use of the certain knowledge first. To determine such a chronology, it is necessary to develop an appropriate logical division of knowledge. It is suggested that several separate databases should be established, as shown in figure 2.
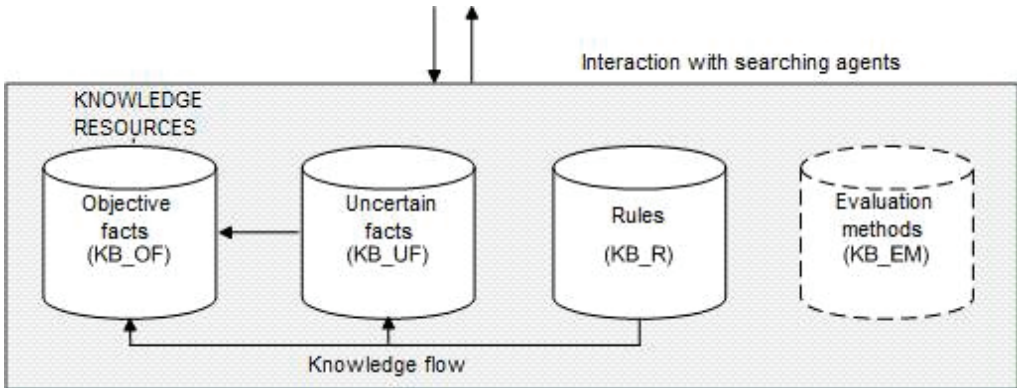
Fig. 2. The structure of knowledge bases in the suggested model [3]

In addition to the knowledge bases, due to its nature (facts, rules), the base of Evaluation Methods should also be taken into consideration. It has been assumed that the assessment method does not contain a typical knowledge base equipped with a set of rules or facts. It has also been assumed that it contains complete models of knowledge processing, within which inference can be carried out. This construction of the knowledge base contains subjective knowledge about evaluation methods (with compelling observations and measurements). Furthermore, it has been assumed that the knowledge accumulated here is a consequence of the different experiences of experts and their conclusions. The use of various assessment methods is described later in the work.
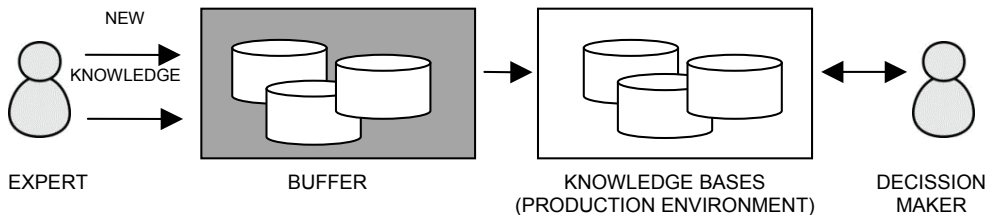
Fig. 3. The concept of knowledge-buffer operation [3]

The knowledge gained in organizations is usually imperfect (incomplete, uncertain, vague). The question arises whether this situation is due to the nature of the organization or perhaps it results from the bad selection of experts? Perhaps knowledge on the same subject from another source would be without drawbacks. There-

fore, the question about the quality of knowledge turns into a question about the confidence given to a developed model. Should the currently acquired knowledge reach the production bases directly and thus give rise to the implemented inference? It seems that the potential risk associated with bad decisions is too high. The model should establish appropriate mechanisms to verify the acquired knowledge. To minimize the risk of putting "junk" in the knowledge base, a mechanism, a so-called *knowledge buffer*, has been developed (Fig. 3). The initially gathered knowledge is stored in the buffer for verification.

2.2. THE SUB-MODEL OF KNOWLEDGE PROCESSING

The Sub-model of Knowledge Processing offers the specific design of an inference mechanism, in which varied inference mechanisms will be applied. It has also been assumed that the model of knowledge processing should be used for typical situations in the operation of any organization: evaluation and streamlining of operational processes, evaluation of the organization's maturity, etc. Experience shows that such situations are characterized by [4]:

- the uncertainty of knowledge,
- the lack of precision of the acquired knowledge,
- its incomplete probability and incompleteness.

For this reason, first of all, it is assumed that the expert should consciously identify (on an accepted point scale) their level of knowledge for each statement. Certainty factors should be introduced for such situations. It has been assumed, in the suggested model, that such an approach focuses on a base of facts. In the second case, it is assumed that the expert is able to describe the complete set of rules specifying the state of domain knowledge. However, it has been established that the expert has no option (and often need) to note them in a sharp (quantified) way. The model can only be described in a linguistic form (in which, by describing, the expert agrees to lesser precision). The use of inference mechanisms based on fuzzy logic has also been assumed. In the case of incomplete probability and the incompleteness of knowledge, it has been assumed that the knowledge has an incremental character. Initially, it is incomplete and thus the application process should consider the level of probability of the posed hypotheses, as the level increases over time as new data is added (when hypotheses are made more probable by facts).

Given the potential problems with gaining knowledge in the area of management, the construction of an inference mechanism based on a hybrid inference algorithm has also been adopted. In this case, the hybrid character is understood as using more than one of the aforementioned methods of inference for each application process.

3. THE VERIFICATION OF THE CONCEPT

3.1. THE VERIFICATION OF DIFFERENT ASSESSMENT METHODS

For the purpose of the model verification process, two IT organizations were selected. The choice resulted from the belief that development processes are the overriding processes determining the essence of their functioning.

The verification was carried out by implementing inference using various assessment methods. During a series of experiments, the functioning of the concept was examined, including:

- simple evaluation models based on fuzzy systems
- more advanced models of self-organizing,
- self-adjustable models.
- neural networks.

These experiments were designed to verify the model's behaviour in different types of decision problems. The identification and elimination of existing problems led to modifications of the model which would allow the main goal of the research to be carried out in the best way, namely, to provide support for the quantitative assessment of the development of IT organizations.

3.2. THE PROCESS OF THE DEVELOPMENT OF AN IT ORGANIZATION DRIVEN BY A MODEL

The experiments described above led to verification of Model of Knowledge Acquisition and Processing. This caused some changes and adjustments, mostly in the structure of the model. After that, authors decided to use modified model as intended. It was used for the needs of an organizational development in real organizations. The process was called "model-driven development".

The authors chose two companies with different characteristics:

- Internet Services Provider – this was the owner of one of the biggest polish web portals that has many different IT services in their offer (e.g. www hosting, email accounts).
- IT department in big company from energy sector – this was good example of IT Support Organization which provides IT services and products either for its parent company or for external customers.

The process of organizational self-development was supported by sub-models of knowledge acquisition and knowledge processing (MKA and MKP) presented before. COBIT was used as the assessment method for the main purpose – to measure the level of organizational processes.

COBIT was used to assess the organizational processes on two levels:
- the assessment of maturity based on the COBIT control objectives in the form of competence questions,
- the classification of control processes in terms of those which have a powerful impact on their level of maturity.

The experiment was divided into two stages.
- During phase 1 a complete COBIT audit was conducted in the studied IT organization and, as a result, processes with the lowest level of maturity were classified. They were identified, first of all, to improve the functioning of the organization.
- During phase 2 – after several months – the functioning of the organization was assessed again to see how the changes suggested on the basis of the COBIT model were implemented into the functioning of the organization [5].

Table 1. A repeated COBIT test in an examined organization – results

Measure	Value – study made in 2009	Value – study made in 2010
The number of tested COBIT processes	184	84 (only the processes that obtained weaker ratings in 2009 were measured)
The number of competence questions to be assessed	262	112 (the competence questions evaluated referred only to the processes which obtained weaker ratings in 2009)
The number of competence questions (the processes evaluated higher in the repeated test, in relation to the first test)	47 questions (38 processes)	
The number of competence questions (processes) with a lower assessment in a repeated test, in relation to the first test	0 (0)	
The number of competence questions (processes) with identical assessment in a repeated test, in relation to the first test	65 questions (53 processes)	

Both assessments were performed mostly basing on questionnaires and interviews with people (employees) in each IT company responsible for managing processes and self-improvement. They were asked to answer set of questions regarding every single process that can be identified in IT organization. In table 1 the most important results of this research were gathered and presented as a comparison 2009 vs. 2010 assessments.

The research shows a positive trend in the levels of process maturity, all the process domains, and hence – the entire organization. The study, which was conducted in the organization of an Internet service provider, after 12 months, shows that as many as 47 competence questions (referring to 38 processes) out of the 112 taken into account (in the buffer) were rated higher. It can be observed that each of the four domains noted an increase in the level of maturity and no investigated process was rated lower than previously.

Conducted in this way (namely, in two stages) the study gave an additional opportunity to show the dynamics of the IT organization's development. Thus, by examining the processes in a similar manner, at regular intervals, there could be attempts to identify both the change trends (to see if the growth is permanent or rapid) and to identify both the processes and all the process areas which increase their level of maturity the slowest.

4. SUMMARY

The work presents the possibilities of developing and building prognostic models that would be able to describe the development of the organization of information with the use of intelligent mechanisms. The authors developed a Model of Knowledge Acquisition and Processing, which allows the managing whole knowledge regarding maturity processes in given organization. Such tool provides opportunities to organize the knowledge and use it consciously for setting quantitative targets for development.

As the development organization has been identified here with its maturity, it was decided to adopt the COBIT standard, which became the main assessment method in this solution.

In order to examine the validity of this approach, a number of experiments were conducted that verified both the model and approach adopted. The model was finally implemented in two real IT organizations, where its usefulness has been demonstrated – positive changes in the maturity processes were observed.

During next steps in their research the authors plan to adopt and implement this concept in organizations from different industry, not only IT.

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ACADEMIC TEACHERS EVALUATION SYSTEM BASED ON SECURE VOTING

In this chapter we present a concept and a prototype of a web-based system for an evaluation of academic teachers performed by their students. The system is based on a secure voting scheme involving distributed and independent units responsible for authentication, gathering of votes and presentation of results. The secure voting scheme makes it possible to separate the authentication data from vote in order to improve the credibility of the whole process. In such scheme the voter can be sure that no one can connect his vote (judgment) with his name. Voting questionnaire consists of several criteria including overall rating as well as some more detailed opinions. The rating can be also weighted by the student's assessments in order to make it more objective.

This chapter presents a scheme of the voting process as well as the architecture of a system and a short discussion of possible practical implementation.

1. INTRODUCTION

1.1. THE IDEA OF TEACHERS' EVALUATION

The ideal process of teaching at every stage of education consists of four main elements associated with each other and connected in a looping manner: teaching itself (students by teachers), testing the effects (knowledge or skills of students), evaluating the teachers by students, changing the methodic of teaching (if needed). It is obvious that effective teaching requires a proper feedback to improve means and methods [3]. This is a continuous process which involves different formal and informal techniques.

Since such procedure is a standard tool for measuring the quality of teaching, there are many universities that provide processes which enable teachers to officially obtain

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feedback from their students on their teaching for use as evidence in academic probation and academic promotion applications. The results of such evaluation remain confidential to the teacher being evaluated, and are only visible for the principals (i.e. dean, rector, etc.)

Teacher evaluation is provided by the authorities of the university and allows the teacher to identify strengths as well as areas where improvement is needed. Teacher evaluation results, in the form of an evaluation summary report, can be used as evidence in professional promotion. These judgments may be tied to decisions of continued employment or change in wages. The literature review shows also that teachers who were rated as ineffective actually produced students of lower academic ability [1].

The whole procedure should not use just one observation as an evaluation tool to judge the sum total of the teachers' performance, principals should use it as a formative one to help improve teacher practice. This can only be done if the observations are conducted throughout the year (or years) on a regular basis [8].

It is also essential that both students and staff have confidence in the security and integrity of the evaluation process. Results are confidential to the teacher and are only provided to the principals. Student responses are always anonymous.

There are many techniques of evaluating academic teachers, most of them are employing traditional, paper form, where each student is requested to fill out special questionnaire containing a set of questions related to the teacher's abilities [14]. Such questionnaire is then sent to the proper office which performs the analysis and presents the results to the principal. Unfortunately, such scheme is only applicable to small schools, where the number of students and teachers is limited. In much larger environment, such as a typical university with many faculties, with academic teachers associated with different departments, having lectures at different faculties, this kind of evaluation is very difficult to be performed. Hence, it creates a possibility to introduce an electronic form of evaluation, with on-line questionnaires and real-time processing of the results, featuring in-depth analysis of the performance of certain teachers over time.

1.2. EVALUATION CRITERIA

There are many indicators that can be measured in order to asses the quality of teaching and the teacher himself. They can be divided into several categories, related to the various aspects of the problem. The following indicators can be taken as a basis for the evaluation of lecture and tutorial classes [14]:

1. This teacher is well prepared for the subject.
2. This teacher communicates the subject matter clearly.
3. This teacher organizes the subject matter well.
4. This teacher presents an appropriate material for the time available.
5. This teacher stimulates me to think about the subject.

6. This teacher appears to be interested in assisting me to learn.
7. This teacher is helpful in responding to questions or problems.
8. Because of this teacher I have felt enthusiastic about studying this subject.

There are also questions related to the aspects of teaching associated with team work and interpersonal abilities:

9. This teacher encouraged me to interact with other students.
10. This teacher organized learning activities for effective use of time.
11. This teacher stimulates the discussion and collaborative activities.
12. Assignments marked by this teacher have been returned within a reasonable time frame.
13. Feedback on assignments marked by this teacher has been helpful.
14. This teacher has been available to discuss problems and questions relating to my assignments or examinations.

Finally, the principals can ask questions about the quality of teaching during practical classes:

15. This teacher provided sufficient opportunities for me to practice my skills.
16. This teacher encouraged me to take responsibility for my skills development.
17. This teacher had appropriate expectations of my practical skills.
18. This teacher provided helpful feedback on my skills.
19. I could ask this teacher if I was having problems in a particular area.
20. Activities/tasks undertaken in this teacher's practical classes are worthwhile learning experiences.
21. This teacher took adequate precautions to ensure the safety of students and others in practical classes.

The "raw" data obtained by the collecting of above questionnaire are not sufficient to perform the proper analysis of the quality of teaching. In most cases the composition of the class undertaking the evaluation may have an impact on the result: undergraduate classes generally rate lower than postgraduate; first year classes generally rate lower than later years. Other factors that may effect ratings include: the discipline or area of study; the type of teaching evaluated [15]. Hence it is necessary to introduce the weights to the process of aggregation of results.

2. CONCEPT OF A VOTING SYSTEM

2.1. SECURE VOTING PRINCIPLES

Initial assumptions are related not only to the general process of evaluation at large but also a process of secure voting in question. A teacher evaluation can be requested by the teacher to be evaluated, a group of students and of course a principal. A teacher can be evaluated for one teaching role in any single subject, during a session.

The problem of evaluation, not only in the case of academic teachers, which provides reliable results, is similar to the problem of electronic voting. Scientists have been trying to improve the traditional voting systems using different methods and techniques for years. Edison's "Electric Vote-Recorder", his first patented invention for use by legislative bodies such as Congress, was presented in 1869 and may be treated as a beginning of modern electric and electronic support of voting [12]. General term *e-voting* (electronic voting) covers many completely different solutions. There is only one common denominator – some kind of electronic device is used to assist the voting process. Today there are two main trends of e-voting: electronically supported voting procedures at polling places and remote electronic voting [7]. The problem of remote voting, or more precisely an internet voting is conceptually similar to the analyzed in this chapter problem of teachers' evaluation. Many cryptographic voting protocols were proposed in this area, including several cryptographic techniques based on blind signatures [4, 9, 10] or mix-nets [2, 11]. Remote voting systems are generally considered as potentially dangerous because of weakness of the equipment on the voter's side (e.g. machines can be infected with malware). For the purpose of remote evaluation, where security is not so critical, the most promising voting protocols seem to be those that use PKI (Public Key Infrastructure) [5,6]. They usually do not require to use any additional dedicated hardware. The starting point for the proposed evaluation system was PKI based protocol with Two Central Facilities [12].

A computer system, which collects questionnaires in the electronic environment must therefore meet several objectives, which are compatible with the assumptions developed for all voting systems. In the case of academic evaluation system discussed in this chapter, we should meet the following requirements.

1. Surveys can be filled only by authorized user (problem of identification and authentication).
2. Single user can fill out and send only one survey (problem of multiple voting).
3. Nobody should be able to link individual questionnaires to specific users (problem of anonymity).
4. Nobody should be able to change the contents of completed and sent questionnaires without detection (problem of integrity and authenticity).
5. Users who sent completed questionnaire should be able to check if their votes have been taken into consideration (problem of verifiability).
6. The evaluation can be performed in the limited period of time, associated with the end of the semester or year.

Additionally, from a practical point of view, we should add one more assumption:

7. Users can perform the entire process using a computer connected to the Internet without having physical contact with the units responsible for evaluation.

It is important that above assumptions are largely incompatible with each other, e.g. anonymity and authentication. Currently, the existing voting systems theoretically allow for the fulfillment of the first six conditions. Usually it is associated with the

transfer of certain operations to trusted individuals and/or introduction of certain physical elements to the voting process.

2.2. SYSTEM ARCHITECTURE

In comparison to electronic voting in this electronic evaluation system there are several interesting issues. One of the most important is the need to take into account the grades obtained by students as weights to calculate the final assessment of the teacher. It is introduced as an effect of psychological observations showing that a student judges a teacher according to his own mark. It means that a teacher often gets better grades from students who got better marks, and on the other hand, he is judged lower by the students who got worse marks.

Another important aspect is the problem of anonymity. In the case of simple voting, it is enough to remove voter ID from the vote (it may be done by a trusted entity), however in this case, the questionnaires, even after ID removal, can be analyzed and one can perform some sort of reasoning about people voting. It comes from the fact that a survey contains students' marks from a specific course ("pattern" of ratings, which with a fairly small population of students that are participating in a course, can allow to guess their identity). Hence, it is necessary to remove additional marks, yet considering them as weights before the survey goes back to the main evaluation body. This task has been delegated to another trusted entity. Possible fraud at this point requires the cooperation of at least two parties involved in the protocol, which in practice is difficult.

Let us consider developed voting system as a structure consisting of universities divided into faculties (see Fig. 1). There are local entities Q, one per each faculty, responsible for whole evaluation process. Students U (voting users) belong to individual faculties. There are two global trusted entities outside the structures of universities: A (trusted entity responsible for the *anonymity* preservation, *ensuring* that a *vote* cannot be associated to the student) and V (trusted entity precalculating the single vote). Some information will be made public to allow the correct execution of the audit of the process. Symbolic public side is marked as P. For the purposes of this work we present the evaluation protocol for a single faculty.

Additionally, it was assumed that each party involved in the protocol (Q, A, V and U) has two pairs of asymmetric keys, one key pair for encryption and another one for digital signing. Developed protocol is presented in the schematic form in Fig. 2.

In this chapter we chose following convention of encrypting and signing functions:

- $e_X(a, b, c)$ – encrypting of concatenation of a, b and c values with public key of X entity,
- $s_X(a, b, c)$ – signing of concatenation of a, b and c values with private key of X entity.
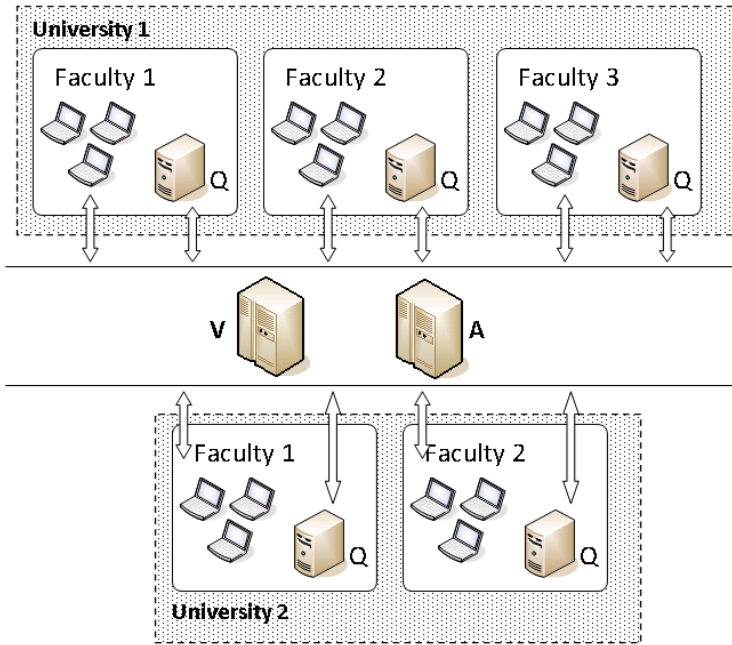
Fig. 1. A scheme of voting system structure
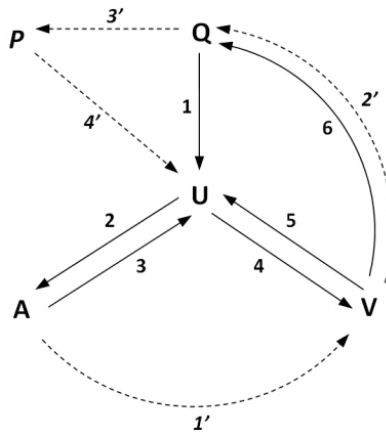
Fig. 2. A scheme of voting protocol

Entity Q prepares a course survey (questionnaire) $c = \{l_1, l_2, ..., i_c\}$, consisting of surveys of specific form of classes (lectures, tutorial, practical classes) taking place in the course l_1, l_2, ... and the course identifier i_c. The questionnaires are generated for each student individually. Each survey of specific form of classes $l = \{q_1, q_2, ..., i_l, i_t, g\}$ contains questions q_1, q_2, ..., form identifier i_l, teacher identifier i_t, and grade g ob-

tained by the student after this form of classes. In addition, Q prepares a token $t = \{p, i_U, n_Q\}$, where p is the period of survey validity, i_U is a student identifier and n_Q is a random value. The signed and encrypted token will be sent indirectly (via student U) to the entity A, the signed and encrypted course survey directly to the student U.

$$Q : c = \{l_1, l_2, ..., i_c\}, \quad t = \{p, i_U, n_Q\}, \tag{1}$$

1.
$$Q \rightarrow U : \{e_A(t, s_Q(t)), e_U(c, s_Q(c))\}. \tag{2}$$

The student U decrypts survey c and verifies its authenticity. Then he generates a random value n_U and signs the concatenation of this value with his own identifier. Signed information is encrypted and passed along with token (received from Q) to the entity A:

$$U : c, i_U, n_U, \tag{3}$$

2.
$$Q \rightarrow A : \{e_A(t, s_Q(t)), e_A(n_U, s_Q(n_U, i_U))\}. \tag{4}$$

The entity A decrypts token t and verifies its authenticity. The student identifier i_U received in this way from Q is used to verification of the identity of the student (students identifier signed by his private key was also received). After successful authentication of the student the entity A rebuilds token t, replacing student identifier i_U by random value drawn by the student. The newly created token t' is signed, encrypted for entity V only and sent back to the student U:

$$A : p, i_U, n_Q, n_U, t' = \{p, n_U, n_Q\}, \tag{5}$$

3.
$$A \rightarrow U : \{e_V(t', s_A(t'))\}. \tag{6}$$

The student U completes a survey (it is denoted as c'), signs it, encrypts, and along with the new token t' sends to the entity V. The blank questionnaire c, signed earlier by Q, is attached to the completed questionnaire c'. This allows the entity V to formally validate questionnaire:

$$U : c, i_U, n_U, c' = \{l'_1, l'_2, ..., i_c\}, \tag{7}$$

where $l' = \{a_1, a_2, ..., i_l, i_t, g\}$ and $a_1, a_2, ...$ are answers to questions $q_1, q_2, ...$

4.
$$U \rightarrow V : \{e_V(t', s_A(t')), e_V(c, s_Q(c), c', s_U(c'))\}. \tag{8}$$

The entity V decrypts blank questionnaire c and completed questionnaire c' and verifies its authenticity. Then V validates completed questionnaire using blank questionnaire for this purpose. In the next step V process the completed survey removing student grades (obtained on particular classes). Grades are used as weights for final evaluation of teachers responsible for the specific form of classes. The removal of

grades obtained by the student reduces the chance of determining by V, which student has fulfilled a given questionnaire. The entity V sends back an acknowledgment to the student U:

$$V : p, i_U, n_Q, n_U, c', c'' = \{l''_1, l''_2, ..., i_c\}, \tag{9}$$

where $l'' = \{a'_1, a'_2, ..., i_l, i_t\}$ and $a'_1, a'_2, ...$ are answers to questions $q_1, q_2, ...$ (after taking into account the grade g):

5. $$V \rightarrow U : \{e_U(s_V(n_U, c''))\}. \tag{10}$$

Completed and processed survey no longer includes grades received by the student. The entity V signs and encrypts this precalculated survey along with the random value n_U. These data are sent then to main evaluating entity:

6. $$V \rightarrow Q : \{e_Q(n_U, c', s_V(n_U, c''))\}. \tag{11}$$

The entity Q decrypts and verifies the received pair: random value N_U generated by the student and student survey c'' processed by V. The survey can be further used by Q for the preparation of the evaluation of teachers responsible for that course.

Outside of the main protocol some extra information are exchanged. The exchange starts at the end of the period in which students can complete survey related to specific course. In this moment entity A collects all values n_Q. The created set N_Q consists of all students who have decided to begin the process of the evaluation of teachers responsible for this course. The set is signed, encrypted and then sent then to the entity V:

1'. $$A \rightarrow V : \{e_V(N_Q, s_A(N_Q))\}. \tag{12}$$

The entity V may use the received set to verify which students continued the evaluation process. If the student did not complete survey then his number n_Q is removed from the set (for example when student broke protocol before transmitting the data to the V entity or the questionnaire was incorrectly filled). The newly created set N'_Q, is signed and sent further to the entity Q:

2'. $$V \rightarrow Q : \{e_Q(N'_Q, s_V(N'_Q))\}. \tag{13}$$

The entity Q decrypts and verifies received set N'_Q. In this moment list of all students who finished evaluation process is available to Q, but a connection between student and his questionnaire stays unknown. The entity Q collects all pairs $\{n_U, c'\}$ constituting a set C''. This set is signed and published along with the set N'_Q. This publicly available information may be used by participants for the verification of correctness of the entire process:

$$3'. \qquad\qquad Q \to P : \{N'_Q, [(s_Q(N)]'_Q), C'', s_Q(C'')\}. \qquad\qquad (14)$$

Since presented protocol involves several independent units, interacting with each other over the electronic communication channel, it can be efficiently implemented in the web environment. Such implementation can be especially advantageous in the Java Enterprise Edition, which features originally cryptographic libraries (PKI infrastructure), communication interface (i.e. SOAP), server-side functions (JSP, servlets), as well as graphical user interface development tools.

3. SUMMARY

In this chapter we discussed a problem of electronic voting strategy applied to the procedure of evaluating academic teachers. Voting questionnaire consists of several elements including overall rating of a teacher as well as some more detailed opinions. The rating is weighted by the student's marks in order to make it more objective. Presented concept of such system is based on a secure voting scheme involving distributed and independent units responsible for authentication, gathering of votes and presentation of results. Employed secure voting scheme makes it possible to separate the identification data from voting results in order to improve the credibility of the whole process. In such scheme the voter can be sure that no one can connect his vote (judgment) with his name.

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INFLUENCE OF ECONOMIC SECTOR
ON PREDICTABILITY OF FINANCIAL INDICATORS
IN DISCRIMINANT ANALYSIS

Running a business is burdened with risks that lead to business failure. Inadequate or lack of decisions at critical moments affect survival of a company.

Appropriate development of research and ongoing monitoring, in particular financial results, by means of specialized tools may allow a company to avoid bankruptcy.

Benefits of advance signals related to financial issues may allow a company to identify signs of a deteriorating situation of a business and introduce remedial action that can save a company from bankruptcy. Frequently, on a basis of financial indicators are created models of predictability in respect to bankruptcy of companies. Calculation of financial indicators based on financial statements for a company may lead to insufficient predictability, especially when abstracted from a comparison with a sector of economic activity. This material offers a solution to select indicators of high value in terms of predicting bankruptcy of enterprises with regard to a specific sectors in which companies operates.

1. INTRODUCTION

Insolvency or bankruptcy are concepts inherent in the functioning of a market economy, prompting many researchers to conduct various analysis of causes of bankruptcy. Causes of bankruptcy can vary, ranging from surplus stocks, bad debts, and ending on inadequate company debt.

In a process of exploration and evaluation of causes of bankruptcy are often subjected to analysis of all businesses regardless of type of activity. Evaluation conducted in this way can lead to wrong conclusions. Therefore, it is vital to notice that companies in sector of production will normally have large stock level. Whereas,

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companies in service sector will not have such level of stock. However, a level of stock is not the only indicator differentiating companies from different industries. Mentioned, simple example justifies how valuable is correct selection of indicators predicting bankruptcy of companies, especially those including specification of a sector in which a company operates.

Financial statements for each company are done identically – using the same rules.

However, the value of different components included in these statements are different – depending from the sector. Evaluation of companies oriented on sector, through calculation of chosen financial indicators, what this work constitutes, can contribute to gaining a deeper understanding of relationships, that allow a better selection of indicators used in discriminant analysis.

This work focuses on selection of financial indicators, on which for example discriminant analysis is based on, to build models of bankruptcy predictions for companies with consideration of sector in which a company operates.

Conducted research that basically came down to calculating values of particular financial indicators was based on simplified financial reports of bankrupt companies, which was taken from Emerging Markets Information Service (EMIS).

Without wide charactaristics of used database we can quickly see, that it is the best source of information regarding upcoming markets. In this database one can find the most important information regarding markets and companies.

Using financial information from EMIS database, this research focused on banckrupt companies, however only the last three year sample was taken under consideration and the selection of evaluated sample was conducted in respect of data completeness.

Companies selected to further analysis were assigned to economic sectors, in which these companies operated. Selected sectors included only those in which there was the highest number of bankrupt companies within analyzed period.

The sectors were limited to three, numbered 1 to 3:
1. all non-industrial production,
2. industrial production,
3. retail sales.

The first sector had 41 bankrupt companies, second sector had 61 and retail sector concluded 42. For all selected businesses, were calculated chosen financial indicators mostly used in discriminant analysis, whose selection was described in further part of this work. Next, calculated indicators were rated in terms of particular sector and compared between sectors. Also, an effort was put to evaluate relationship of particular indicators with the ability to predict company's bankruptcy.

2. FINANCIAL INDICATORS IN DISCRIMINANT ANALYSIS

Discriminant models are used among others, as a synthetic measurement of evaluation to state whether company threats bankruptcy or not. In other words, these models are meant to recognize early dangers regarding effectiveness of business activity. With evaluation of company's financial condition, such systems of early warning can be a useful tool for company's bankruptcy prediction. But it is also vital to notice, that they should not be the only analytical tool, on basis of which, an evaluation of company's financial situation can be conducted.

Discriminant analysis uses indication analysis and formalized tools of conclusion (methods of statistical analysis). When building a synthetic indicator (aggregative), we base it around empirical data. The indicator itself is made up of many different partial indicators, to which are assigned so called weight factors (defining importance of each partial indicator). Usage of discriminant analysis leads to reduction of multidimensional space of variables to one synthetic and aggregative variable.

Methods of discriminant analysis have a purpose, as its name suggests, to classify evaluated units (companies) by classes, minimum two [2,5]. Evaluation is done by means of variables (indicators), which in the best way allow to divide assembly of given classes.

There were 47 discriminant models that were evaluated for the purpose of this work [1, 4, 7]. Research of these models clearly concluded that, in structures of many models is used standard assembly of financial indicators, which can lead to a conclusion, that selection of indicators used for predictability of company's bankruptcy is under subjective evaluation of authors of evaluated models. A purpose of verification of these insights, and also as the main purpose of this work, was to conduct a deeper analysis of chosen financial indicators. At first, were chosen most frequently used financial indicators in evaluated discriminant models – in total 13. However, due to a limited boundaries of this work, there were presented only three financial indicators from different group, what is presented in Table 1.

Table 1. Chosen financial indicators

Group of indicators/Type of financial indicator
Indicator for dept service
Indicator for commitments coverage by surplus finances
Indicators for liquidity
Indicator for current current liquidity
Indicators for turnover
Indicator for share of claims in income from sales

Selected financial indicators were most popular in discriminant analysis and were analyzed from an angle of predictability, which means ability of indicators to predict company's bankruptcy, including sector, in which company operates. For the evaluation were chosen mentioned simplified financial reports for bankrupted companies taken from EMIS database. On a basis of gathered financial reports of earlier selected companies, there was a calculation of financial indicators for one, two and three years before bankruptcy. Unfortunately, financial reports of bankrupt companies available through EMIS database were incomplete, and thus in effect the sample of calculated indicators depending on the number of years before the bankruptcy was different than the number of analyzed companies. The performance of calculated indicators were presented as histograms and then analyzed.

3. SECTOR ANALYSIS OF FINANCIAL INDICATORS
USED IN DISCRIMINANT ANALYSIS

Selected financial indicators were examined through similar diagram. In the beginning was calculated the value of indicators in the consecutive three years that were taken under consideration. In parallel, three ranges of limit values of a particular indicator, adequate for its specificity were set out. Then, separately for each sector, as well as for subsequent years, counted values of indicators in respect of multiple occurrence and the results were showed as percentages. The results are shown graphically in the form of histograms – separately for each sector.

Conducted evaluations were described below with referrals to the individual indicators. This made the ground for intervals to extract maximum value of a particular indicator.

Indicator of current liquidity is a relationship of current assets to current liabilities, this ratio can determine whether liabilities are covered by short-term assets of the business. In literature, reference interval for this indicator is considered to be: 1.2–2.0 [6]. When the indicator exceeds 2.0 then business is considered to have an excess of liquidity, which means, it may have a large amount of cash in hand or in bank accounts, but may also have large stocks or high level of receivables.

However, when the rate is less than 1.2, then there is lack of liquidity. Unfortunately, adopted standards for this indicator are vague and may wrongly assess the organization's ability to repay short-term liabilities.

In a specific case, it is also possible that within the range of 1.2–2.0 as well as 1.5–2.0 lack of liquidity and excess liquidity occurred. Therefore, it is vital to compare the value of this indicator by sector [3].

For the current liquidity ratio three compartments were found:
- <0,6 – very bad level of indicator,

- 0,6–1,2 – lack of liquidity,
- >1,2 – by literature: satisfying situation.

In this analysis was not considered an interval, which means the excess of liquidity, which stems from the fact that the occurrence of such companies in the sample of companies was unlikely.

Obtained results are presented in graphical form, separately for each of the sectors, which is showed in histograms below.

Histogram 1. Percentage values of indicators
for current liquidity separately for each sector

Percentage values of indicator for current liquidity (1)

one year prior to bankruptcy | two years prior to bankruptcy | three years prior to bankruptcy

.<0,6 : 73,33% / 34,38% / 27,03%
0,60-1,2 : 20,00% / 37,50% / 40,54%
>1,2 : 6,67% / 28,13% / 32,43%

Percentage values of indicator for current liquidity (2)

one year prior to bankruptcy | two years prior to bankruptcy | three years prior to bankruptcy

.<0,6 : 50,00% / 0,00% / 0,00%
0,60-1,2 : 36,36% / 44,64% / 50,00%
>1,2 : 13,64% / 55,36% / 50,00%

Percentage values of indicator for current liquidity (3)

Legend: one year prior to bankruptcy ■ two years prior to bankruptcy □ three years prior to bankruptcy

The above data for sector 1 (all non-industrial production) clearly indicate occurrence of a relationship between the level of liquidity and bankruptcy.

A year before the bankruptcy percentage of companies with poor liquidity was the highest, while the three years before bankruptcy, this structure was the opposite.

Also for the sector 2 (industrial production) occurs the same relationship between the level of liquidity and bankruptcy, although not as clear.

However, for sector 3 (retail sales) such relationship does not exist.

Another investigated indicator was a rate of covered debts by financial surplus, also known as an indicator of creditworthiness. The value of this indicator specifies the coverage ratio of total liabilities using the financial surplus generated by the company. The trend is considered favorable when there is a growth of this indicator, because it means: reduced time needed to repay company's commitments [8].

This indicator's values of commitments coverage by financial surplus for all sectors shows a decline of a trend in indicator during the three years prior to bankruptcy. So we can say that, this indicator has predictive properties in relation to each targeted sector.

Another evaluated indicator was an **indicator for participation rate in sales revenue.** This indicator represents the opposite of an indicator for an average collection period.

This indicator allows to specify how many grosz receivables falls on one złoty from sales during considered period. Favorable trend is considered to be when this indicator decreases in value. However, the value of this indicator should be compared to the industry, in which examined company operates [9].

Histogram 2. Percentage values of an indicator
for commitments coverage by company's financial surplus
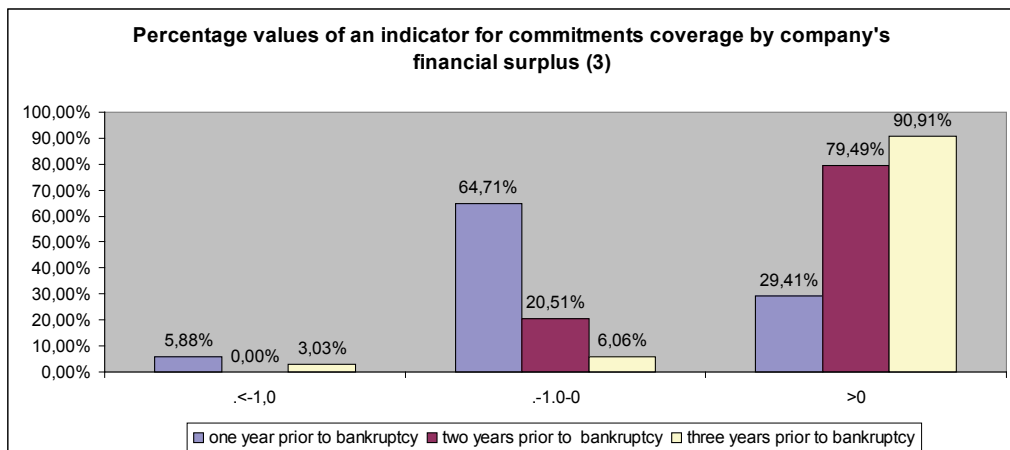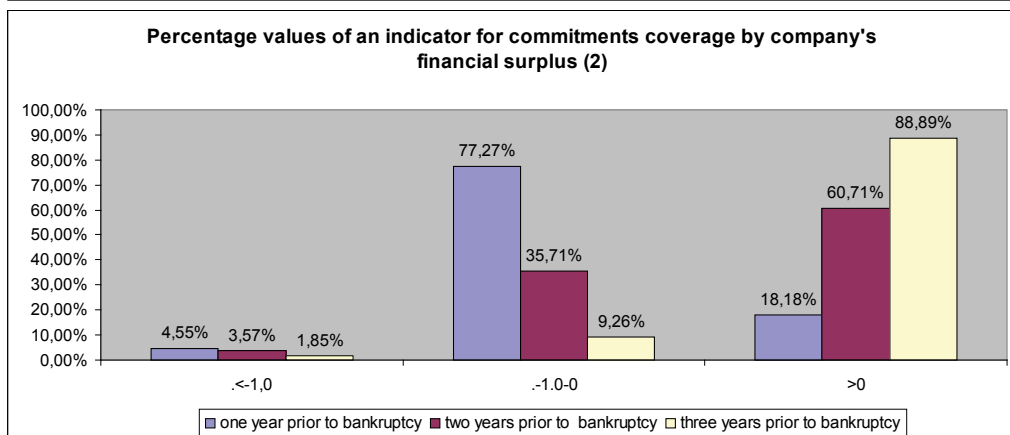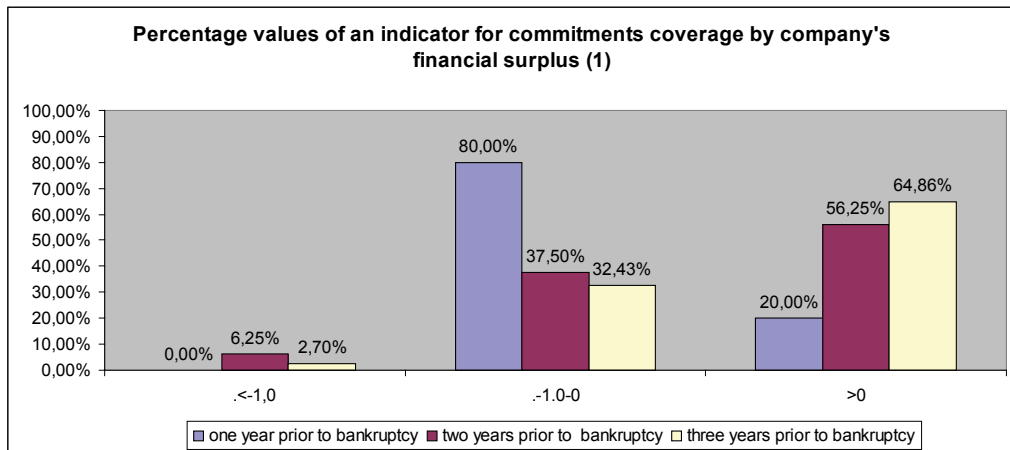
Histogram 3. Percentage values of an indicator for participation rate in sales revenu.
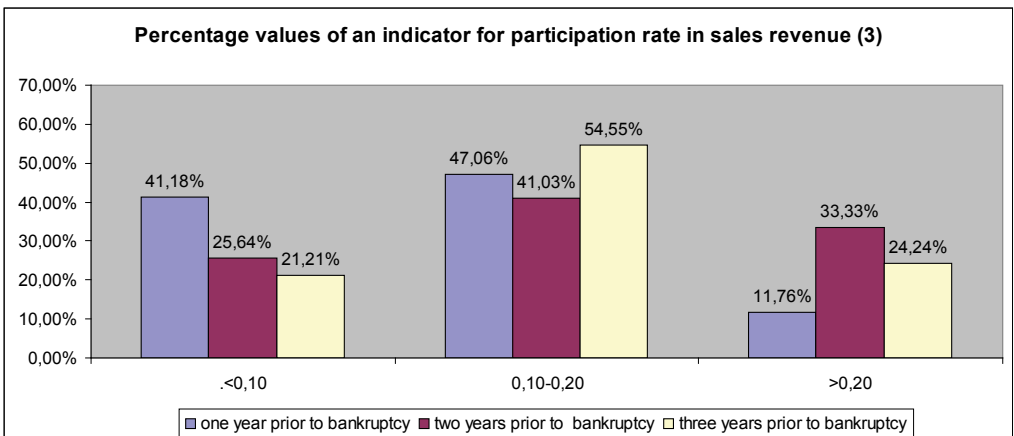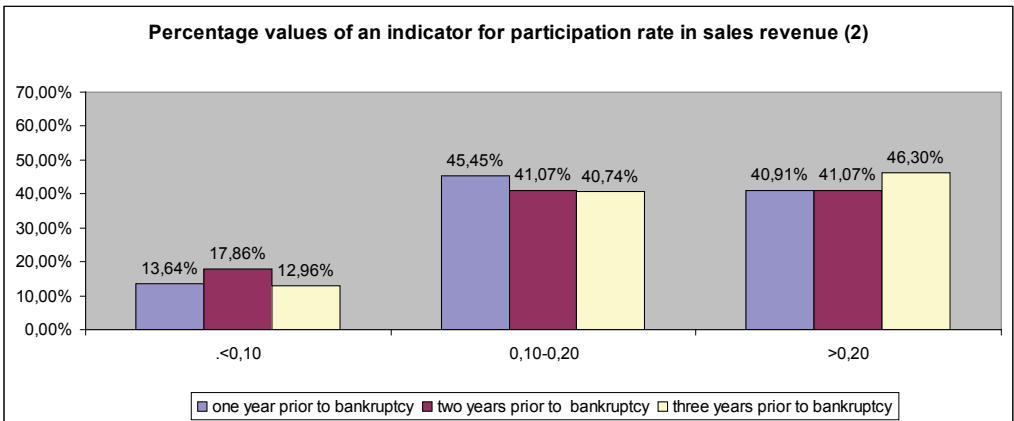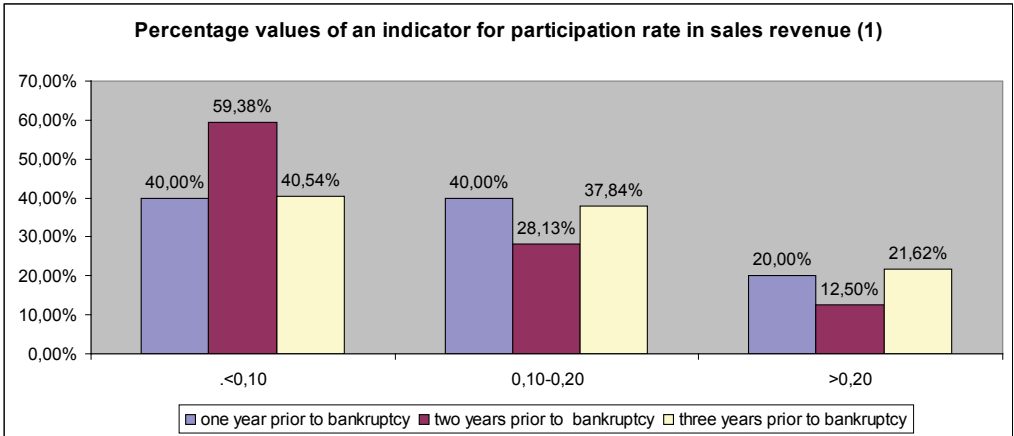
Changes in examined indicator during the period prior to bankruptcy for companies from the sector 1, 2 show no clear trend.

However, changes in examined indicator for sector 3 (retail sales) show a slight trend decline in the value of assessed indicator in the three years prior to bankruptcy.

This may mean a negative correlation of indicator with aggregated variable. It is recommended to keep values of this indicator as low as possible.

This also indicates a lack of predictability of this indicator for companies in sector 1.2, however it indeed has the predictive ability for companies in the third sector.

4. SUMMARY

There were 47 integrated models analyzed in carried out evaluations. Based on the analysis of these models, there were 13 indicators selected that most frequently occurred in presented models.

Selected indicators came from different groups: four debt indicators, three indicators for each: liquidity, profitability and turnover. This work illustrated the analysis of three selected indicators.

Selected indicators were then analyzed from an angle of their ability to predict bankruptcy of a company.

For the test period of three years prior to bankruptcy of selected companies, there was an effort to gather company's financial statements, in order to calculate certain financial indicators.

Based on the undertaken analysis of sector indicators, were selected indicators with predictive characteristics. Predictive capability of indicators is based on the observed trend of changes of the indicator's value, which then allow assessment of company's condition.

By means of sector analysis, it is possible to notice a correlation between the ability of indicators to predict bankruptcy and a specific sector. Among the indicators presented, the current liquidity has prognostic features to sectors of wildly understood production. However, this indicator does not have the foresight for companies in the retail sector. In turn, the indicator for commitments coverage with the financial surplus is characterized with predictability for all mentioned sectors. However, the indicator for participation rate in sales revenue holds that ability only for companies in the retail sector.

The results indicate the need to build adequate discriminant models to the sector concerned. It seems that the creation of universal models may be wrong.

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PART III

SOME COMPUTER SUPPORT SYSTEMS IN MANAGEMENT

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APPLICATION OF BPMN FOR
THE PMBOK STANDARD MODELLING TO
SCALE PROJECT MANAGEMENT EFFORTS
IN IT ENTERPRISES

The project management scaling to the needs of the project is an important task. For many project managers it is difficult to do a correct scaling of the work effort for a given projects class since the methodology is in a form of a compendium of knowledge. This very often sparks a desire for consideration of all PMBOK processes in detail by projects manages, which leads to unnecessary overload of work in the project management.

This work shall propose the solution that will facilitate the scaling. The solution is based on setting up the PMBOK standard as a model in the BPMN, distinguishing further activities in all 42 processes and linking them to the process output artifacts. Unfortunately, these activities are not explicitly defined in the PMBOK. The authors conducted identification of those activities on the basis of a detailed analysis of the standard and interviews performed with domain experts. The model presented in the next phase will be used for the automatic scaling of the model methodology. Project managers and project team members can also use the model to obtain knowledge of the PMBOK quickly and without the need for spending extensive time on analyzing the documentation. Supplementing the model representation with ontological models will provide a complete understanding of the PMBOK standard.

1. THE INTRODUCTION

A lot of ventures are projects based, due this at it most effective way of work organization. In connection with the growing competition it is necessary to finalize the projects as quickly as possible and limit time needed for creation. This forces entrepreneurs to deliver products by minimizing the scope of work. This situation can be perfectly described by MMF (Minimal Marketable Feature). The need to reduce work

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in the project impels minimization of costs associated with managing projects. Agile methodologies have been created to diminish this expense.

One of the problems of classical methodologies is the difficulty of mastering all of project management knowledge, which in turn leads to a lack of competence in the scaling an effort associated with managing a project by a project management team. The authors believe that a description of the methodology in the form of the BPMN [1] models will help to acquire knowledge of the methodology quickly, which may be useful particularly for experts from the industry. Additionally, the division of the processes into activities will promote the scaling of project management.

The work focuses on classical methodologies that are the most widespread, i.e. the PMBOK (Project Management Body of Knowledge). This methodology is a comprehensive document which is the ANSI standard [2]. It has been constructed and is still being developed through the experiences of professionals in the field of project management. The organization responsible for the development of this standard is PMI (Project Management Institute). PMI allows the scaling of the methodology for the respective needs and the decision about the scaling depends on the project performers, i.e. a project manager and a project team.

The PMBOK standard defines 42 processes and it is divided into five groups and nine knowledge areas. For each of the processes data flows described in the form of inputs and outputs of processes are defined. These processes are represented as elements of well-defined interfaces, in practice they overlap and interact with each other. It is known that there is more than one way to carry out the project properly. Each process is linked with certain data and documents. Some processes produce necessary documents that are used as inputs to other processes. The whole methodology includes 75 artifacts of that kind.

The PMBOK is a descriptive standard and its specification is extensive. Therefore, many project managers find it difficult to scale the project effort correctly. A common practice to deal with this is to omit the scaling and use all processes. This results in increasing costs and hampering the project due to the increased amount of work and a high number of documents.

Due to these problems an attempt has been made to create a solution to facilitate both the scaling and learning of the methodology. The solution is to create a model of the PMBOK standard using a specific notation that allows one to create an accurate description of activities within processes and then to link activities to artifacts. Finally, in attempt to create the complete and detailed model of all 42 processes of the PMBOK an accurate analysis of the methodology must be conducted.

2. PROBLEMS OF PROJECT MANAGEMENT SCALING

In recent years scaling methods have been investigated for effective IT project management. The point is that the effort of the project manager and the project team

associated with the management correlates with the size and complexity of the project. Thus, the scaling will be subjected to work related to management.

Use of the scaling depends on the construction of the business of an enterprise. If the enterprise carries a small number of projects, it is possible to use the scaling separately for each project. It is common in the project-oriented organizations that the scaling is defined for different project classes. In this situation, work related to management, hinges on the class of the project. From the outset of the project, both the project class and project management efforts are determined.

Carrying out the scaling requires expertise and experience concerning management methodologies and characteristics of performed projects. Since it is very difficult to obtain such expertise, necessary knowledge should be provided through models in fast and consistent ways. On the basis of such solutions, efficient methods to scale the project management should be developed [3].

In order to solve the presented problems a series of activities connected with a complete and coherent description of project management methodologies must be performed. For project management methodologies ontological models supplemented by business models and models of data flow between processes are created.

The basic way of describing knowledge are ontological models used for a formal description of data through their categorization and hierarchy. The basic components of the ontology are roles, artifacts, events and processes. Use of these components allows for accurate methodology modeling and the precise description of the structure of the standard. These assumptions satisfy presented in [4] a complete model of the PMBOK. This model perfectly describes the methodology from the formal side. However, such a description does not constitute complete knowledge of the methodology. To supplement this model, it is necessary to create a process model to describe the activities taking place within the processes.

Due to high complexity and nature of the PMBOK methodology, not all notations are well suited to its modeling. One of the notations, allowing for the description of this methodology is DFD (Data Flow Diagram). It can be used for a graphical description of data flow between processes. This way of modeling is also useful, since the standard is described in a manner similar to the DFD notation. In [7] the full model of the PMBOK methodology was developed using the DFD notation. This model and the notation focus on data so that examining the artifacts flow between processes is doable. It is possible to analyze the methodology for a single process, the whole areas of knowledge as well as from a perspective of a particular artifact.

Despite such a large amount of information provided by the model it has one essential drawback, i.e. a lack of a description of a course of specific processes. Illustrating inputs and outputs only to the process is not satisfactory. Therefore, it was necessary to endeavor to find a different notation to model the knowledge contained in the PMBOK.

To describe the PMBOK methodology based on processes, the BPMN (Business Process Modeling Notation) is very well suited. This notation was chosen because of a possibility of a detailed description of activities within the process and a possibility of linkage processes and activities with artifacts. This will provide the complete modeling of all 42 standard processes with an emphasis on activities performed in them and linking artifacts produced during the process with the relevant activities.

3. RULES OF MODELLING THE PMBOK STANDARD

The main problem with modeling this methodology was the fact that activities inside the processes are not explicitly defined. It was necessary to thoroughly analyze the standard. Sometimes consultations with domain experts were necessary. It is worth mentioning that the separation of activities is a subjective interpretation of the PMBOK standard that was made by the authors of this work.

Another problem that was encountered during the modeling was overlap of roles in the PMBOK. All roles in the PMBOK are considered as project stakeholders. The person who is a project manager is also a member of a project team. In addition, there are several other examples of this overlapping. The BPMN notation enforces marking lanes for only one role, thus each activity has the role of the most adequate. Additionally, assigning the role to the activity does not mean that a single person deals with it. This relationship means that this activity may be performed by one person or by a few people with appropriate functions in the project.

In practice, the PMBOK processes can be executed in parallel. In order to simplify the created model authors enforce the sequenced process execution. Each process has a clearly defined start and end. In practice, the project manager can stop working on one of the processes and then start dealing with another one. Without doubt, attempting to model a parallel process execution can result in the unreadable BPMN diagram, which essence in fact should be clarity and simplicity.

3.1. MODELING THE INTERACTION BETWEEN THE ROLES

Interactions between roles play an important part in the management processes. They were modeled with the BPMN swim lanes. Each role performing a particular activity is assigned to a specific lane. Such interactions usually take place while making decisions concerning acceptance or rejection of some important documents or change requests. Figure 1 shows an example of modeling interactions between roles.
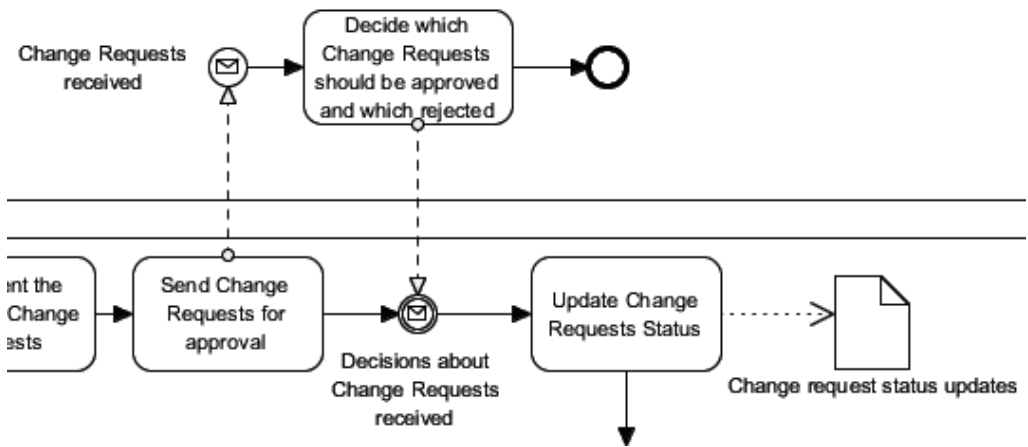
Fig. 1. The fragment of the process of conducting the integrated change control
which shows the interaction between the roles and linkage of data with the activities

The lower lane is taken by the project manager and the upper by the change control board. The project manager sends change requests to the change control board which decides which changes should be accepted and which must be rejected. Then the board sends the decision back to the manager. After receiving this information the project manager updates the status of change requests.

3.2. LINKING ARTIFACTS WITH ACTIVITIES AND PROCESSES

When describing the activities, an assumption to write a name of the artifacts in capital letters was made. This facilitates finding the activity in which data objects are created or used. This also emphasizes importance of data and documents in the project management process. In addition, each activity which creates an output document is associated with an adequate artifact. This approach can be also seen in Figure 1.

3.3. INCLUSION OF TOOLS AND TECHNIQUES IN THE MODEL

An important role in the processes is also played by the PMBOK tools and techniques. There is a group of processes in which mainly some calculations are made or requirements are collected. Such processes do not need to use all of the tools and techniques, so when modeling this type of decisions the BPMN logic gates were used, in which the project manager decides which tool or technique should be used. Figure 2 shows an example of this solution.
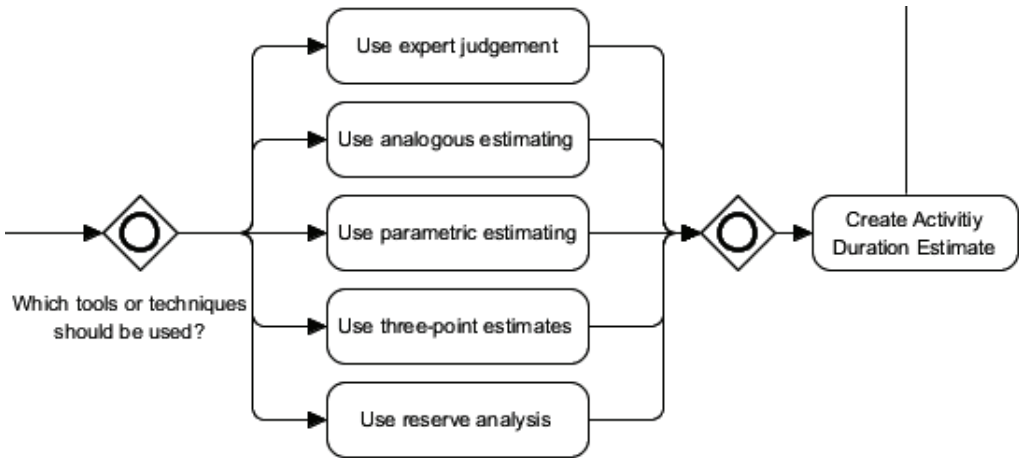
Fig. 2. The fragment of the process of estimating the duration of activities
that shows the example of selecting the tools and techniques

This part is based on estimating the duration of an activity in a project. To achieve this, various tools and techniques could be used, but not all of them must be applied. Hence there is a choice to use the BPMN notation or gates.

3.4. APPLICATION OF FEEDBACKS

During modelling processes, where there is a verification of the created document or other work is done, feedback is used to re-enable the execution of a function and correct possible errors. The same situation often takes place in the processes that are focused on the aforementioned tools and techniques. In this case, feedback allows for re-election and possible use of other methods.

4. THE GENERAL STRUCTURE OF THE MODEL

Designed diagrams can be divided into three groups. The first one contains only one diagram, it presents the methodology as a whole, provides and brings together all the PMBOK processes, modeled as a BPMN subprocesses. The second group includes the diagrams which show in detail all 42 processes of the PMBOK. Finally, the third group contains artifacts connected to adequate processes.

The overall diagram of the PMBOK model (Fig. 3) is a quick reference diagram, and it has been modeled to enable returning to the various processes, as suggested in

the PMBOK compendium. Clearly, there are many proper sequences of performing various processes through the project management. Additionally, this diagram does not contain conditions between processes; of course, some of them depend on each other, primarily because of required documents. However, the attempt to impose restrictions on the transition could cause a large increase in illegibility of the diagram. Therefore, in this case this simplification was adopted. Each diagram for a particular process has been named according to its original PMBOK name and numeration.
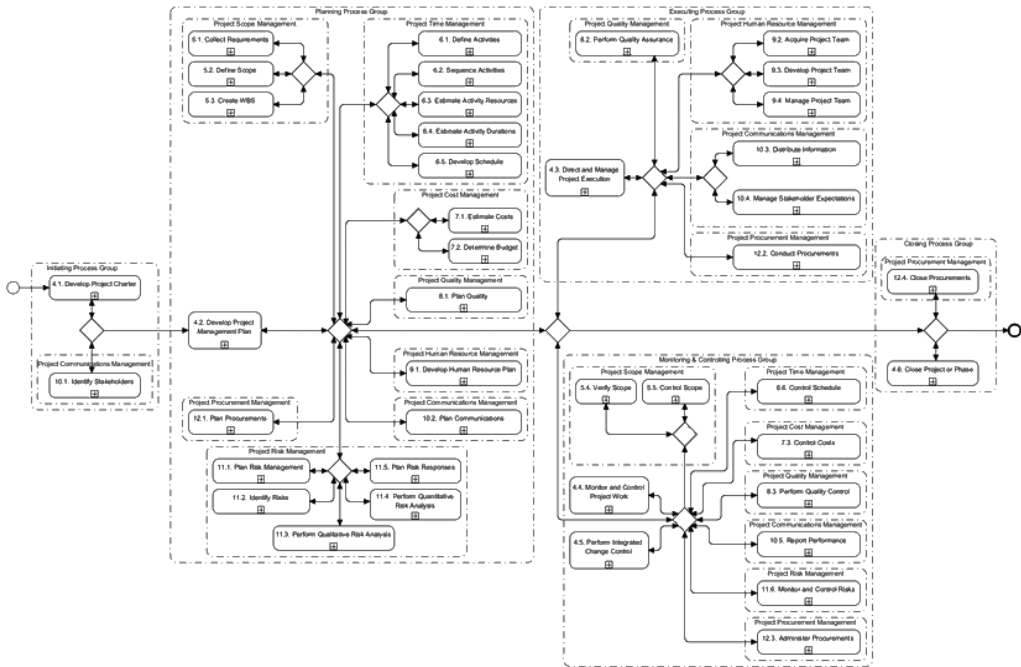
Fig. 3. The overall diagram of the PMBOK model including all processes

The BPMN notation does not focus on creating links between data objects; it pays attention to a description of activities that must be carried out in a specific order to complete the process successfully. However, it is possible to link artifacts to the process. This linking has been made with use of the BPMN directed associations. Figure 4 presents the approach to the described problem.

This example process has five input documents and produces only one output document. With the possibility to reuse the same data object on several different diagrams, it is possible to analyze the flow of the artifact between different processes.
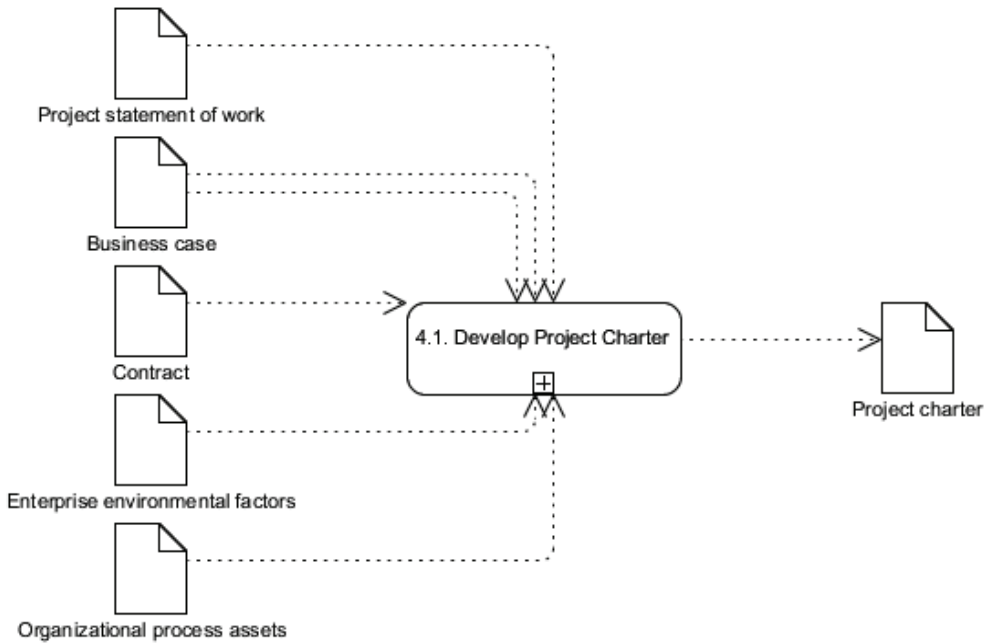
Fig. 4. Data binding with the process of creating the project charter

5. THE PMBOK STANDARD ANALYSIS RESULTS

The model in the first step was used to analyze correctness of the PMBOK standard. Communication between the PMBOK processes is mainly based on the interchange of 75 different artifacts (data objects). The model allows for the analysis of data in terms of its participation in the project management process.

5.1. ARTIFACTS WHICH ARE REPETITIVE OUTPUTS OF VARIOUS PROCESSES

Most of the artifacts are produced by exactly one process, and then transferred to one or more processes. There are some artifacts that are outputs of more than one process.

The first group consists of data, which often appear at the outputs of processes, especially in processes of monitoring and controlling. This group consists of the following artifacts:

- Organizational process assets updates,
- Change requests,

- Project management plan updates,
- Project document updates.

It is worth highlighting that except for changes requests those data are simply updates of other documents in the project.

All of the control processes of three basic project constraints: scope (5.5 Scope Control); time (6.6 Schedule Control) and cost (7.3 Control Costs) generate an important artifact which is Work performance measurements, this artifact is later used in the processes of quality assurance and distribution of information to the stakeholders.

Further analysis resulted in the discovery of inconsistency in the PMBOK methodology. This interesting situation concerns the artifact called the Resource calendars, this artifact is an output of two processes but in practice, they are two different data objects. The first of the calendar appears at the output of the process 9.2 Acquire Project Team, it is connected with available working time of each team member and serves to reduce the impact of holidays and other time constraints imposed on employees. The second of those calendars, which is the output of the process 12.2 Conduct Procurements, is concerned with availability of contracted resources.

Last group considered in this section consists of two update artifacts. The first are Enterprise environmental factors updates, which are output of two processes 9.3 Develop Project Team and 9.4 Manage Project Team. The second are Risk register updates, which appear at the output of almost all processes from the risk management group (from 11.3 to 11.6).

5.2. ARTIFACTS PRODUCED OUTSIDE PROCESSES

The PMBOK has some artifacts that are not produced in any of the processes. Some of them are related to the organization, another to the specific contracts, others are results of inaccuracy or adopted generalizations in the PMBOK. The first group covers documents that come from within the organization implementing the project. Such data include Enterprise environmental factors and Organizational process assets. During the project there are frequent updates of data.

The second group concerns the documents needed for the initialization of the project, which includes: Project statement of work, Business case and the Contract. In the case of the last document mentioned above, again there is some inaccuracy because the artifact with the same name appears as the input to the process 12.3 Administer Procurements. Moreover, same data are inputs to the process 7.2 Determine Budget, but in this case the artifact is written in the plural - Contracts. The last artifacts in this group are Teaming agreements.

Another example is a simplification adopted by the authors of the PMBOK. One of the entrances to the process 4.2 Develop Project Management Plan is the Outputs from

planning processes. This simplification is understandable; however it creates the formal problem and causes a lack of consistency.

Another inconsistency relates to the document called Approved change request. It is the entrance to three other processes, but it is not produced anywhere. The PMBOK compendium shows that this document comes from the process 4.5 Perform Integrated Change Control, but the only related output of this process is called Change requests status updates which includes not only approved but also rejected change requests.

Further analysis enabled us to capture the fact that the process 10.4 Manage Stakeholder Expectations has two inputs (Issue log and Change log) that are not produced anywhere else. Both documents are a part of the Project documents. Inconsistency of the methodology in this case is connected with the fact that Project documents are also listed among the inputs to other processes (11.2, 12.2). In the case of Issue log, there is another paradox because it is listed as a technician in the 9.4 Project Team Manage.

Next oversight in the case of two project management plans concerns Cost management plan and Schedule management plan. Both documents are not outputs of any of the processes, the PMBOK authors suggest that these are the overall results of work on planning in both of these knowledge areas. But again there is some inconsistency because in other knowledge areas management plans are the outputs of the respective processes.

The last case in this section relates to the process 12.2 Conduct Procurements; this process has two input artifacts which are not produced by the processes of the PMBOK. The first is the Qualified seller lists, it comes from within the organization. The second document is called Seller proposals, which is derived from sales bidding.

5.3. ARTIFACTS NOT USED AS INPUT TO OTHER PROCESSES

There are some artifacts produced by the process but not used as inputs to other processes. First of all, this group consists of updates to other project documents, which for obvious reasons, cannot be used as inputs.

As a result of the last executed process which is 4.6 Close Project or Phase, the output called Final product, service or result transition is produced. This artifact is a kind of a symbol of successful completion of a project or a phase.

All plans of different knowledge areas are not used as inputs to the process due to simplification discussed in the previous section concerning the artifact Outputs from planning Processes. Another justification of this fact is connected with the fact that the Project management plan is treated in the PMBOK as a whole.

The previous section also included the discussion about Change requests status updates. It is not an input to any process, only its part (Approved change request) is used.

Another inaccuracy is related to the outputs of the process 5.3 Create WBS; there are two interesting outputs of this process – WBS and WBS dictionary. However, they are used as inputs to other processes as a part of the Scope baseline, which is also an output from the aforementioned process.

There is a certain group of artifacts that after being produced in the processes migrate to the Project documents. Those artifacts are Resource breakdown structure that is produced in the process 6.3 Estimate Activity Resources. A similar situation occurs in the case of artifact Schedule date produced in the process 6.5 Develop Schedule. The last such case concerns the output of the process 8.3 Perform Quality Control called Validated changes.

The last of the described inconsistencies relates to the process 12.2 Conduct Procurements. This process produces two artifacts unused as inputs in other processes. The first one is Selected sellers, the manual suggests that it is passed to the process 12.3 Administer Procurements, but this process does not have such an input. The second artifact is Procurements contract award.

6. CONCLUSIONS

As a result of performed work, models for all 42 processes of the PMBOK standard using the BPMN notation have been created. Models were produced thanks to the precise analysis and the discussion with domain experts. As a result activities for every process have been separated. On average, there are seven activities for every process. For each activity output artifacts are assigned..

With the help of the created model, it was possible to study the standard precisely which then resulted in the discovery of its inaccuracies.

What is more, the standard model and the individual processes are presented in an approachable graphic form. This will enable project managers and team members to gain knowledge of the PMBOK quickly and without a need to delve into the extensive documentation.

The model can be used to make decisions related to the scaling of the efforts associated with the project management based on the PMBOK standard. The scaling will lead to removing unnecessary activities, artifacts, and even entire processes. Achieving consistency of such a reduced model will require a review and an application of appropriate amendments. Then the model will be used for the automatic scaling of the model methodology.

The developed model will be an important addition to the PMBOK ontological model [4]. Those two models together constitute a coherent and complete knowledge of the standard. The development of models in such a way for different methodologies may be used for integration and scaling of project management efforts in a flexible way [6].

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PROJECT TEAM MANAGEMENT
SUPPORTED BY AN AGENT-BASED MODEL

This work is a continuation of a series of works about research into the use of multi-agent systems to support IT project management. Previous studies have shown the possibility of using a multi-agent in order to optimize management decisions concerning the selection of methods for project implementation. It was noted that the project manager's decisions are influenced by three fundamental parameters: the entropy of the project, the maturity of a client and the maturity of a team. The current phase of research, described in this work, is focused on issues related to team management and to supporting the selection of team management practices by a multi-agent system.

1. INTRODUCTION

This work is a continuation of a series of works about research into the use of multi-agent systems to support IT project management. Previous studies [1, 2, 3] have shown the possibility of using a multi-agent in order to optimize management decisions concerning the selection of methods for project implementation. It was noted that the project manager's decisions are influenced by three fundamental parameters: the entropy of the project, the maturity of a client and the maturity of a team. The current phase of research, described in this work, is focused on issues related to team management and to supporting the selection of team management practices by a multi-agent system.

Due to the fact that the team's level of maturity is important for the selection of project implementation methods, any mismatch between the methods and the

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capabilities of the team implies problems during the implementation of project tasks (examples of which are shown below). Such incompatibility often results in delays in the project and, at worst, leads to a cessation of work or even the dissolution of the project team. Thus, matching the methods to the team is crucial to the success of the project.

The increasing role of project teams also results from the fact that modern organizations implement most of their tasks using the project approach, replacing the traditional organizational structure (divisions) by interdisciplinary teams consisting of people from different departments.

Therefore, in this situation, it seems appropriate that the selection of people to such project work is supported by a system. This way, the organizational risk, which grows in the course of the project and potentially leads to failures, can be minimized. In addition, social sciences like sociology and psychology have for many years been providing toolkits and methods for positioning people within groups and verifying the team's competence. The use of these tools, in combination with mechanisms for selecting project management, allows the creation of a closed entity leading to total support for project managers while constructing a project team.

The model presented in this work allows the team member selection process to be streamlined by showing that each person can have their representation in the form of a dedicated agent. The agents (through a series of competence questions) acquire information on people who are to participate in the project, and pass the information to the manager agent. On the basis of a rule-based knowledge base, the manager agent verifies the suitability of the members (examines the team's level of maturity) which subsequently allows automatic inference as to which method is best suited to a team with a given level of maturity.

2. THE CONCEPT OF THE SYSTEM

The authors' previous studies focused on the development of the overall architecture of the system, which, using intelligent agents, expert knowledge and codified methodical knowledge (ontologically described in the OWL language), will be able to support project managers' decisions regarding the selection of project management methods. Earlier publications [7] showed the mechanism of information flow in the system and the hierarchical relationship between the agents to ensure proper system operation. In this work, the focus has been placed on issues related to the measurement of one of the key decision variables – the maturity of the team, which has been marked on the diagram.
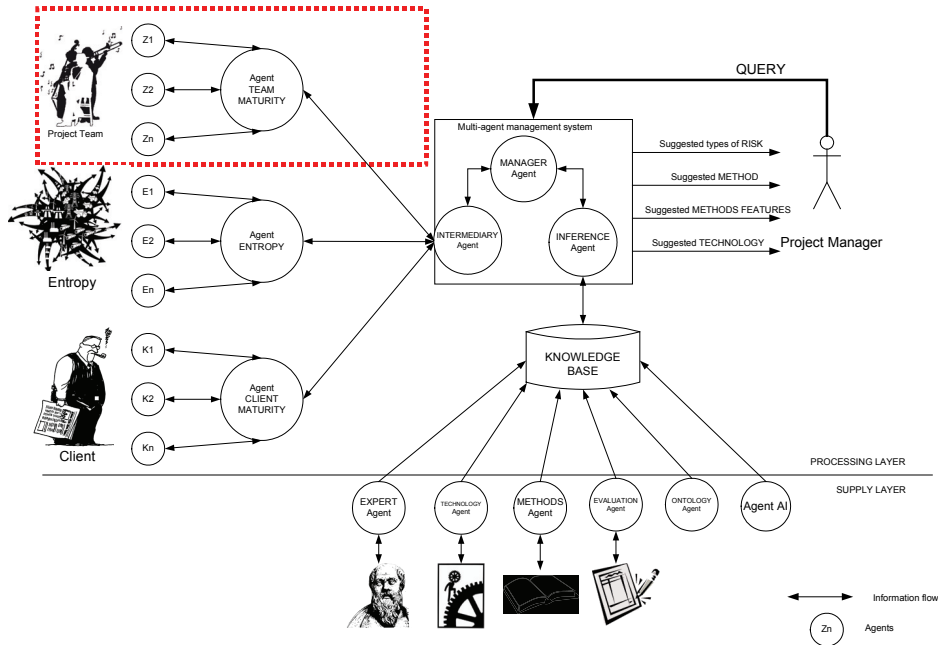
Fig. 1. Concept of the system

Before discussing the section on team maturity, it is worth looking at the overall concept of the system. The multi-agent system presented above is the result of several iterations during which the model matured according to the pace of the research. Subsequent work led to the presented version of the system, whose main task is to support managers in the selection method for IT project management.

The basic elements of artificial intelligence in the system are:

- Agents – supervising the work of the system, acquiring knowledge, communicating the results, communicating with the user;
- Ontologies – which are dictionaries of terms, explaining expressions used in the system;
- The Expert system – using the knowledge base into which experts put their rules via the relevant intermediary agents.

The use of these elements in the system provides scalability, as well as a response to the commonly encountered dispersal of project stakeholders. It often happens that the unity of time and place is not applicable to the manufacturing team members, the representative of a client and the experts. Given that today transnational projects are gaining importance (whose members are scattered across the globe), using the multi-agent system seems to be the most convenient way to provide integration between all parties.

The mechanism operating the system can be summarized as follows. On the basis of decision variables, and knowledge derived from several sources (experts, knowledge base, etc.), intelligent agents look for an appropriate method to match to the characteristics (the realities) of the project. The project realities are the parameters which were mentioned earlier, namely, client maturity, team maturity and the entropy of the project.

The inference agent, which is responsible for seeking the best match, analyzes the system's knowledge resources and juxtaposes them with the decision variables. The obtained result – a match – is presented to the manager as a suggestion about the best method to lead the project at a given level of project realities. In addition, it is planned for the system to generate guidance in the form of technology which would be useful to support the implementation of tasks, and to show the level of organizational risk. Organizational risk is defined as the potential appearance of adverse effects.

The ultimate decision-maker is obviously the manager, who, on the basis of the system's suggestions, decides how to implement the project. In a more advanced version, the manager would be able to use not only the suggestion referring to the choice of method, but also to the individual characteristics of different methods. Then it could be called an adaptive method of project management. Bearing the above solutions in mind, it is worth examining the decision-making mechanism, thus developing a section on the parametric description of the project realities.

3. DECISION-MAKING MECHANISM

As mentioned earlier, IT project managers, choosing the method (e.g. RUP, Prince, SCRUM) with which they intend to carry out project tasks, should be aware of the consequences of improperly matching the chosen method to the realities of the project. The improper choice of a method is likely to result in exceeding one of the fundamental project limitations (such as budget, scope or schedule, and, at worst, a few of them). It thus seems appropriate to look closely at the project realities before deciding "how to implement the project". In a previous work, the authors defined three basic areas (variables) that should be addressed by the project manager. The areas include:

- maturity of the organization and/or team;
- maturity of the client and his organization;
- project entropy.

Each of these three elements (entropy, the client and the team), which contribute to the project realities, should be taken into account by the manager before project implementation is initiated. It is difficult to determine which area is most important;

however, due to current observations, it can be concluded that each of them is important from the viewpoint of matching project management methods. The dismissal of entropy, in other words the complexity of project work, often turns into wrongly formulated objectives and project requirements. Misunderstanding the client and disregard for the client's level of knowledge (or absence of it) about the specific features of IT projects will most often lead to the generation of unexpected variability (e.g.requirements). Finally, the lack of recognition of the maturity level of the team (as referred to in the next section) may degenerate into a lot of complications in the project work.

The separation of the three major decision variables led to the development of a skeleton for a decision-making mechanism (as shown in the figure below).
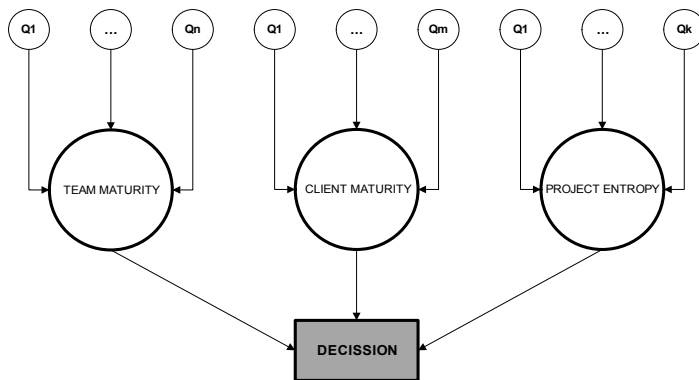
Fig. 2. Pre-processing model for generating decisions

It is also clear that the aggregated variables outlined above (organization maturity, client maturity, and entropy) consist of a large number of minor parameters. It also seems that managers find it difficult to answer whether their team is mature, or to directly assess the client's level of maturity.

Therefore, the authors decided to include elements of pre-processing in the decision-making mechanism – which means modeling the input data in such a way that via a set of questions posed to the manager, the client and the team members, the values of these three main parameters could be determined.

A closed list of questions is planned to be created, which will allow the inference of the project entropy, and the maturity levels of the client and the organization.

At the current stage of research, the most recognized areas are the organization and the manufacturing team (the appropriate software is being developed, using intelligent agents to determine the level of maturity, based on competence questions).

4. TEAM MATURITY

The issue of project team maturity comes directly from classical management theory, which mentions planning as one of the fundamental processes. Planning processes are the domain of the IT projects manager, before they are actually initiated. The selection of the team is included in basic resource planning. Project teams often consist of people from many departments and many areas, and their task is to realize a common goal. To achieve the goal, a lot depends on the degree of maturity of the team and on interaction between team members. The inclusion of people with the same qualities within one team most often leads to unconstructive conflicts.

The role of the manager is, therefore, to select team members in such a way that they are mutually complementary. It is a different situation if the team has been established from the beginning and created without much involvement of the head (so-called imposed teams). In both cases, the manager should choose such a method of management which will be most suited to the state of the team. The state of the team - a set of experiences, skills and personality predispositions – has been defined as team maturity.

The observations showed that teams with low levels of maturity (beginner teams, not experienced in the implementation of projects) find it easier to operate according to classical methods (e.g. RUP) and the more experienced teams often prefer agile approaches (e.g. SCRUM). In addition, it should be emphasized that the improper matching of the project management method to the current state of the team may have negative consequences during the implementation. The following entries illustrate the experiences (experiments) and observations of the authors of this work.

4.1. THE EXAMPLE

Research in one company showed that the cause of its projects failing was the lack of understanding, on the part of the employees, of the rules which governed a given method of project implementation.

A good example here is an interview with one project manager (source: own), who, while using the SCRUM method, observed that his workers were greatly disheartened during their daily meetings, typical for this method, at which the participants responded to fundamental questions of SCRUM, namely:

- "What did you do yesterday?"
- "What are you going to do today?"
- "What bothers you at work?"

These three basic questions arising from the method chosen by the manager proved to be quite "sensitive" for the workers and caused a deterioration in their well-being at work and resulted in delays in the ongoing work.

This example therefore shows that while selecting the method of project implementation, the project manager should also have considered conditions other than his own intuition, his knowledge of the method or the universal use of the method in corporations (some companies create their own methods of project management according to their own needs). The lack of consideration for certain characteristics of the team members led to the ultimate failure of the project. The workers' lack of knowledge about the method caused discomfort in the implementation of tasks. Thus, the conclusion is clear – when selecting a project management method, factors associated with the project team should be taken into account. The selection is dependent on the human factor.

4.2. THE EXPERIMENT

To show how important it is to match an appropriate project implementation method to a team, the authors of this work performed an experiment on a group of young participants (graduates and students of Gdansk University of Technology).

During the implementation of a project, a group of participants was asked to execute project work based on an agile approach to software development. The project implementing teams, in accordance with the agile approach, were supposed to carry out such tasks as, inter alia, self-organization of the team, team decision-making and the execution of work in short cycles. However, the experiment showed (and thus confirmed the hypothesis posed above) that a young immature team is not able to carry out work in accordance with the agile approach. Due to their lack of experience, the participants were unable to organize their work and make important decisions about the course of each iteration. This experiment also proved that the choice of method is important from the viewpoint of the project team and it affects project work.

In the second stage of this experiment, it was decided to change the agile approach for a classical one, relying on the best practices of the Rational Unified Process (RUP). The iteration plan was prepared by superiors (the manager) and the participants were assigned roles. The appropriate documentation (e.g. containing a Work Breakdown Structure - the structure of workflow) was prepared to organize work and the key products of labor were identified as inputs and outputs of tasks. It turned out that the test group carried out the work very effectively and the project tasks were executed in accordance with the agreed timetable.

Generalizing the case discussed, it should be underlined that the role of selecting project management methods is vital, not only in reference to the team, but also in reference to the organization as a whole. It seems to transpire that the degree of maturity of the organization may also indicate whether the organization should use specific methods to carry out their project work or not.

5. PROPOSED SOLUTION TO THE PROBLEM
OF DETERMINING THE MATURITY OF THE TEAM

Taking the conditions of the team from experiment 1 into account, it was decided to construct a mechanism that determines the level of team maturity. A purpose-designed tool was used, namely, an experience and competence test. The test was divided into two parts, as shown in the figure below.

Fig. 3. Sample of questionnaire

The first part relates to experience (project skills). It contains questions to which the participant must respond with numerical values (rates). To construct this part of the test, a number of ancillary questions were used, such as:

- How many years have you been involved in projects?
- How many projects have you been involved in during your career?
- What percentage of them were IT projects?
- In how many projects did you have a managerial role?
- What percentage of your projects do you consider to be successful?

The second part of the test concerns suitability for teamwork. In order to investigate the suitability, a selected number of questions from the BELBLINA test were used. The BELBLINA test is known in psychology as a tool for showing what type of work, within teamwork, a person is predisposed to. The BELBLINA test does not determine specific roles in an IT project (but, as we know, according to the principles of RUP, some roles should be changed in the following stages of a project); however, it allows the team members to be positioned, as it shows that some individuals are better suited to work as coordinators and others as prospectors of new solutions or meticulous executors of tasks.

Researching the team's competence, in conjunction with establishing the team's level of experience in project implementation, may eventually result in determining the level of team maturity. According to the conclusions drawn from experiment 1, the lower the level of team maturity, the more classical solutions, such as the already mentioned RUP, are recommended.

The questionnaire, the scheme of which was outlined above, is used to measure the maturity level of individual members but it also provides the same opportunity to establish it for the whole team. The way of researching the maturity of the team is a part of the multi-agent system described earlier. Such a questionnaire, or its modifications, can be implemented in a multi-agent system providing complex support to managers in the decision-making process. The single intermediary agents should be treated as instances of individual participants. Each participant completing the questionnaire (responding to questions asked by the agent) shows their level of experience and enables their positioning in the team. Therefore, the information obtained by the intermediary agents may affect the management system, where analysis and verification based on the knowledge base (expert knowledge) is dealt with by dedicated inference agents.

An additional advantage of such a solution is the possibility to simulate the team's work through agents. If we assume that the agent is the representation of a single participant of the project, it is possible to quickly give a few virtual tasks and observe if the state of the team fits together properly. For the purposes of processing data on project team maturity, the following formal record can be used:

$$o_t = \begin{bmatrix} ok1_t \\ ok2_t \end{bmatrix}$$

o_t – variable of the project team maturity level $o_t \in \,<1, 5>$,

$ok1_t$ – variable of the maturity level of key processes in the manufacturing of IT systems, $ok1_t \in \,<1, 5>$,

$ok2_t$ – variable of the maturity level of key management processes in the manufacturing of IT systems, $ok2_t \in \,<1, 5>$,

t – (current) time of project implementation, $t \in \,<1, t_{kon}>$,

t_{kon} – time of project completion.

In the above record, the team maturity level is determined by the maturity level of key processes. For the above record, the assumed values for maturity ratings range from 1 to 5, where 5 is the highest value of maturity level.

Summing up the above considerations, the use of agents in assessing team maturity is important in two ways – it identifies the characteristics and personality traits of members, allowing the manager to match up the method of project implementation, but also enables the observation of team behaviors in the virtual space.

6. SUMMARY

To sum up, it is worth noting two issues. The first one concerns the selection of the team. The conducted experiments have shown how important it is to properly identify the maturity level and to subordinate an appropriate method of management to the level. The team maturity test may therefore be used and be examined by agents of the system supporting project managers.

The second important issue is the possibility to increase the scalability and flexibility of the multi-agent system. The use of competence tests in the multi-agent system showed that any analytical tool may be implemented at the level of the team. Such a questionnaire can be further developed/modified in accordance with current or future trends in management. This approach seems to be important for the whole system. It turns out that any evaluation method can be implemented in the system.

This observation seems to be most important for further work. The next stage will be devoted to studying the entropy and client maturity. The construction of appropriate analytical tools (or using existing ones) is planned to investigate the complexity of project work (entropy), as well as the selection and suitability of the client. In the next steps, it is also planned to develop a module of cooperation with experts. Recent experience shows that the demand for domain experts in many current projects is increasing. Possessing expert knowledge, or permanent contact with an expert (and their knowledge), with the use of mobile agents, can solve many problems arising unexpectedly in the course of teamwork.

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BPMN-XPDL TRANSFORMATION
USING THREE DIMENSIONAL DCD MODEL

A mapping from BPMN diagrams into XPDL standard and the implementation of these mappings made in Dodocum modeller environment is presented. The business processes are modelled in BPMN notation. Then refined BPMN diagrams and automatically generated DCD diagrams can be round trip transformable, aligning services with business processes requirements. DCD diagrams are automatically translated into XPDL notation so can be entered into BPM platform. DCD diagram provides not only the transformation of all information from BPMN notation to XPDL standard, but also allow to enrichment the missing information of BPMN diagram such as structure, functionality, or behaviour of the designed system. The mappings reveal that all major BPMN elements can be transformed to similar XPDL elements through the DCD model. Furthermore, the Dodocum modeller makes business processes models managed by BPMN Toolset available in XPDL format. The reverse transformation from XPDL (BPM platform) into BPMN diagrams is also possible.

1. INTRODUCTION

Business Process Management (BPM) [1] and Workflow Management [1] (WfM) is very quickly growing discipline in recent years. This is because more and more companies must improve their business processes management in order to reduce costs and increase their competitiveness in the market. That is why many companies are looking for tools that include support for a comprehensive business process management. Content Management Systems provide just such features. These systems also allow the exchange of business processes descriptions.

There are two standards to exchange of business processes descriptions: BPEL [2] and XPDL [2]. BPEL is implemented in tools for modelling business processes [2], and

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XPDL is a standardized language allowing process definitions interchange between a variety of tools ranging from workflow management systems to modelling and simulation tools [2].

Unfortunately, today's CMS platforms offer only their own notations to describe business processes. Hence, in practice, no BPM platforms that use the language of BPMN for modelling business processes.

In this work however we are going to propose Documents Circulation Diagram (DCD) in order to reach our goal: business processes modelling through BPMN diagrams and translating them into XPDL standard in order to be able to validate of the correctness of their design of business processes by building CMS applications in many BPM platform. DCD diagram provides not only the transfer of all information from BPMN notation to XPDL standard, but also allow to complement the missing information of BPMN diagram such as structure, functionality, or behaviour of the designed system.

BPM platforms provide capabilities across business process modelling, execution, business activity monitoring, analysis and simulating. These functions are based on Business Process Management (BPM) concepts [2]. BPM platforms also allows users to build and deploy process models supported by XPDL standard.

This work proposes the method of the exchange of business processes descriptions between BPMN and XPDL models. BPMN and DCD diagrams are designed and integrated each other in the Topcased environment on the Eclipse platform.

The organization of this work is as follows: in section 2 the translation rules from BPMN to DCD are presented, in section 3 the transformation of business processes from DCD to XPDL are described. An example is presented in section 4 implemented in BPM platform (Documentum) and some conclusions are given in section 5.

2. FROM BPMN TO DCD

2.1. DCD DIAGRAM

DCD – Document Circulation Diagram is used to show the flow of documents in the information systems. DCD model is intuitive and easy to understand for both business and IT people and thus can be used to bridge the gap between them. DCD model was applied to build the Integrating Administration Control System for the use of EU agricultural in Poland [].

In Figure 1 an example of an auction process is showed. DCD diagram was described in details in [17]. According to ANSI/IEEE 1471-2000 [18] the DCD model is a view of software architecture.
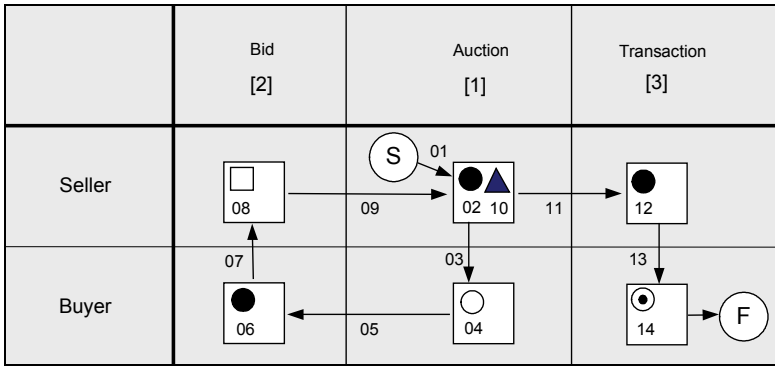
Fig. 1. The Document Circulation Diagram – DCD diagram

The header of the diagram contains the DCD objects and first column shows DCD actors. In the next columns the DCD operations are given, each one is performed by appropriate DCD actor. There are several kinds of DCD operations: Creating, Copying, Checking, Archiving, Approving and Other. These operations are performed on the instances of the DCD objects (grouped into the DCD Document). Example presented in Fig. 1, visualizes an auction process (basic path). Seller sets up an auction (02), then Buyer who bids (06) the highest price wins (08). The closed auction is archived (10) and then Seller creates financial transaction (12), which is approved by Buyer (14).
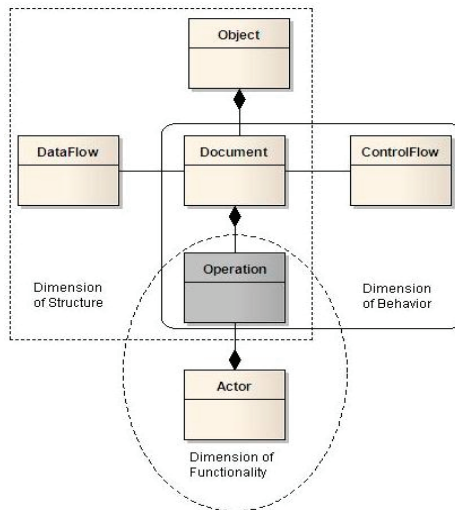
Fig. 2. The simplified DCD metamodel

In Figure 2 the simplified DCD metamodel is presented. The dimension of functionality describes Actors and Operations. Documents, Control flows and Operations depict the dimension of behaviour, and the dimension of structure contains Objects, Documents, Data flows and Operations. The common element is Operation and it enables to integrate the three dimensions of software architecture.

<center>2.2. BPMN MAPPINGS</center>

In Figure 3 the simplified BPMN metamodel is shown. The BPMN metamodel has Flow elements with Sequence flows (behaviour), data objects with associations (substitute of structure), and swimlanes (substitute of functionality).
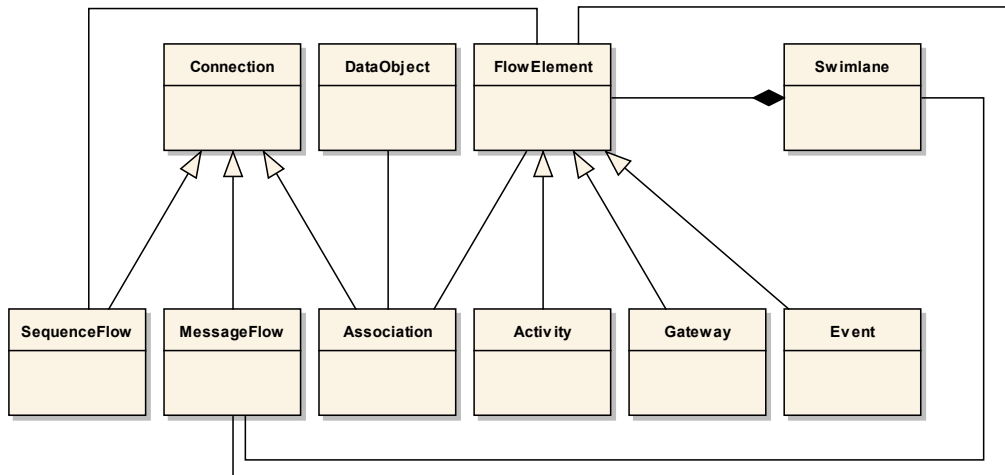
Fig. 3. The simplified BPMN metamodel

In Figure 4 the mappings between DCD model and BPMN diagram is shown. These diagrams describe the design view of the software architecture. The DCD model has simple and unambiguous relationships with BPMN diagram.

Each element in the header of the DCD model corresponds to only one object from BPMN diagram. Each DCD operation corresponds to only one activity in the BPMN diagram. The number types of DCD operations is limited, so their names may be used to create the name of an appropriate activity in the BPMN diagram (e.g. the DCD operation of type "Creating" with the "02" label corresponds to the activity labelled "Creating 02"). In similar way the DCD actors can be mapped into swimlanes in the BPMN diagram. Each activity is identified as a DCD operation, and

each activity is associated to an actor, which performs particular DCD operation. To keep the readability of Fig. 3 better, not all dependencies between diagrams are shown.

DCD diagram – use case realization diagram
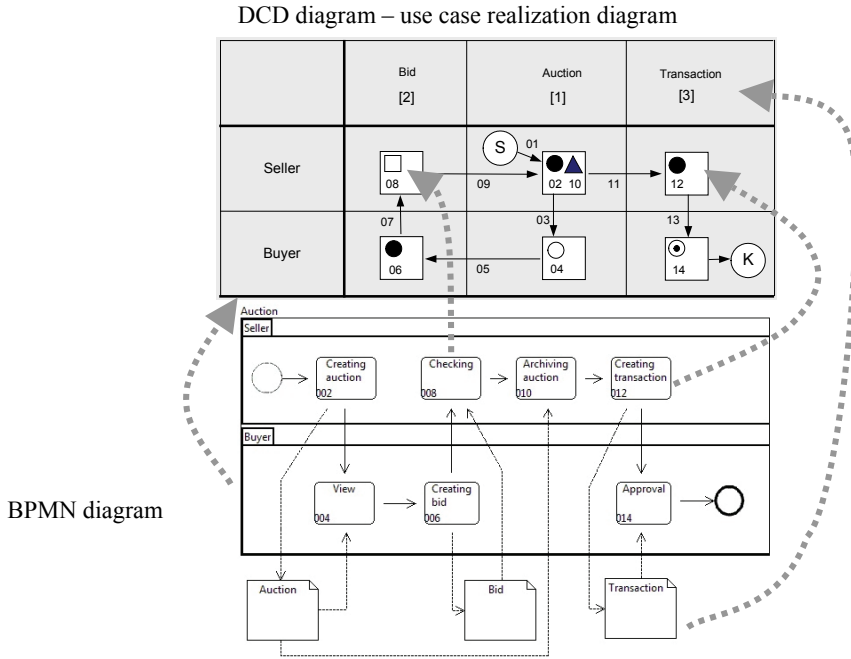
BPMN diagram

Fig. 4. The mappings method between DCD model and BPMN diagrams

2.1. BPMN TO DCD TRANSFORMATIONS

Moving business process model from BPMN notation to DCD diagram requires non-trivial transformations and detailed knowledge about the metamodels of each notation involved. Transformations from DCD do BPMN notation in Triple Graph Grammar are presented in Fig. 4.

A Workflow Process Type is composed of Activities and Transitions. Activities are related together to form a control flow via transitions. An activity can act as a join when it is the target of multiple transitions. An Extended Attribute enable to move many information about the business process like structure (data objects), behaviour or functionality of the business process. In Figure 5 the part of the Documentum metamodel of XPDL standard is shown. Additional information for EMC Documentum platform is contained in <docNS> package.
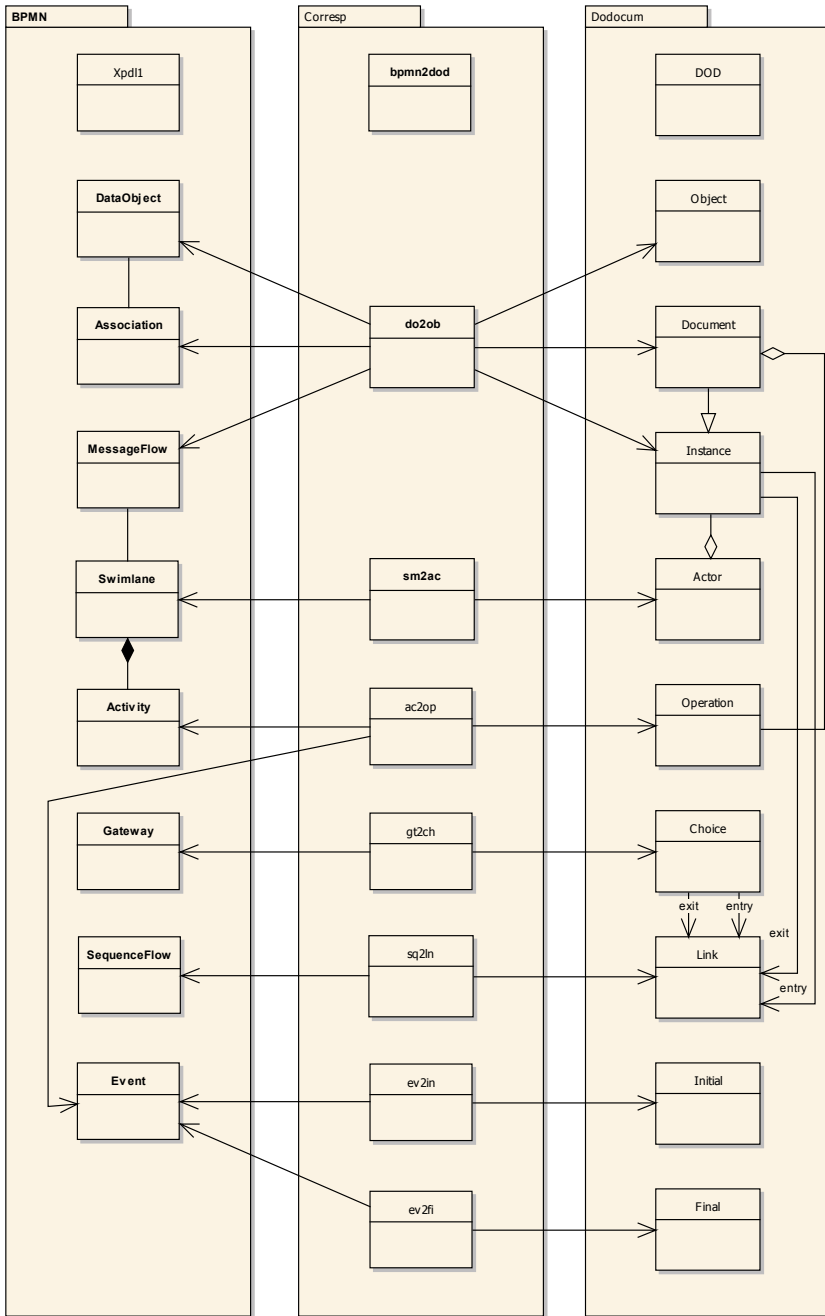
Fig. 4. BPMN to DCD transformations

3. FROM DCD TO XPDL

3.1. XPDL BUSINESS PROCESS DESCRIPTION
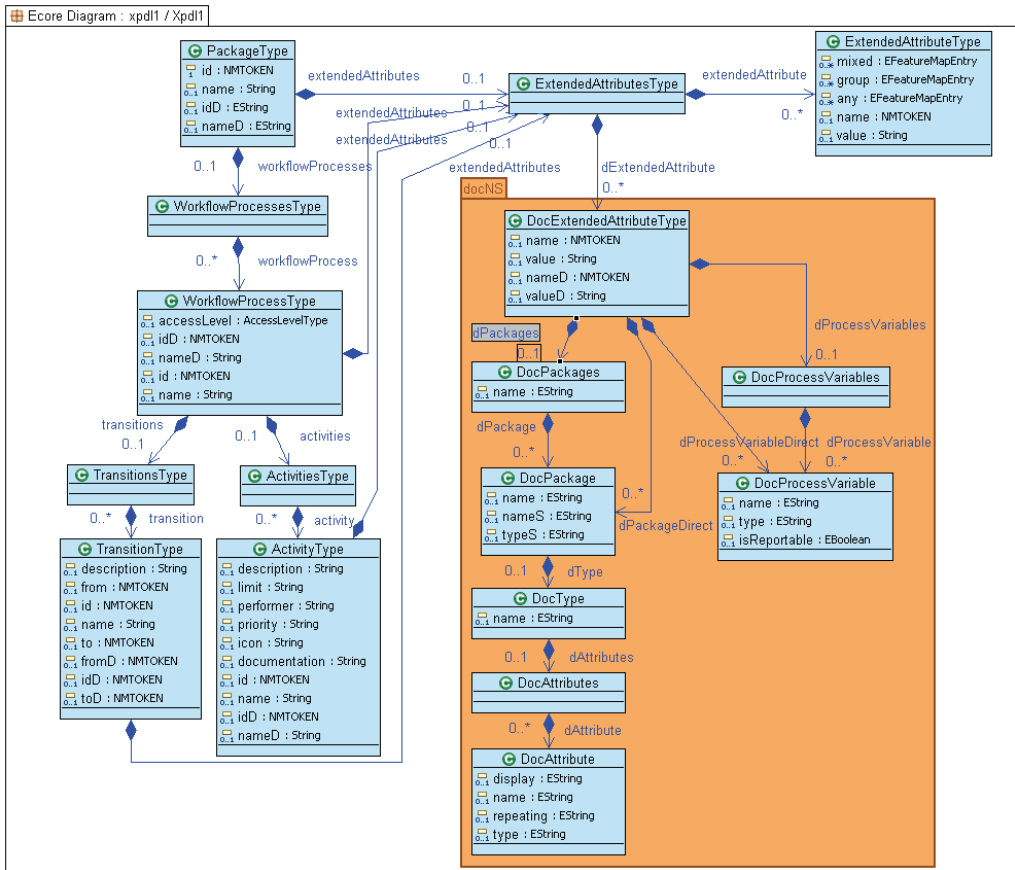
Fig. 5. XPDL metamodel

3.2. DCD TO XPDL TRANSFORMATIONS

In this section we will present the transformation from DCD to XPDL. This transformation has been presented in Triple Graph Grammar. In the following we will illustrate the transformation by mapping model elements – Fig. 6. To avoid confusion we use the containers with elements of each notation.
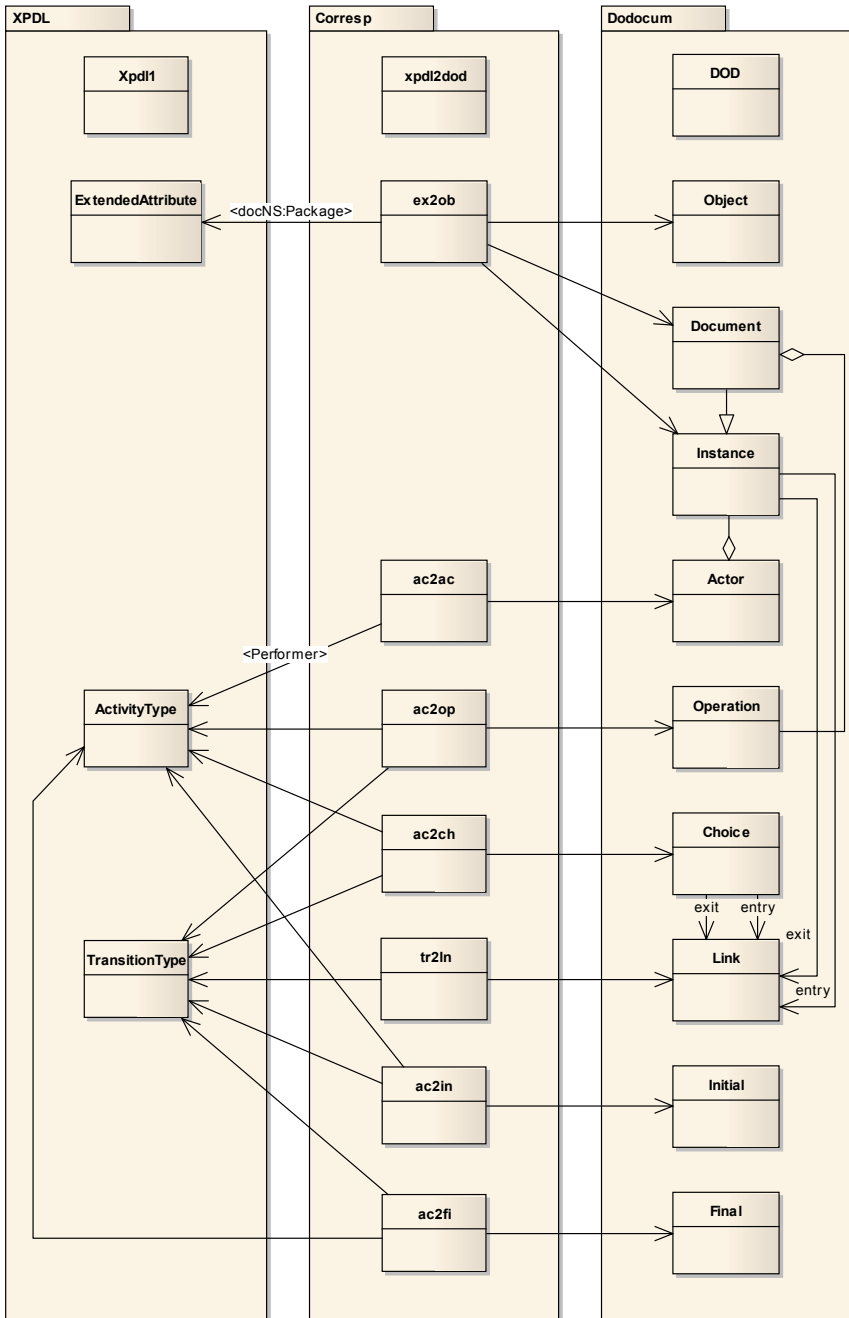
Fig. 6. DCD TO XPDL transformations

4. CONCLUSIONS

The proposed method for changing descriptions of business processes between the BPMN diagram, and the standard XPDL file enable to automate and accelerate the analysis and design work on the construction of CMS platform accepting BPM XPDL standard. In addition, modeller Dodocum allows to preserve the completeness and consistency of business processes description, and also enable to complement full description of business processes in the Dodocum editor.

The three dimensional DCD model presented in brief in this work enables to keep consistency and completeness in the description of the business processes. This model can provide automatic relationships between BPMN diagrams and XPDL standard file.

The three dimensional model has others advantages, which can be used in the others views of the software architecture. Applying this model in the others views we can expect an extended model for information systems, in which "a huge gap between the client's requirements and the implementation-oriented models" ([23]) would be filled. Currently the possibility of mapping Event-driven Process Chain elements directly into the DCD diagram is studied.

The authors experience shows that configuration of any platform BPM requires the engineers of competence in terms of both modelling systems, and construction of this platform. Create and describe business processes such as the EPC notation relieve business people from the need to know technical details of the BPM target platform.

Thus, manual configuration of the BPM platform can be replaced by automatic importing business processes descriptions in the XPDL standard exported by modeller Dodocum integrated with other notations such as BPMN, UML, EPC.

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REDUCTION OF PAYMENT GRIDLOCKS
BY SMALL ENTERPRISES

Management of receivables and maintenance of them at an adequate level have an impact on the value of small or medium-sized enterprises. Profit maximization is inextricably linked to a growth in operating risk. Similarly, an excessive focus on limiting risk at all cost eliminates opportunities to generate profits resulting from the use of financial tools, e.g. gearing/leverage. Each enterprise aims at making more money from the capital invested in the business than it could receive by depositing such capital with a bank. This reflects the financial objective of running a business – the maximization of its owners' wealth, or more precisely, the maximization of the market value of its owners' equity. Any action related to managing a business's finances should be perceived from this perspective. If an action increases the owners' wealth it should be undertaken, if not – it should not be carried out.

1. INTRODUCTION

The economic processes occurring at each economic entity are conditioned by the amount of capital involved, income gained and costs incurred to generate it. All managerial decisions regarding a business's operation are reflected in financial, cash-related categories. An enterprise is a success if its finances are managed properly. The capital needed to set up a business, to finance its day-to-day operation and development can be acquired from various sources. This necessitates the use of specific instruments for rational selection of capital sources as well as for capital generation. This is why the efficiency of those in charge of running a business, particularly its financial resources, which should result in achieving the paramount strategic goal of the business, i.e. the maximization of its owners' gains, reflected in a growth of its market value, is of such importance.

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Capital involved is the driving force behind each business, including a small one. Without sufficient capital, no business will develop. Decisions regarding financial resources affect other decision-making areas as well as the functioning of the entire enterprise [1].

This means that financial decisions play a crucial role in managing each business, irrespective of its size and other parameters characterizing its potential. They cement all aspects of business operation. This calls for a system approach to management, based on financial criteria. Such criteria refer, above all, to the choice of sources of finance, the forecasting of gains and costs related to the investment of capital in various assets, the assessment of associated risks, the estimation of the enterprise's projected and actual income, the assessment of financial liquidity, capital return and managerial efficiency.

Considering the financial content and subject of the decision processes referred to above, which occur at practically every business, it should be pointed out that they encompass:

- raising finance – financing day-to-day and investment activities,
- investing capital in various undertakings,
- managing working capital – handling current assets and current liabilities.

In developed markets all financial management functions are of equal importance. The strategic nature of investment and financing development activities warrants the opinion that decisions in these areas are the most important. The need to apply various financial methods, instruments and tools in order to defeat the competition and to achieve a market success constitutes every-day reality for each enterprise, not only for a large one. Such processes are equally important to small businesses, as they affect economic continuity and development prospects. Financial resources have an impact on both a business's capability to survive and its future competitive position. This is especially significant in the case of SMEs, because of financial barriers [2].

Each economic organisation that operates energetically and effectively finances its expenditures partly with its own assets and partly with third-party funds. It is not difficult for a business to develop if it covers all of its expenses with its own cash. The art of managing finance consists in using third-party money – to a reasonable extent, of course – with a view to achieving the business's fundamental aim, i.e. increasing the owners' resources (wealth) (gearing/leverage) [3].

2. CASH MANAGEMENT BY SMALL ENTERPRISES MODEL

Small enterprises maintain cash balances at an acceptable level without observing the procedures referred to in the literature. Many of the owners of small enterprises handle their financial liquidity by guess – this is the response received from 83.3% of

the surveyed small enterprises. A cash management model for small enterprises based on factoring and term bank deposits was prepared. Cash acquired from the factor can be placed on a term deposit with a bank until the enterprise has to meet its financial obligations in order to reduce the costs of dear factoring. Another management aspect is the choice of the quarterly tax payment regime by PIT, CIT and VAT payers so that the money can be kept with the bank longer.

In order to maintain financial liquidity, factoring and term bank deposits can be used, which is presented in the cash management model for small enterprises in Illustration 1. The factor is secured with the invoice issued by the enterprise.
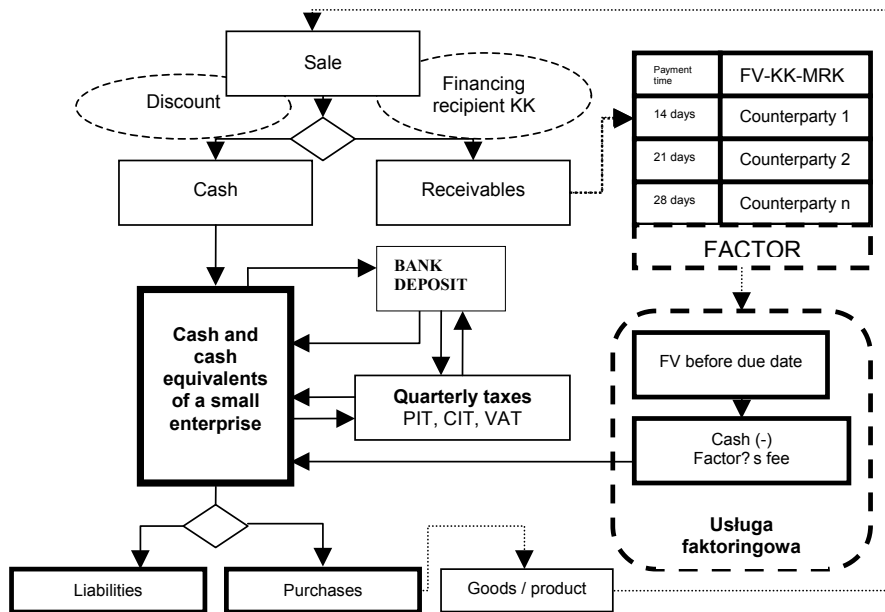
Illustr. 1. Cash management model for small enterprises.
Source: own concept
1 – _____ Cashflow, 2 – .... Accounting records flow

Small enterprises sell for cash and on trade credit, which generates accounts receivable. An enterprise's counterparties can be divided into two groups: high credit risk counterparties (FV-KK-DRK), who pay within varying time limits, and low credit risk counterparties (FV-KK-MRK), who pay within agreed time limits. A factoring agreement covers a selected group of small credit risk counterparties. The factor's client informs them about his choice of the payment system.

Polish banks or factoring companies offer factoring services to clients who present at least seven of their counterparties to which invoices are issued. The factoring agreement must also specify the upper or the lower cash limit to be used by the client.

The cash obtained from the factor can be used to finance the continued core business; it cannot be used to repay debts incurred by the enterprise, as factoring services are rather dear.

Factoring services should be used sparingly; only during major payment gridlocks, which can be foreseen. A factoring agreement can include information about the use of factoring by the small enterprise on an ad hoc basis.

The main drawback of factoring is its cost as compared with other available sources of finance (it is more expensive than traditional bank financing in the form of operating credit) [4, 5], especially where the enterprise has a large number of debtors and makes out relatively low-value invoices. Factoring costs should be analysed for each enterprise individually and in a broader context, considering the alternative costs in the form of the costs of insuring credit against commercial risk, the costs of collecting information about trade partners, and the costs of bad debts, i.e. doubtful receivables. When examining the possible use of factoring, one should not disregard the costs of interest on any loan or the risk of being refused a bank loan.

2.1. FACTORING AND ITS COST

Factoring is applicable to non-overdue receivables prior to the date of payment.
It has been assumed that the factor will obtain some rights to the receivables:
- **300,000.00 PLN** – non-overdue receivables sold to the factor (on the 1st day of the month),
- **240,000.00 PLN** (80%) – received by the enterprise from the factor (on the 2nd/3rd day of the month),
- **53,149.97 PLN** (20% minus the factor's fee) – received by the enterprise from the factor (on the 3rd day of the month),
- **300,000.00 PLN** – paid by the factor's client to his suppliers (on the 30th day of the month).

Table 1. Components of the factor's fee

X – amount of receivables sold to the factor	300,000 PLN			
FACTORING	[%]	Net amount [PLN]	VAT [%]	VAT [PLN]
A – front-end fee	0.80%	2,400.00	22%	528.00
B – service charge	0.20%	600.00	22%	132.00
C – del credere charge	0.40%	1,200.00	22%	264.00
Subtotal		4,200.00		924.00
D – discount commission		1,726.03		
d1 – payment time in days (e.g. 21)				
d2 – discount	10%			
d3 – number of days in a year (365)				
Total		5,926.03		924.00

The amount of receivables constitutes the basis for calculating factoring costs, which include: A – a front-end fee, B – a service charge, C – a del credere charge, D – a discount commission, which is calculated according to formula (3). The components of the factor's fee are presented in Table 1.

$$D = [(X*d2)*(d1/d3)] \ (3)$$

Factoring services are settled by means of a VAT invoice, which specifies the net value of the service and the amount of VAT. A specimen VAT invoice is presented in Table 2.

Table 2. Specimen VAT invoice issued to the factor's client (enterprise)

INVOICE No. XX/200X	Net amount [PLN]	VAT	VAT amount [PLN]	Gross amount [PLN]
1	2	3	4	5
1) Factoring service	4,200.00	22%	924.00	5,124.00
2) Factoring service	1,726.03	Exempt		1,726.03
Total	5,926.03		924.00	6,850.03

The VAT invoice is received by the enterprise from the factor; it is a tax document reducing the enterprise's operating costs and output VAT.

2.2. GENERATION OF INCOME FROM BANK DEPOSITS

Any cash obtained from the factor can be placed with a bank, as a term deposit, until the enterprise needs to meet its obligations. Our example assumes that the term deposit will amount to 300,000 PLN.

Banks offer various annual rates of interest on term deposits. By way of example, the lowest interest rate offered by PKO BP and the highest interest rate offered by ING Bank have been selected.

A small enterprise has hardly any room for negotiation with its counterparties with a view to extending payment times for its obligations (one month at most). Any cash received from the factor can be placed with a bank as a term (one month) deposit. The amounts of income generated by such deposit are presented in Table 3.

Table 3. Amounts of income generated by a term deposit

Name of bank	Annual interest	Amount of interest [PLN]		
		1 month	2 months	3 months
PKO BP	2.85	712.50	1,425.00	2,137.50
ING	8.00	2,000.00	4,000.00	6,000.00

The average interest income generated by the term deposit is shown in Table 4.

Table 4. Average interest on a term deposit

	1 month	2 months	3 months
Average interest income on a term deposit [PLN]	1,356.25	2,712.50	4,068.75

Each enterprise is able to negotiate with the bank the interest rates on its term deposits.

3. PROJECTIONS OF CASH BALANCES

In order to maintain adequate cash balances not only does one need to monitor current assets and current liabilities on an ongoing basis, but also to determine the amounts of assets and liabilities to be held in the near future. Consequently, it is necessary to plan future cash inflows and outflows. The enterprise's cash needs are one of the most important components of short-term planning [6].

In order to forecast cash flows in an example small enterprise the historical information from its balance sheets and profit and loss accounts for the years 2001–2007 were used (Table 5).

Table 5. Actual sales, costs, net profit, accounts receivable, accounts payable, current liquidity ratios and return on sales of an example enterprise in the years 2001–2007

	Selected actual amounts [PLN]	2001	2002	2003	2004	2005	2006	2007
1	Sales	2,691,338.84	2,158,787.74	3,390,822.68	6,134,709.94	9,684,341.81	11,502,982.98	13,553,936.34
2	Costs	2,607,769.50	2,132,863.54	3,329,801.50	5,973,288.66	9,399,725.07	11,165,520.82	13,189,477.21
3	Net profit	83,569.34	25,924.20	61,021.18	161,421.28	284,616.74	337,462.16	364,459.13
4	Receivables	337,288.65	150,643.97	321,655.97	411,852.11	648,076.01	875,891.51	1,249,130.02
5	Liabilities	405,078.05	143,252.72	266,128.54	395,875.58	522,793.50	769,730.30	860,645.25
6	Liquidity ratio	1.25	1.17	1.07	1.55	1.55	1.41	1.41
7	Return on sales [%]	3.11	1.20	1.80	2.63	2.94	2.93	2.69

The example presents the principal parameters that have a direct impact on the amount of cash in an enterprise, i.e. sales (issued invoices), accounts receivable (extended payment options for sales invoices for customers), costs (purchase invoices and other payables) and liabilities (extended payment options for suppliers and other creditors). Using the 2001–2002 data the values of selected parameters for 2003 were projected. The 2004 projections are based on the actual data from the years 2001–2003. The projections for successive years take account of all the relevant historical data. Selected parameter projections for the years 2003–2007 are presented in Table 6.

The obtained projections of receivables and liabilities for the year 2003 are negative, as they are encumbered with serious errors. The historical data from two

years are insufficient. In fact, the receivables and liabilities are positive values, disclosed in the balance sheet on the assets side and the liabilities side respectively.

Table. 6. Projected sales, costs, net profit, accounts receivable, accounts payable, current liquidity ratios and return on sales of an example enterprise for the years 2003–2007

	Selected projections [PLN]	2003	2004	2005	2006	2007
1	Sales	1,626,236.63	3,446,466.93	6,484,451.86	10,200,578.64	12,865,041.02
2	Costs	1,657,957.58	3,412,176.85	6,334,304.66	9,915,990.53	12,491,444.35
3	Net profit	–31,720.95	34,290.08	150,147.20	284,588.11	373,596.67
4	Receivables	–36,000.71	254,230.18	404,035.77	638,738.20	885,118.69
5	Liabilities	–118,572.61	132,536.93	326,400.83	493,041.81	726,306.18
6	Liquidity ratio	1.09	0.98	1.46	1.61	1.58
7	Return on sales [%]	-0.71	0.73	1.97	2.66	2.95

An analysis of the deviations of the projected values of the selected financial components has shown that such projections should be based as much as possible on historical information. The obtained projections with small deviations from the actual values can be taken account of in making financial decisions.

4. CASH OF A SMALL ENTERPRISE − A COMPUTER APPLICATION

When conducting economic activity, even small enterprises should document all events by means of internal documents, e.g. DW (journal voucher), KP (cash register receipt), KW (cash register disbursement), and external documents, e.g. WZ (external release), bills or invoices. Using such documents, events are entered in tax registers such as Revenue Accounts, Revenue and Expense Ledger or Books of Account for the purposes of income tax, or in Sales Register or Purchase Ledger for the purposes of VAT (tax on goods and services).

Numerous computer applications for tax settlements have been developed by such firms as Insert or CDN. These can be used for assessing taxes for many enterprises. The information collected in the application registers reflects the operating history of businesses and can be used for financial analysis.

One of the major tasks in managing a business is the maintenance of financial liquidity. Payment gridlocks are a common cause for losing such liquidity, also in the case of small enterprises.

The payment gridlock reduction model applicable to small enterprises that is described in this paper has been used in the Środki pieniężne w małych przedsiębiorstwach [cash of a small enterprise] application]. The program can be utilised to analyse the profitability of factoring, possible reduction in lost opportunities by making use of bank deposits and the projection of cash value for the purposes of limiting payment gridlocks in business. The program has books of account ledgers and other registers for entering tax information from enterprises' tax registers. If need be,

additional modules can be implemented for detailed analyses by individual enterprises. The main modules available for analysing tax information include: A – Aktywa [assets], P – Pasywa [liabilities], RZS – Rachunek zysków i strat [profit and loss account], ID – Informacje dodatkowe [additional information], RPP – Rachunek przepływów pieniężnych [cash flow statement], W – Wskaźniki [ratios]. Cash balances can be projected on the basis of historical information in the modules designated as: A(Pgn) – Aktywa prognozowane [projected assets], P(Pgn) – Pasywa prognozowane [projected liabilities, RZS(Pgn) – Rachunek zysków i strat prognozowany [projected profit and loss account], ID(Pgn) – Informacje dodatkowe prognozowane [projected additional information], RPP(Pgn) – Rachunek przepływów pieniężnych prognozowany [projected cash flow account], W(Pgn) – Wskaźniki prognozowane [projected ratios], and OD(%) – Odchylenie wartości prognozowanych w stosunku do wartości rzeczywistych [deviation of projected figures from the actual figures]. The above-mentioned modules can be used for analysis based on input actual data by means of the following functions: faktoring 1, lokata 1, faktoring 2, lokata 2, which is shown in Illustration 2. When using the faktoring 1 function, on the basis of actual figures in A – Aktywa, item Należności [accounts receivable], a decision must be made about what part of the rights to the accounts receivable should be given to the factor.
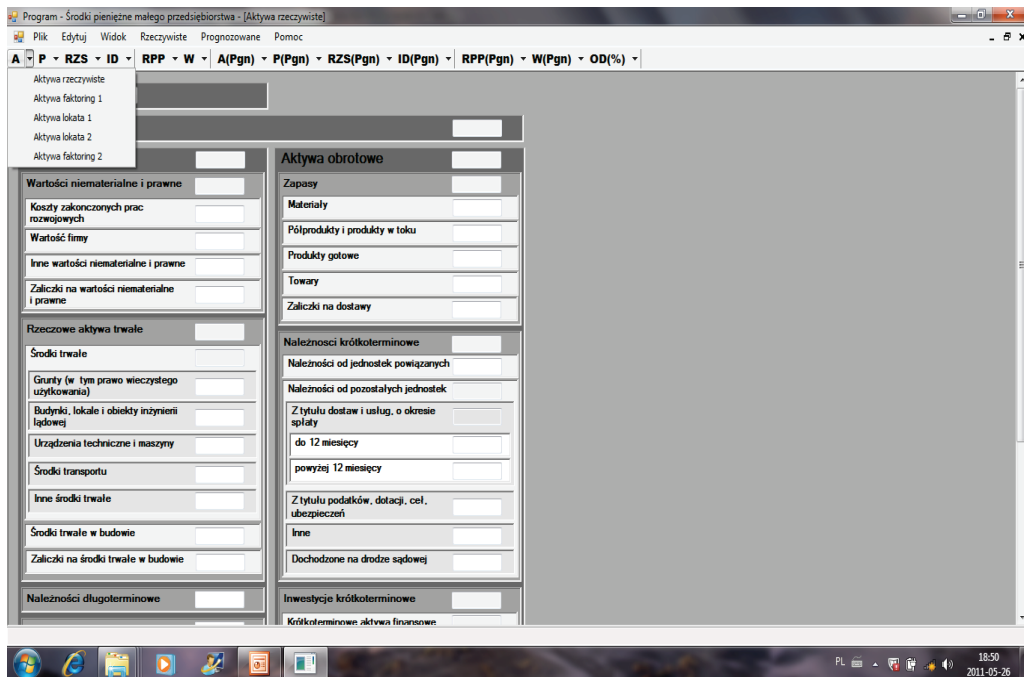
Illustr. 2. Modules and functionalities offered by
the *Środki pieniężne małego przedsiębiorstwa* application

Illustr. 3. Summary of factoring costs
in *Środki pieniężne małego przedsiębiorstwa*

Illustr. 4. Summary of income (interest) from a bank deposit
in *Środki pieniężne małego przedsiębiorstwa*

Using the established value of accounts receivable, the costs of factoring can be calculated by means of the Obliczanie faktoringu function, which is presented in Illustration 3. The factoring costs change in the following modules: P – Pasywa – Faktoring 1 in Zysk (strata) netto [net profit (loss)], RZS – Rachunek zysków i strat [profit and loss account] – Faktoring 1, items Odsetki [interest] and Inne [other] in other modules. At the next stage of the analysis the value of the lost opportunities is established, i.e. the term bank deposit is selected that will be used for placing the cash obtained from the factor, which is shown in Illustration 4.

The amount of income from a bank deposit changes the figures in module A – Aktywa lokata 1, items Środki pieniężne w kasie i na rachunkach [cash at bank and in hand] and Inne środki pieniężne [other cash and cash equivalents], whereas its value increases in module P – Pasywa lokata 1 [liabilities deposit 1], item Zysk (strata) netto [net profit (loss)]. In module RZS Lokata 1 [deposit 1], item Przychody finansowe [financial income] increases in item Odsetki [income], and so on in other modules.

In projecting cash balances the historical values, registered in individual modules, are taken into account, which is shown in Illustration 5.

Illustr. 5. Projected cash balances
in *Środki pieniężne małego przedsiębiorstwa*

Cash balances can now be projected on the basis of two reporting periods (years) of the enterprise's operation. Obviously, such cash balance projections are encumbered with serious errors. The projections for the successive periods, which take into account

all the historical operating periods of the enterprise, are characterised by small deviations from the actual figures.

CONCLUSIONS

Managing cash in a small enterprise is a very difficult process. Payment gridlocks, which are increasingly common in business and which particularly affect small enterprises, force firms to look for new solutions to maintain cash balances at an acceptable level. Payment gridlocks can be eliminated, for instance, by factoring. The factoring system proposed in this paper is less complicated, but also expensive; the costs can be reduced by placing the cash received from the factor with a bank, as a term deposit, until the enterprise is required to meet its financial obligations. Another cost-cutting mechanism is the payment of PIT, CIT and VAT on a quarterly basis, as a result of which cash can be kept longer with the bank. The actual figures describing the enterprise's operation in the past can be used to predict cash inflows and outflows. The application Środki pieniężne małego przedsiębiorstwa, which implements a payment gridlock reduction model, can be used in managing a small enterprise. The maintenance of financial liquidity should be regarded by small enterprises as a priority, as this is one of the crucial factors enabling them to survive on the market.

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Paweł HOLDENMAJER

COMPARATIVE ANALYSIS
OF TRADING SOFTWARE
FOR STOCK EXCHANGE INVESTORS

Number of individual investors on Warsaw Exchange Stock is one of the highest in Europe. The number of securities accounts depends on the situation on the stock while the number of internet securities accounts has been increasing continuously since several years.

The functionality and reliability of trading software for stock exchange individual investors is nowadays an important factor that can attract new investors. This work presents a comparative analysis of five applications that are most common in Polish brokerages. A methodology of the research was described. One stated seven main functions important from a viewpoint of investors. The level of these functions realization in each system was estimated according to the rules worked out. Moreover the questionnaire survey was conducted to examine opinions of the users and to assess the importance of particular function. The results helped to state the significance of each function and to calculate the position of each analyzed application in the final ranking. The results obtained were presented, discussed and compared with the results of different survey carried out by the Polish Society of Individual Investors in 2010.

1. INTRODUCTION

In principle the stock market works in a way that is similar to any other market. There are two sides: buyers and sellers and they want to exchange their stocks. The buyers plan how much they can pay for them and the sellers know how much they want to sell for. The buyers make an offer ("bid"), the sellers list their price ("ask") and then the actual price of the stock goes up or down in value. Traditionally, stocks were exchanged on the trading floor of a Stock Exchange, which was crowded by

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brokers wearing red suspenders and yelling out prices. However this image is completely outdated because today most of the biggest stock exchanges use computer system. It means that stocks are sold electronically – both buyers and sellers place exchange orders through computer software. The individual investors can do it making use of brokerage's services or personally – using software for stock exchange individual investors. The functionality of those systems varies depending on the brokerage.

2. SECURITIES ACCOUNTS

2.1. TRADITIONAL SECURITIES ACCOUNTS

The number of securities accounts has increased in Poland by almost 350 000 during last year. Towards the end of 2010 year the number of these accounts was about 1 477 500 and as it can be seen from the figure 1, it means an increase by 30% compared to the end of 2009. This rise in the number of accounts is closely connected with the privatization of some big companies. Nevertheless last year was record-breaking because never before the interest of investors has been such visible.
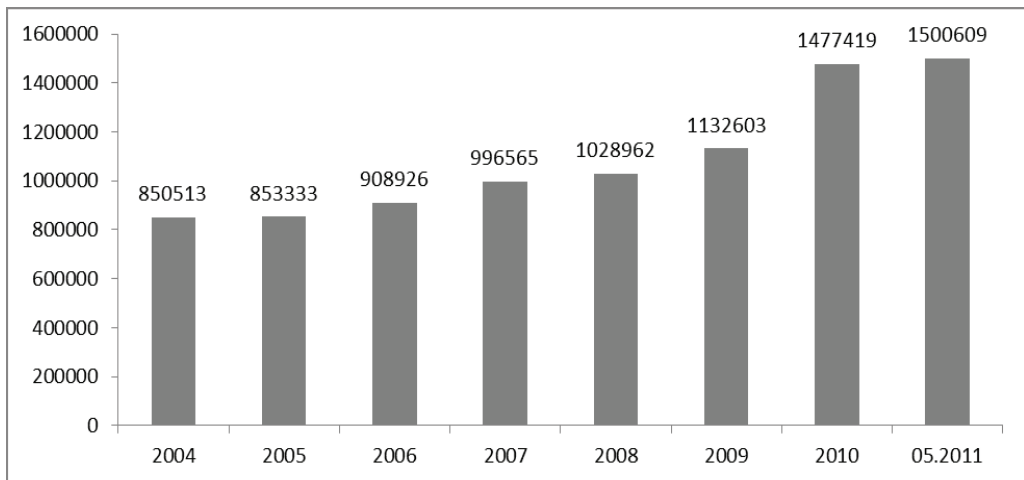

Fig. 1. Number of securities accounts in Poland 2004–2011 [1]

Today in Poland 14 banks and 51 brokerages have a permission to carry out activity. A number of brokerages has doubled during last ten years and at present reaches the level from the beginning of 90. (it was a period of rapid growth in Polish economy).

Taking into consideration the number of securities accounts DI BRE Bank was the leader at the end of May 2011 (with about 220 000), in second position was CDM Pekao SA (around 214 500) and the third place was occupied by DM Pekao SA (about 182 000) [1].

2.2. ONLINE BROKERAGE ACCOUNTS

Number of new securities accounts depends closely on the situation of the stock exchange and it obviously increases during the bull market. Number of online brokerage accounts proliferate irrespective of that situation, even during the slump. In 2003, when the biggest four-year boom has started on the Warsaw Stock Exchange, only 41 000 stock market players used Internet. In 2007, at the peak of the bull market, the number of online accounts exceeded 23000, and at the end of April 2010, after the slump, it amounted to 410 000 [5,7]. Changes in the number of all securities accounts and online brokerage accounts within the space of the last six years are presented on the figure 2.
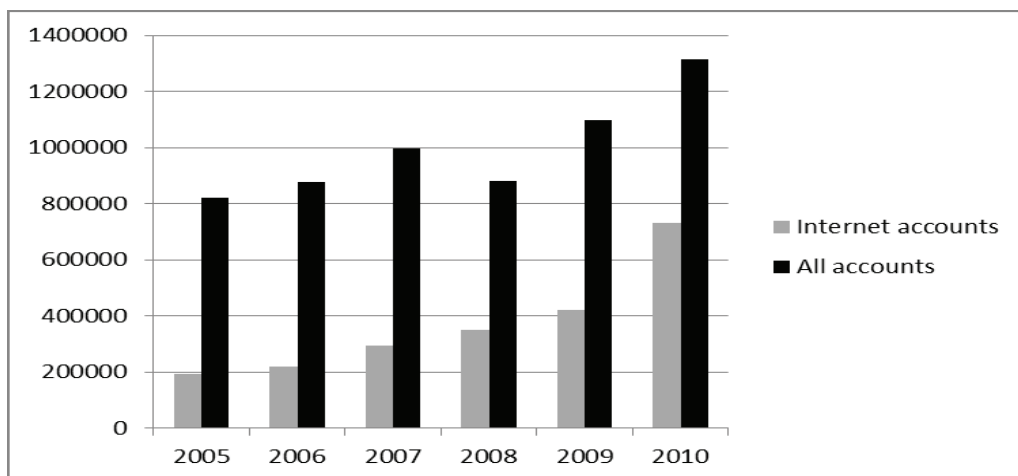

Fig. 2. Number of online brokerage accounts in Poland
in comparison to a number of all accounts 2005–2010 [2]

Along with the growth of wealth and economic consciousness of society and an easy access to financial service, a participation of individual investors gains an importance. Use of Internet has displaced former methods of placing bids and asks (by fax, by phone, in person). In 2010 a number of orders placed via Internet made 72% of the share trading market value and 83% of the forward transactions and options market value [5].

3. TRADING SOFTWARE

In Poland, the first institution that offered internet access to trading platform was BOŚ S.A. Brokerage House in 1996. Since that time more and more brokerages has made available this service. An open access to brokerage platform using browser or application is a standard now. It is more comfortable, quick, cheap and the investor has possibility to use his account at any time of the day or night. However a simple access isn't sufficient nowadays. Investors are more and more demanding and they want not only to have a possibility of checking shares quotations but also of familiarizing themselves with stock exchange reports, analyses, recommendations and first of all a possibility of placing exchange orders. In these circumstances brokerages do their best to adapt their applications to the investors' needs.

3.1. FUNCTIONS OF APPLICATIONS

An ideal application that enables investing via Internet should be free, stable during trading session and has functions that are in accordance with investor's preferences. A set of basic functions useful for investors is described below [6].

- History of an account – a possibility of browsing all transactions that were carried out. History involves all transactions, orders and transfers. Data can be sorted according to different criteria (date or type of an offer). An investor can choose a history of one security or a range of data that he is interested in.
- Quotations survey – it is probably the most popular and frequent use function. Many brokerages give their clients a possibility of surveying offers for free, however the number of available offers depends on the monthly turnover of the investor. For example in Bzwbk Brokerage one receives five best offers if monthly turnover exceeds 100 000 PNL. If the monthly turnover exceeds 200 000 PNL one receives complete information. Of course an investor can also determine a set of offers he wants to receive and pay for it.
- Adjusting an application to personal preferences – an investor can choose his favorite colors for application, typeface and size of font. One can also determine preferred companies or indicators used for technical analysis that should always be within reach. All preferences can be saved and applied during next use of application.
- Fundamental analysis – it is a method used to determine the value of a stock by analyzing the financial data that is "fundamental" to the company. One takes into consideration variables that are directly related to the company itself, such as its earnings, its dividends, and its sales. Fundamental analysis concentrates exclusively on the company's business in order to determine whether or not the

stock should be bought or sold. Its methodology doesn't take into consideration overall state of the market [4].

- Technical analysis – it uses a different types of charts and calculations to find trends in the market and individual stocks and to try to predict what will happen next. Technical analysts don't take into consideration qualitative data about a company (for example, its management team or the sort of industry). They believe that they can accurately predict the future price of a stock by looking at its historical prices and other trading variables. According to technical analysts, market psychology can wield enormous influence on trading so they are able to predict stock rises and falls [4].
- Recommendations – some brokerages make available reports prepared by professional analysts. The most important parts of these reports is an analysis of company prospects and its valuation that based on the results of fundamental analysis.
- Creating own investing strategies – they are based on the results of technical analysis. It is necessary to determine whether the strategy will concern securities buying or selling. Moreover the indicators taken into consideration and their levels should be determined. New strategy is saved and it is possible to compare its potential results with a profit made from investing in WIG companies.

3.2. APPLICATIONS COMPARISON

One takes into consideration five of the most popular applications for internet securities accounts:
- AmerNet – an original trading system of AmerBrokers brokerage, it has been used since 2000.
- Atech Professional – a system for investors from DnB Nord Polska brokerage, Probably, it has been used since 2007.
- eMakler – an easy browser-based trading platform for mBank clients. It has been used since 2005.
- NOK 3 – one of the most popular application offered by brokerages like: DM AliorBank, DM Bzwbk, DM Bossa, DM BankBPH. Probably, it has been used since 2006.
- Sidoma8 – a system for investors from ING Securities or XTradeBrokers brokerages. It can be used irrespective of a web browser that is applied and has a version for mobile phones. An application was introduced in 2005 and version 8 has been used since 2010.

All these applications have been compared according to seven functions that were described above. The results are presented in table 1. A sign "X" means that a function occurs in the application. The results show that the application that have been taken

into consideration differ widely. Only two systems (Atech and Sidoma8) have all functions required. One application (eMakler) falls behind the others.

Table 1. A functionality of applications for internet securities accounts [3]

Application Function	AmerNet	Atech	eMakler	NOL 3	Sidoma8
Quotations survey	X	X	X	X	X
Orders placing	X	X	X	X	X
Transactions archive	X	X	X		X
Adjusting to personal preferences	X	X	X	X	X
Own strategies creating		X		X	X
Technical analysis	X	X		X	X
Fundamental analysis	X	X		X	X

4. RESULTS OF RESEARCH

The research was conducted in May 2011. Its purpose was to familiarize with the investors' opinion about trading software. First, a questionnaire was prepared and distributed among stock exchange investors [3]. Men between 25 and 40 years old were in the majority, what was in accordance with the profile of Polish investor. Most of the respondents used eMakler and NOL 3 (33,7% each) and Sidoma8 (15,8%). The experience in using systems was different. About 39% of investors have been using it shorter than one year, however the sizes of three groups were similar.
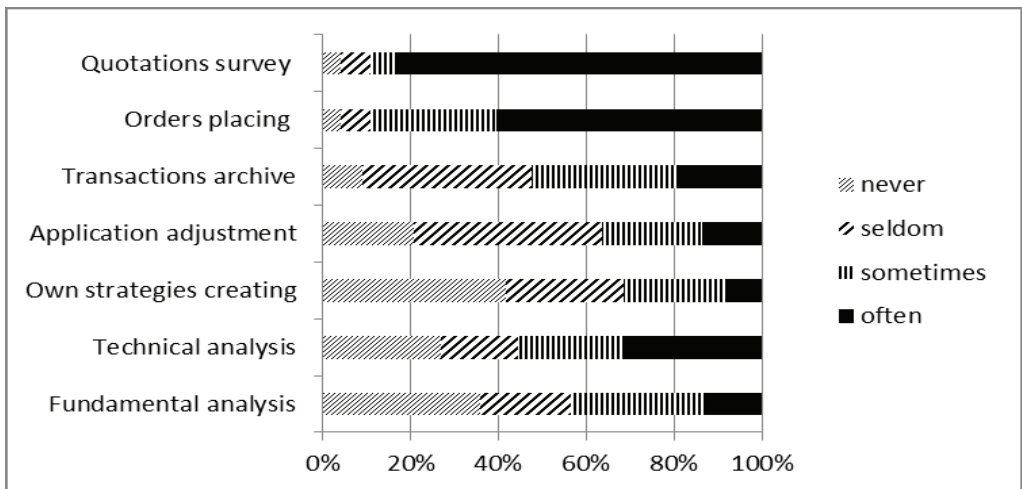

Fig. 3. Functions usage frequency [3]

To date more than three quarters of investors used only one system. People who decided to change it justified their decision mainly by: high costs of commissions, low level of functionality and system frequent failures. Two thirds of the respondents didn't observe any problems with their system during last six months. This result shows that analyzed applications work properly, however detailed question proved that no system functioned without problem during that period.

Figure no 3 presents how often respondent use functions described in the chapter 3.1. The most frequently used function is "Quotation survey" (83% of respondents uses it often). Surprisingly, function "Orders placing" is often used by only 60% of investors and sometimes by almost 29% of them. "Technical analysis" is next in the order of importance – it is often used by 32% of respondents and used sometimes by 24% [3].

The less popular function is "Creating own strategies", however at the same time it is the less available function for investors because only three among five analyzed application offered it. No wonder that more than 42% of investors never used it. Own strategies are often built only by 8% of respondents and sometimes by 24% of them. "Fundamental analysis" isn't also universally applied by investors. Only 13% of them often use this function, 31% do it from time to time.
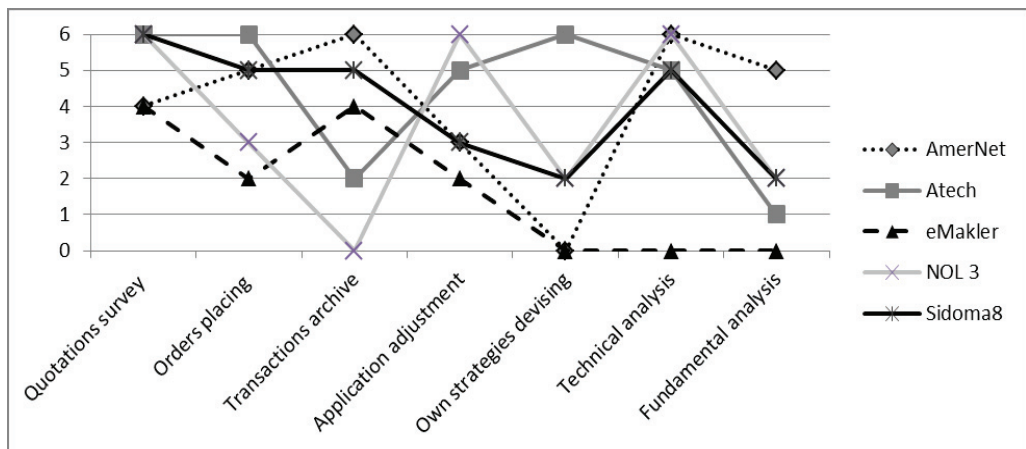

Fig. 4. The evaluation of the functions in analyzed applications [3]

Respondents were also asked to assess the importance of each function. As expected, the results were very similar to mentioned above and according to their opinion there are two equally important functions: "Orders placing" and "Quotations survey". Both of them has received notes close to 4.5 on a five-point scale. "Technical analyses" again takes third place with considerably lower note (3.7). All the other functions received significantly less points and their results were similar (from 3.2 to 3.4 points).

More than 85% of respondents is satisfied with the system they use and their attitude doesn't depend on the time they use the application. In respondents' view, the function that most of all requires polishing up in three the most frequently used systems (eMakler, NOL 3, Sidoma 8) is "Creating own investing strategies".

The last question concerned the feature that the users valued highly in online trading software. According to 40% of respondents, the most important quality of system it is its reliability. About 25% of those polled states that failure-free software is a significant feature. A little less respondents (20%) considers user-friendly interface as a most important quality. Only 15% of those polled thinks that the number of function is a basic advantage.

The next stage of research consists in evaluating the realization of each function in each application. A seven-point scale was applied where "0" means that the function doesn't occur in the system and '6' means that the function was carefully worked out. The results of this evaluation were very diversified (see figure 4). In the case of two systems (Atech Professional and NOL 3) as much as three functions obtained the highest score. However one system (eMakler) didn't have any function that got at least "5". At the same time this system obtained the highest number of "0" points. "Quotations survey" was the best evaluated function (26 points on 30 achievable). Both "Own strategies creating" and "Fundamental analysis" got the lowest result (only 10 points) and "Fundamental analysis" was also the only function without note "6".
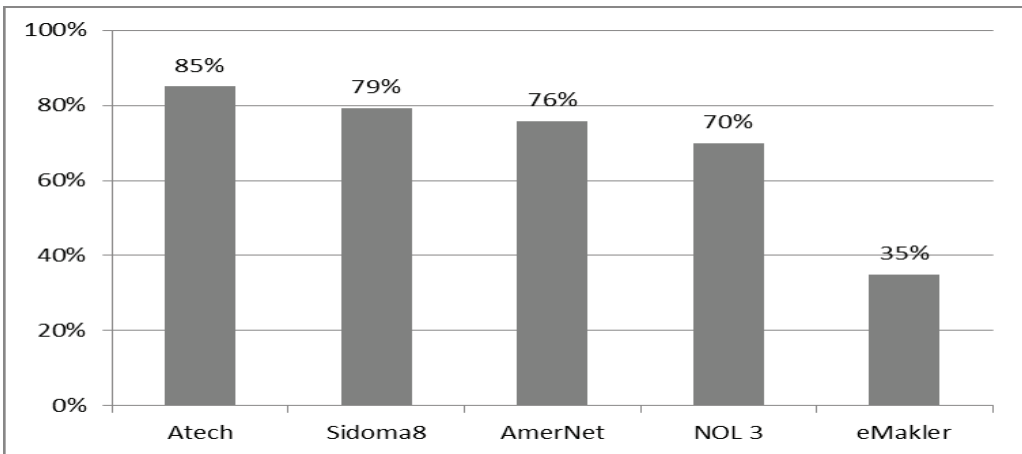

Fig. 5. Ranking of trading systems

At the last stage of research a significance of each function was determined and then final values for each system were calculated. The weights of each function were set taking into consideration both the importance of functions determined by respondents and experience of authors.

The highest weight (0.3) were assigned to two functions that are most often used and regarded as the most important by respondents. There were "Quotation survey" and "Orders placing". "Technical analysis" received the weight of 0.15. It is a very useful function but it is rarely used by investors because it requires necessary skills and experience. The weight of "Fundamental analysis" was 0.1. This function is used definitely more rare then "Technical analysis" and it seems to be underestimated by investors. Well performed fundamental analysis gives a lot of useful information about the analyzed joint-stock company. All remaining functions received the same weight – 0.05 – because they were rarely used by investors and in their opinion the significance of these function was low.

The products of weights and scores obtained by each function were calculated and added up (see figure 5). An undisputed leader of this ranking is Atech Professional with 85% of the points achievable. It is in every way a professional application. At first glance it may appear a little complicated but it is very useful for more experienced user. Two systems (Sidoma8 and AmerNet) have similar results – 79% and 76% respectively. In the case of Sidoma8 that takes second place it is worth mentioning about clear windows of the system and ergonomically designed buttons. NOL 3 received 70%. This system is widely used in Polish brokerages and a very intuitive interface is its strong point. eMakler is an outsider in this ranking. It obtained only 35% but supporters praise its simplicity and lack of unnecessary functions.

5. CONCLUSION

Individual investors' turnover of shares on Warsaw Exchange Stock makes 19% of the total turnover and its value amounts to 40,3 billion zlotys [6]. At first glance the choice of brokerage shouldn't influence the success in playing the market. Nevertheless the professional support in addition to good computer system attracts the investors.

According to the results of survey conducted in 2010 by the Society of Individual Investors, the most important factors taken into consideration choosing or changing brokerage by 3000 of Polish investors are [6, 8]:
- a quality of internet platform,
- a level of charges and commissions,
- a level of customer service.

The two first factors are very important for more than 70% of respondents who placed them on the first or second place. A quality of internet platform is more important than others features for the investors with a longer experience on the stock and for these who deal in large sums.

The results of survey show that the brokerages should give more attention to the functionality and reliability of the trading systems they offered. Nowadays, when a level of charges and commissions is similar in all brokerages a software perceived as fast, reliable and responsive seems to be the formula for success.

According to the results of research described in this work, the majority of respondents is satisfied with trading systems they used, moreover they highly value theirs reliability and good functioning. One analyzed five systems taking into account seven functions. The level of realization of each function in each application was assessed and final notes were calculated. Atech Professional was the winner of the ranking, Sidoma8 and AmerNet took the second and third places with similar score. The results of this ranking coincide with the opinion of the investors that took part in the survey conducted by Society of Individual Investors. In their opinion, the quality of internet platform was the highest in XTradeBrokers where Sidoma8 is used.

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