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## SECTION 2

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**11th European conference of young researchers and scientists**

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# Can intellectual property basics help to determine the value of radio spectrum?

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**Abstract.** This paper deals with radio spectrum as an intangible asset. It provides short view of how radio spectrum is treated in economic theory from macro or micro point of view and explains the basic value theory of radio spectrum. After, the basics of intellectual property are presented and methods of estimating the value of intangible assets are chosen for valuation of radio spectrum license – which is micro economic point of view as radio spectrum value depends on the price that operators are willing to pay for it. In the end the paper outlines theoretic approach for radio spectrum revenue sharing.

**Keywords:** Radio spectrum, value, license, intellectual property.

## 1. Introduction

The radio spectrum is the part of the electromagnetic spectrum from 8.3 kHz to 3000 GHz allocated to 40 Radiocommunication services in line to the Radio Regulations (RR) of the International Telecommunications Union (ITU). [1] In this paper we focus on radio spectrum allocated to mobile operators and approaches applied for estimating the value of spectrum.

Radio spectrum is a scarce resource, understanding its economic value[1] is crucial to managing it efficiently. With the rapid increase demands for spectrum, especially the rapid development of global mobile internet, constant growth of mobile data services and steep rise in mobile subscribers, the traditional spectrum management approach, which based on administrative authorization, has no longer met the need of society and economy development.

Theoretical basis for spectrum value says it is not inherently valuable; rather its value derives from its use in deploying wireless services. As the profitability of spectrum-based services increases, the value of deployable spectrum assets also increases.

Estimating the value of radio spectrum, however, creates challenges not found in valuing most other assets. For goods that are traded regularly, looking to comparable markets transactions and possibly adjusting for unique features, as one would adjust the price of house for number of rooms it contains, usually provides a good indication of value. For goods that are not publicly traded often – think of nuclear power plant – market comparables alone will not work as well. The value of radio spectrum is difficult to measure even for its intangible nature.

## 2. Literature review

Radio spectrum as a scarce resource is treated in various different ways, because there is no clear definition in economic theory how radio spectrum should have been viewed.

[1] Economic value is represented by the maximum amount a consumer is willing to pay for an item in a free market economy. In contrast, market value represents the minimum amount a consumer will pay. Economic value thus often exceeds market value.
While National Regulatory Authority (NRA) is a seller of licenses of radio spectrum (a license can be perceived as a right to use certain portion of spectrum) a consumer may be represented by a mobile operator, however, final consumer is a mobile service subscriber.

## 2.1. Economic theory of radio spectrum

Literature pointed out that the economic value of the radio spectrum shows in both of the macro and micro aspects. On the macro level, spectrum´s economic value can be consider as the economic activity´s value that produced by the radio spectrum devoted into production as an economic factor. On the micro level, spectrum´s economic value could be calculated by the costs that operators pay for using spectrum as a kind of raw material devoted into products. [2]

Many scholars made researches on spectrum evaluation through different methods, which generally treat spectrum as a *sort of production factor*. For the earliest period, Ronald Coase (1959) proposed that radio spectrum must be treated as a kind of production factor and its value must be determined in free market [3] and Corejova (2005) slightly modifies production factors in the field of telecommunication as labour, capital equipment and space - which includes land and radio spectrum. They can be combined in different proportions whereby each economic sector prefers different combinations. [4] Some regarded spectrum as a production factor as *capital*, and evaluated the contribution of spectrum to economic growth based on the Cobb-Douglas production function. [5] Some compares the radio spectrum to *land* and its value to form of a rent. While the iconic example of rent is the value of land, the concept applies equally well to radio spectrum [6] - they have very similar characteristics e. g. both of resources are varied, scarce, they can be made more productive, cannot be stored for later use or cannot be exported. [7] Afterwards some scholars employed the methods of *producer surplus and consumer surplus* to measure the direct economic contribution of spectrum to national GDP [8,9,10]. The method of Net Present Value (NPV) was also presented – some experts argue it is the best way to capture the estimate for spectrum value. It balances the net costs against the net revenues; to measure a spectrum value in a certain application is to calculate the current spectrum value by the present value of future profits that can be generated by the given band of spectrum. This is the economic concept of NPV:

$$NPV = \sum_{t} \frac{R_t - C_t}{(1 + r_t)^t} \tag{1}$$

The present value of an economic profit earned from a spectrum license over time is equal to the sum of the present value of each annual net return of revenue minus costs or net cash flow (R-C), discounted by the rate of return (r) for that year.

Since radio spectrum value is not static but kinetic, scholars are applying new approaches which attempt to capture the radio spectrum value e. g. using bottom-up Long-Run Average Incremental Cost (LRIC) models to calculate radio spectrum value for mobile operators; methodology for radio spectrum resource management, which analyzes the performance of the economic value of radio spectrum resources and proposes a set of economic assessment indexes; analysis of driving factors of spectrum demand and establishing a forecasting model etc. [11,12,13] More or less these approaches treat the radio spectrum as a sort of production factor.

If complete information were available each of these valuation approaches would result into similar estimates. Due to nature of spectrum, however, complete information is generally not available. [14]

## 2.2. Intellectual property

How can a spectrum be viewed in any form of intellectual property? The spectrum can be perceived as an economic resource and as a technical resource, but no matter the view it is constantly an intangible asset (not excluding for mobile operators and NRAs). Intellectual property rights are themselves a form of property, called intangible property.

Intellectual property is usually divided into two branches, namely “copyright” and “industrial property”. *Copyright* relates to artistic creations, such as poems, novels, music, paintings, and cinematographic works. In most European languages other than English, copyright is known as

author's rights. The expression copyright refers to the main act which, in respect of literary and artistic creations, may be made only by the author or with his authorization. [15]

On the other hand *industrial property* may be described as intangible property such as inventions, industrial designs, trademarks, which is afforded protection under national and international intellectual property laws. An industrial property right represents an asset for its owner which not only may be used by the owner himself, but can also be sold or licensed to third parties.

According to International Accounting Standards 38 (IAS38) the intangible assets are non-monetary assets which are without physical substance and identifiable (either being separable or arising from contractual or other legal rights) e. g. patented technology, computer software, mortgage servicing rights or licensing, royalty and standstill agreements etc. [16]

A right to use a certain portion of spectrum – license[2] – and the methodology of estimating the value of a license is adjusted in IAS; it includes definitions for common bases of value and generally accepted practice procedures for valuing assets of all types. Moreover, some types of valuations have already been used for radio spectrum valuation e. g. business type of valuation - discounted cash-flow method which is NPV concept.

In this paper we present the idea of radio spectrum valuation by methodology used for estimating the price of property rights – licenses. The value of license is derived from maximal amount a consumer is willing to pay – economic value of radio spectrum.

## 3. Methods

In this paper there are used few research methods:

- Method of analysis - data analysis is the process of extracting useful information from the given data series, that will be useful in taking important decisions;
- Method of synthesis - defined as the opposite procedure of analysis, used to combine separate elements or components in order to form a coherent whole.

## 4. Empirical analysis

In Slovak Republic the current legislation regulation for estimating the value of intangible assets can be found in Journal of Laws No. 492/2004, Decree of Ministry of Justice of Slovak republic. For valuation of property rights there are two methods, even though foreign literature points out more than two various approaches: Method of License Analogy (mostly known as a *Relief from Royalty Method*) and *Capitalized Excess Earning Method*.

These two methods are forms of the Income Approach[3], in which value is equated to a series of cash flows and discounted at an appropriate risk-adjusted rate. The Relief from Royalty method (RRM) is based on a hypothetical royalty (typically calculated as a percentage of forecasted revenue) that the owner would otherwise be willing to pay to use the asset – assuming it was not already owned. This is an economic concept of RRM (abbreviations are from Slovak origin):

$$HV = RV * LP * KZ * PM * KK \qquad (2)$$

The Capitalized Excess Earnings method (CEEM), on the other hand, calculates the value of an asset based on the expected revenue and profits related to that asset, less the portion of portion of

[2] The spectrum property rights model advocates that the spectrum resources should be treated like land, i.e. private ownership of spectrum portions should be permitted. The allocation of these portions should be implemented by means of market forces e. g. by auction. The basic idea of spectrum property rights was first proposed by Leo Herzel in 1951.

[3] The Income Approach is one of three major groups of methodologies (others are Asset and Market Approach), called valuation approaches, used by appraisers.

those profits attributable to other assets that contribute to the generation of cash flow. [17] This is an economic concept of CEEM[4]:

$$VSH_{nim} = SH_{oz} * p_{nim} \quad (3)$$

Since the range of paper does not allow describing each of method separately we present only the common parts. Both of methods have something in common – in equation (1) and equation (2) it is "p" (percentage, revenue sharing) – to be able to calculate the price of license for intangible asset it is necessary to estimate the share of intangible asset (the share of portion of radio spectrum) on company revenues.

### 4.1. Radio spectrum revenue sharing

The derived value of spectrum is based on the value that spectrum adds to wireless services [14], which means that being able to estimate the radio spectrum revenue sharing is crucial to calculation by above mention methods.

Wireless services are being provided by mobile operators using mobile networks serving to mobile subscribers. Radio spectrum creates its value in between of mobile network (services) and mobile subscribers as it is not inherently valuable itself – what is the value that spectrum adds to services to make revenues?

Radio spectrum revenue sharing can be determined by the intersection of sets (mobile network and subscribers) while the size of intersection describes the value radio spectrum adds to wireless services (Figure 1).

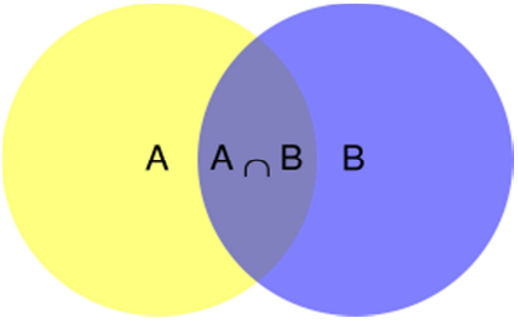


**Fig. 1.** Intersection of sets – value produced by mobile network (A) and value produced by mobile subscribers (B)

The intersection of *A* and *B* is written "$A \cap B$". Formally:

$$A \cap B = \{x : x \in A \wedge x \in B\} \quad (4)$$

Estimation of intersection of A and B can be calculated after each element of A and B is determined. Thus spectrum can be perceived as an economic resource and as a technical resource; the elements can be also be technical or economic nature. The economic elements makes radio spectrum evaluation kinetic.

The set of A is represented by mobile network and to find all elements the main question should be answered: *What elements are a part of mobile network and create the profit in mobile network?* Answering this question help to understand the economic value mobile operators see in radio frequency spectrum – the amount of difference between expected revenues and costs to mobile network.

[4] Detailed information about calculation methods can be found in Journal of Laws No. 492/2004, Decree of Ministry of Justice of Slovak republic.

The set of B is represented by mobile subscribers – demand side. *What elements are critical to demand and determinate it?* Previous researches show that when the demand side is ignored the impact of competition of investments is downward-biased. [18]

## 5. Conclusion

Question posed in the title of this paper may be answered – theoretically intellectual property rights can help to determine the value of radio spectrum. Intellectual property and methods for valuing intangible assets provides a good basic for evaluation appropriate goods, moreover some of methods are being already utilized for radio spectrum (NPV). Radio spectrum valuation is a complex process demanding a lot of information with market involving various stakeholders with different interest (NRAs, mobile operators, mobile subscribers) – that is the point where the existing methods can fail.

The understanding of value that radio spectrum adds to mobile services and mobile network can be a good start point for calculation the price of radio spectrum license and for further research, taking the micro economic point of view of spectrum.

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VEGA 1/0515/15 Endogenous factors of the IPR intensive Industries in the regional enterprise environment in Slovak Republic

VEGA 1/0916/15 Business Excellence status assessment in relation to the corporate social responsibility concept

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# Modern Communication in the Industrial Environment by Means of Augmented Reality

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**Abstract.** Augmented Reality (AR) technology is becoming more available not only for everyday applications but also for industrial use. OPS UA communication standard represent platform independent service-oriented architecture for industrial communication between client and server. In this paper we present a system combining both technologies to one solution. The task of this paper is to design a system where are integrated functionalities for the collection and evaluation of production data via the network connection. The essence of the implementation is identification of the industrial production unit using the augmented reality technology. This system forms an integral part of complex MES system and deals about integration of smart mobile devices.

**Keywords:** information system, data transport, augmented reality, OPC UA.

## 1. Introduction

Manufacturers of modern Enterprise (ERP) and Manufacturing Execution Systems (MES) in the framework of modern trends and innovations continue to increase its attention on user environment and mobility software solutions. Mobility systems in general are among the major trends of the present time, which will affect the whole area of industrial information systems for the future. In this paper we will focused on mobile solutions in MES. Companies are already sufficiently saturated intelligent mobile devices based on modern platforms such as iOS, Android, Windows which want to increasingly integrated into the business processes. The idea is not the creation of a complete MES system for mobile platforms, but rather the integration of some already exist functions and use the modern standards for industrial communication. Mobile application support and is usable in analyzing performance of individual units and maintenance control.

## 2. Manufacturing Execution Systems

Manufacturing Execution Systems (MES) are computerized systems used in manufacturing. MES can provide the right information at the right time and show the manufacturing decision makers. MES work in real time to enable the control of multiple elements of the production process as inputs, personnel, machines and support services.

MES might operate across multiple function areas, for example: management of product definitions across the product life-cycle, resource scheduling, order execution and dispatch, production analysis for Overall Equipment Effectiveness (OEE), and materials track and trace.

The idea of MES might be seen as an intermediate step between, on the one hand, an Enterprise Resource Planning (ERP) system, and a Supervisory Control and Data Acquisition (SCADA) or process control system on the other; although historically, exact boundaries have fluctuated [1].

### 2.1. The Idea of Mobile Devices in MES

MES represents complex functions and can't be confused with systems that address one or two aspects of the complete system. The latest model by MESA standardization considers the 10 basic MES functions. We focus on the key functional units of MES, where we see the greatest potential for integration of smart mobile devices. The area of use is:

- **Maintenance Control** - minimizing downtime and maintenance costs (card machine, maintenance requirements, work commands, scheduled maintenance, buying the warehouse, documentation management, reviews, analysis and reporting).
- **Performance analyzer** - measuring and improving efficiency in real time (OEE, downtime, performance, quality, non-productive times, the course of contract performance, registry work of operators).

## 3. Integrated Automation

At different production sites several MES and automation systems based on many platforms from various vendors are installed. Process control systems from many manufacturers are connected to discrete automation provided by many others manufacturers like Siemens or Mitsubishi. However each of the plants uses different set of equipment. Interoperability issues and incompatibility of many different proprietary protocols are big challenge at this kind of environment. On Production Level harmonized communication on the field and production level using 'Classic' OPC is already a standard and is successfully used in process control. However, Classic OPC is not a very good solution when there are communication needs to other company networks. It is not unified for all platforms in automation. The centralized applications need to collect data from process control, packaging and warehouse control. MES, Track & Tracing, OEE, LIMS, and database connections into the IT network require firewall friendly, cyber secure and reliable standardized protocol. The solution is new standard OPC UA.

### 3.1. OPC UA Industrial Standard

The OPC Unified Architecture (UA), released in 2008, is a platform independent service-oriented architecture that integrates all the functionality of the individual OPC Classic specifications into one extensible framework. Building on the success of OPC Classic, OPC UA was designed to enhance and surpass the capabilities of the OPC Classic specifications. OPC UA is functionally equivalent to OPC Classic but it is platform independent (hardware platform and operation systems).

OPC UA is the successor of the well known 'classic' OPC standard. UA replaces the old DA, A&E and HDA interfaces and adds platform independence, authorization and authentication using X509 certificates and SSL encrypted transmission. The migration from legacy OPC to UA systems via wrapper/ proxy components adds several advantages: it enables a stepwise integration, it introduces a single point of administration and configuration, and it can be done in an unchanged network infrastructure without impact on the existing communication [3].

### 3.2. OPC UA Data Transport Protocols

OPC UA defines an abstract set of Services that is mapped to different technologies. Currently there are two protocol mappings and two encodings supported. The reason for having abstract Services is that, if a new technology for data communication enters the stage, OPC UA can be adapted to that technology just by defining another mapping. The reason why OPC UA support two protocols is that OPC UA will be applied in different application domains with different requirements. Supporting HTTP and UA TCP allow it to run Internet applications crossing firewalls with HTTP as well as running optimized applications with limited resources via the UA TCP protocol, which is optimized for the wire (no overhead) and the needed resources (no HTTP stack

needed). But the main optimization on the wire is not UA TCP versus HTTP but exchanging binary encoded data versus XML encoded data. “Fig. 1” summarizes the use of different protocol options in a simplified form [2].

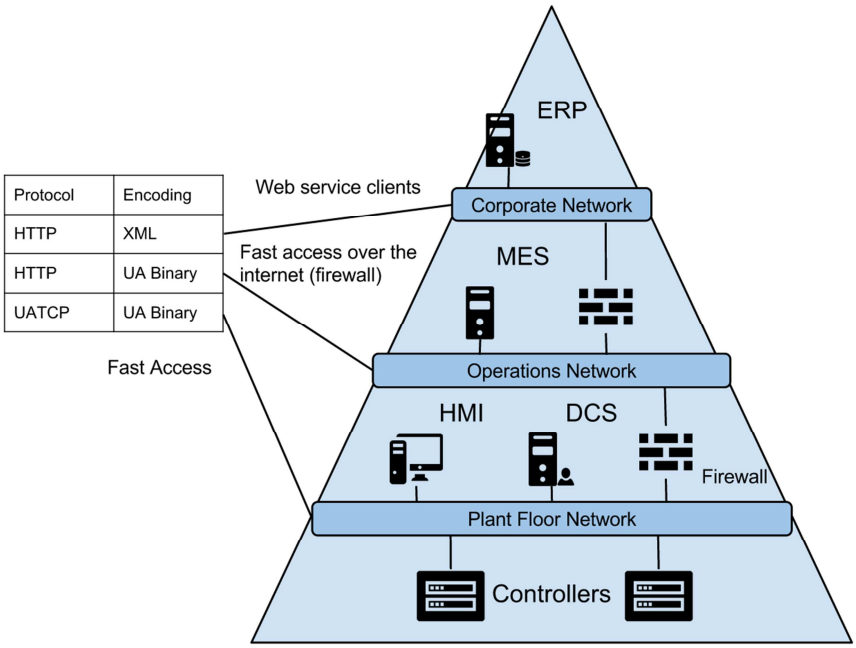


**Fig. 1** Simplified view of OPC UA transport protocols and use.

## 4. Overview of the solution

### 4.1. Defining System Requirements

The main idea is to design software solution, a mobile client that connects to an industrial information network and distributed information server based on OPC UC communication. Once connected, its role is to mine data from production unites, whose identification is based on the input data from augmented reality, the results are then displayed in form of user interface and augmented reality. The main requirement of the system is that it must be mobile, fast and usable at any location within the network. In the design, implementation and testing of different technologies were used, which were taken into account:

- **Industrial technology information network:** Industrial Ethernet (PROFINET)
- **Wireless network technology:** Ways of connecting a mobile client to the industrial network. (WiFI standard for wireless LAN networks based on IEEE 802.11)
- **Communication interface:** It used standardized industrial communication interface OPC UA. This interface is important mainly for the communication between server and the MES system.
- **Hardware components:** define all the technical means of information system requirements on the mobile client, server stations and all devices connected to the server from process level. From a process level we require that PLC devices are able to communicate on the software level with the OPC information server. Various manufacturers of PLC devices may use different communication protocols.
- **Software components:** define the software packages and its configuration, which is necessary for the proper functioning of the information system. The basic requirement is installed OPC server with UA architecture or UA gateway.

## 4.2. Augmented Reality and Industrial Unit Identification

The task of this work is to design a system where are integrated functionalities for the collection and evaluation of production data via the network connection. The essence of the implementation is identification of the industrial production unit using the augmented reality technology, connection to the industrial network via OPC UA interface, collect data about the identified unit through the network, their processing and visual display.

We use augmented reality and marker-less systems for identification manufacturing unites. The marker-less system detects and tracks the features that are naturally found in the image itself by comparing these natural features against a known target resource database. Every manufacturing unity need unique marker with unique identifier ID. For industrial use we need special type of fiducial marker called frame marker. This kind of marker has unique ID which is encoded into the binary pattern along the border of the marker image, see “Fig. 2”. Camera of a mobile device is used for marker identification.

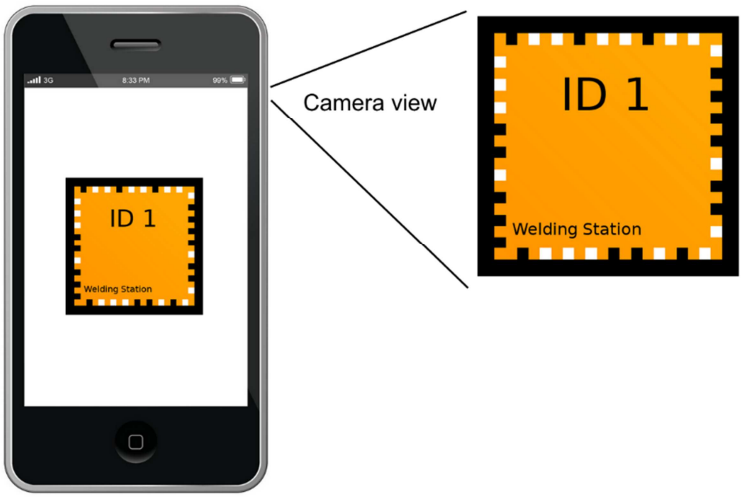


**Fig. 2** Frame marker captured by mobile device.

## 4.3. Basic Parts Description

Our automated system uses two servers. The first OPC UA server is considered as an information server, which is able to display and description of the all network components. Given the approach that is encrypted and secure certificates, it is possible to securely connect from other places than direct local network. The second server is used to recognize and identify markers for augmented reality, be regarded as a system for managing markers.

All functionality as OPC UA server, system for managing markers and our client form the basic functionality of the system and communication between the individual blocks as shown “Fig. 3”.

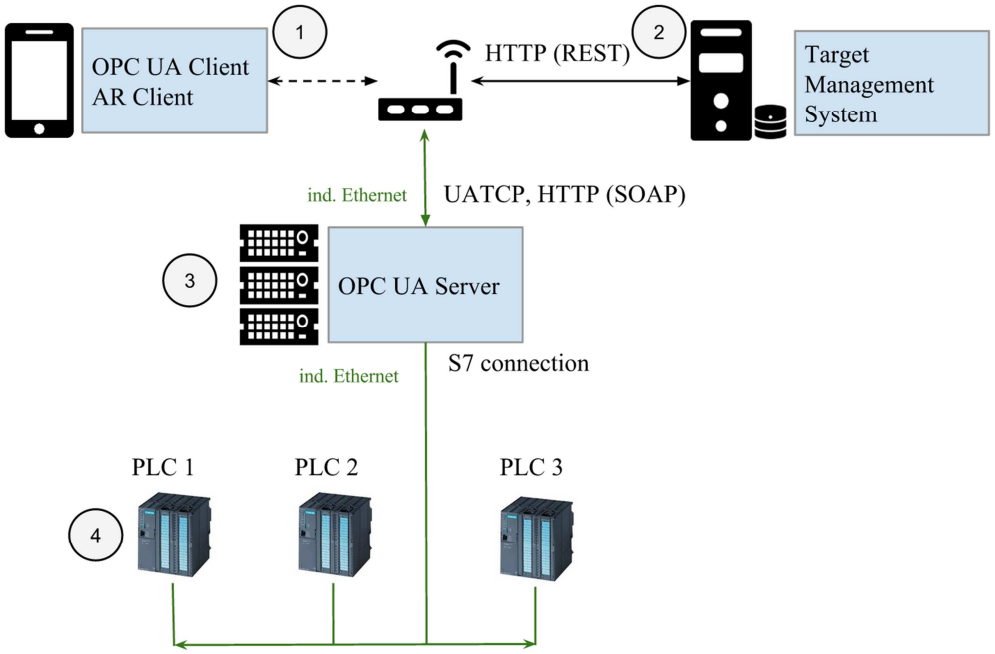


**Fig. 3** View the basic functions of the system.

| No. | Component | Description |
|---|---|---|
| 1. | Mobile Client | It represents our client application which consists of two main parts. The first is the OPC UA client that connects to an industrial information network and receives from it the necessary information about the required facilities. OPC UA client sends requests for OPC UA server and that it answers. The second part is a client for augmented reality, we call it also the client because we use online database of markers and marker cloud recognition. |
| 2. | Target Management System | It is the server that contains a database of markers. In general, this online system is used for creating databases where information about observed objects is stored. Cloud recognition system system is able to identify a marker and back send the necessary information. |
| 3. | OPC UA Server | OPC UA server transforms the data from a process level, such as the S7 data to OPC UA OPC data and provides services such as recording, read, write and monitoring of data. OPC server contains information about all devices in the process level. |
| 4. | Controllers | Represent devices that mediate the necessary information on the production units to which they are connected. |

## 5. Conclusion

In this paper we proposed an efficient system based on AR and modern industrial communication based on OPC UA standard. We focused on mobile solutions like integrated part of complex MES system. We see great potential for integration smart mobile devices where area of use is maintenance control and performance analysis.

The main task of this paper is to design a system where are integrated functionalities for the collection and evaluation of production data from process level via the network connection. The essence of the implementation is identification of the industrial production unit using a camera device the augmented reality technology. After identification it is connection to the industrial network via OPC UA interface, collect data about the identified unit via the network, their processing and visual display.

## Acknowledgement

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# The application of ergonomic prevention program and its benefits

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**Abstract.** On the basis of practical experience, it is possible to point out the fact that addressing the issues of ergonomics helps to humanizing the work, optimizing the working conditions and thus to the growth of productivity and quality of work. With the use of ergonomic programs can ensure the effectiveness of each element of the work process. Emphasis on the application of ergonomic program is currently due to the current because frequently occurring serious musculoskeletal injuries. The team, which is part of the program should provide an integrated approach to the ergonomic assessment.

**Keywords:** Micro ergonomics, macro ergonomic, ergonomic prevention programs, musculoskeletal disorders.

## 1. Modern ergonomics

For practical reasons, began to apply the division of ergonomics to micro ergonomics and macro ergonomics. This division is not yet fully enforced and applied in Slovakia. As stated Hatiar, macro ergonomics includes understanding of ergonomics as a whole. In the context of the development of new solutions it focuses mainly on equipment and systems. In their creation, we should start with the implementation of the legislation and to use such data as accurately characterize the population for which they are intended to be a solution. It is therefore a proactive approach [1, 5].

Micro ergonomics is trying to solve the problems in enterprises in a systematic way. In the context of ergonomic programs through ergonomic analyses and methods of trying to uncover the negative impact factors of work and working environment for employees. In particular, the effort to eliminate difficulties associated with musculoskeletal system that identifies deficiencies in terms of workplace ergonomics. The aim of micro ergonomics is to remove difficulties, thus achieve a positive impact on the health of workers and also bring the benefits of cost.

### 1.1. Ergonomic prevention programs

Working conditions are people working in enterprises tailored to only in exceptional cases. Currently, against improving conditions in the workplace are the people themselves due to fear of withdrawal risk premiums and the fear of losing their job.

From a practical standpoint, we can consider ergonomics for science, which seeks to ensure the human comfort and at the same time bring benefits to the enterprise [2]. When the requirements of the workplace or the workplace is higher than the physical skills of an employee, the result is often musculoskeletal disorders (MSDs).MSDs are also known in the context of other names:

- CTDs (cumulative trauma disorders).
- RSIs (repetitive stress or repetitive strain injuries).
- RMIs (repetitive motion injuries).

The most commonly used name for the MSDs are cumulative trauma disorders (CTDs).These belong to the group of diseases from wear and tear injuries, which may have an effect on the muscles, nerves, tendons, joints, blood vessels, spine, and other effects.

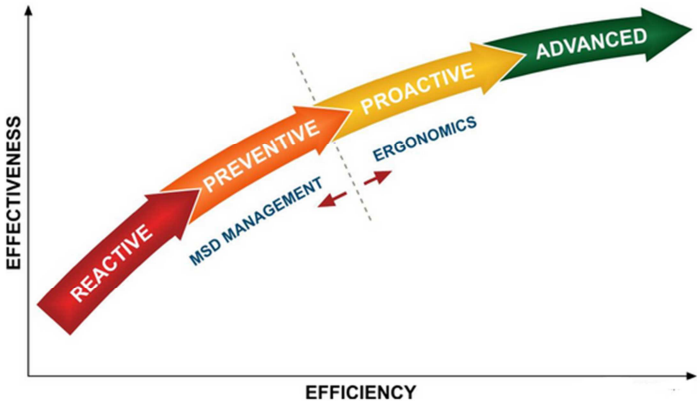


**Fig. 1.** The approaches ergonomic prevention program.

### 1.2. The application of ergonomic prevention programs in Slovakia

Enterprises in Slovakia adapt the working environment and production facilities to man only in very few cases. They focus in particular, to meet the requirements of current the legislation, pursuing the supervisory authorities, public health authorities and institutions of OSHA. Application of ergonomic preventive programs in companies would bring more effective ergonomic human labor, as well as economic benefits. Their use should be especially useful for their anti-crisis potential.

The application of ergonomic prevention programs to Slovakia is only used in such if does not turn out well control of the labor inspectorate or hygiene and it is needed to implement control measures. When the check finishes, it finishes the use of ergonomic programs. In some cases, there is a large percentage of the difficulties of musculoskeletal system that are caused by the implementation of demanding work. It is also a major employers in Slovakia and, therefore, the state authorities in solving this problem not placed from its own interests.

Slovak companies are trying to introduce ergonomic programs, but not to a sufficient degree. Doctors in the company who would regularly monitor the impact of the working environment on human health of businesses have gone and replaced them in occupational health services. Therefore, efforts to introduce ergonomic prevention programs remained only on safety technicians, who, however, in particular dealing with safety at work [5].

## 2. The methodology for creating and applying ergonomic prevention programs

In order to achieve optimum productivity, efficiency and undertaking to ensure minimum risk of injury to employees, it should apply preventive ergonomic program. The program aims to identify and eliminate ergonomic risk factors and thus improve workplace conditions. It is necessary to note, however, that a comprehensive and integrated approach will have the best results in the long term. A comprehensive approach is one which:

- improving workplace conditions through a systematic process of improving ergonomics,
- creating a "healthy workplaces" through systematic education and training process itself, early intervention and involvement of staff in the process of improving ergonomics.

As with all questions relating to safety and health at work, employees should be a key element in the development and implementation of ergonomic preventive program. Therefore, it is important that management understand the benefits of effective ergonomic prevention program and supported it.

Based on the findings has been proposed methodology for the development and application of ergonomic prevention programs. The methodology is illustrated by means of a flow diagram Fig. 1 and is divided into six main phases.

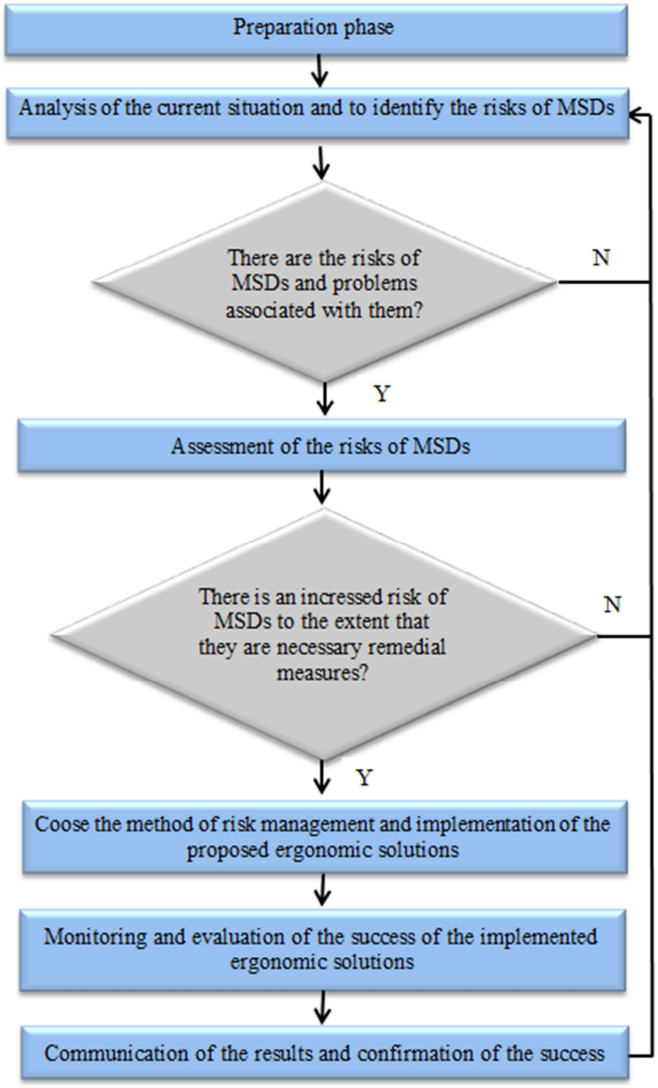


**Fig. 2.** Flowchart of the proposed methodology.

The methodology can be divided into six phases:

1. Preparation phase. To achieve maximum performance and productivity of the person it is necessary to choose a strategy that will ensure the health of employees. The main keys to preventing of risks of the MSDs in the workplace are:
   - The commitment and support of management.
   - The basic document concerning the process for the prevention of MSDs, which is available to all employees.
   - Employee participation in the process of prevention.
   - Providing training on the prevention MSDs to all interested parties.
   - Understanding of the risks of MSDs.
2. Analysis of the current situation and to identify the risks of MSDs. In the workplace, should be created by the procedure for the recognition of professional activities which may lead to the occurrence of the risks of MSDs. This procedure should be created even if not yet recorded any difficulties associated with MSDs. Some workplaces already have available a number of resources available, on the basis of which it is possible to recognize the work and it is possible to assume occurrence of musculoskeletal disorders. Regular monitoring of the data on injuries and accidents in the workplace, of data relating to human resources and data

from production, they can identify those occupational activities for which there are risks of MSDs. Completed Nordic Questionnaire on the perceived difficulty and discomfort in the workplace can be a source of information and can help to identify the jobs for which it is necessary to suggest improvements.

3. Assessment of the risks of MSDs. Risk assessment methods allow you to thoroughly assess the level of risk to employees performing work where the risk of musculoskeletal disorders.
4. Choose the method of risk management and implementation of the proposed ergonomic solutions. The aim ergonomic prevention program is to perform a control of the risks of MSDs. The diversity of approaches, ideas and suggestions may be helpful in eliminating of the risks to which workers are exposed.
5. Monitoring and evaluation of the success of the implemented ergonomic solutions. The implementation of the controls is not the last step in the prevention of risks. The selection process and the implementation of controls should then be monitored and should be evaluated by its success [3, 4].
6. Communication of the results and confirmation of the success. Communication tools are important to maintaining the interested members in the implementation of ergonomic prevention program and informing them of the results obtained.

Back to recognizing of the risks of MSDs and related problems. After the implementation and application of ergonomic prevention program is to ensure the prevention of the risks of MSDs constantly ongoing process. After informed about the results achieved, it is necessary to go back to the recognition of other risks and look for opportunities to improve.

## 3. Conclusion

Preventive ergonomic programs can be regarded as proactive security programs, which promote the ergonomics and health protection at work. All employees should work together and ensure the safety and health of their colleagues. Therefore, it is very important to develop a skilled workforce, which will apply the principles of ergonomic and healthy lifestyle while ensuring a decrease in work-related accidents.

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# Valuation Process in the Company using Economic Value Added

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**Abstract.** This article deals with the issue of company valuating as an important part of the financial management. Every investor wants to know the efficiency of his investments. This contribution shows the process of valuation and possible methods usually used in it. We focused on the income method –economic value added which calculates the value of the company using net operating assets and net operating profit after tax. Both theory and practical example point out the main adjustments that have to be made with the common data from the financial statements in the Slovak Republic. This article's outcome is the net equity value calculation in the company that will be the starting point for the future manager's decisions.

**Keywords:** valuation, valuation process, economic value added, net operating profit after tax, net operating assets.

## 1. Introduction

Valuation process is the traditional and important part of economic decision-making and standard economic discipline for enterprises in the developed market economies. This activity follows the needs of the market participants; it especially provides information for their investment and capital transactions decisions and helps to set certain criteria for taking effective decisions. The valuating process itself requires big, sufficient and reliable information base, which is available for the entities operating in these mature markets. Unfortunately, in terms of transition economies, where we advise Slovak Republic, this economic discipline got attention in recent years, at the turn 20th and 21st centuries. Its beginnings were not easy, especially because of the absence of classical economic market relations and the lack of legislative regulation. Later, there was created related legislation in the Slovak Republic and on the international level [6].

## 2. Valuation Process

Determination of the company's value requires certain procedure to do, because it is not possible to calculate it without the analysis of all available data. The aim of the analysis is to evaluate and assess the financial health of a company using common financial statements. As a basis for financial analysis were used balance sheet, income statement and cash flow statement (since 2010 to 2014) in the practical example, which we considered to be reliable and complete.

First of all, evaluator has to set the purpose of the valuation and to answer the questions: Who needs to know the value of the company? And why?

Literature [2] recommends use of the following steps by this process:

1. Collecting of input data
2. Data analysis
    A) Strategic analysis
    B) Financial analysis for detection of financial health of the company
    C) Distribution of assets on operationally necessary and unnecessary
    D) Analysis and forecast of value generators
    E) Approximate valuation based on value generators

3. Financial Plan
4. Evaluation itself
    A) Choice of method
    B) Evaluation of a company based on selected methods
    C) Summary of evaluation

To calculate the value of the company is not the process of price determination, because the term of value has not the same meaning as the term price. Price is the financial amount, for which the buyer buys some asset and for which the seller sells the item. The term *value* has certain forms; there is not just one kind of value used in practice. We can recognize the fair value, special value, synergistic value, going concern value, liquidation value, salvage value, intrinsic value. We also know many methods from the corporate finance theory and the most common in practice are those ones based on the assessment of income. Choice of method is an important step but all these methods are usually used in the combination which leads to the compliance of the company's value. There are lots of different methods in this field, but they can be classified in groups of approaches as follows [4]:

- Income Valuation Approach
- Market Valuation Approach
- Asset Valuation Approach.

The most common approach used all around the world for company valuation is based on incomes (Income Valuation Approach), which include following methods:

- Discounted Cash Flow (DCF)
- Economic Value Added (EVA)
- Capitalization of earnings
- Combined Method

## 2.1. Economic Value Added and Market Value Added in valuation

Recently, economic value added, also known as EVA indicator, has become very popular in the financial analysis and also in the valuation process as one of possible methods. [8] Its advantages lie mainly in the consideration of risk and the capital markets. Desirably, EVA was positive or at least zero. The higher is value of this ratio, the more value company creates. We can use different variations of EVA calculation.[1] We will deal with a variant of EVA entities in the example.

The market value added (MVA) is the present value of future EVA. MVA could be described as a form of "goodwill". EVA measures the success of last years; the MVA is looking to the future, which reflects market expectations with respect to the company.[10]

MVA can be calculated in two ways:

- Ex post - as the difference between the market value (as determined in the capital market based on market capitalization) and value of its operating assets NOA,
- Ex ante - as the present value of future operational EVA.

## 2.2. EVA calculatio

EVA method for calculating company's value can take different forms in terms of calculating the expected business growth. This could include: the model with perpetual annuity, sustainable growth, two-phase, three-phase models or another modifications. Two-phase model appears to be the best one, where the second phase of the selected model is calculation the continuing value of a perpetual annuity:

$$H_n = NOA_o + \left( \sum_{i=1}^{T} \frac{EVA_i}{1 + WACC_i} \right) + \frac{1}{WACC} * \frac{EVA_{T+1}}{(1 + WACC)^T} - D_o + A_o \quad (1)$$

We have to distinguish between the net and the gross value of a company. Gross value is the value covering the entire enterprise as the whole (with all its parts) and the net value is the value of equity.
$H_n$ – is the net value of equity
$NOA_0$ – net operating assets by the valuation date
WACC – weighted average cost of capital
T – number of years of the first phase
$D_0$ – interest-bearing debt
$A_0$ – non-operating assets

Firstly, EVA calculation starts with weighted average cost of capital, than follows net operating assets determination and the last input to the EVA formula is the net operating profit after tax (NOPAT). [4]

## 2.3. NOA Calculation

The starting point for the calculation of the net operating assets (NOA) is the balance sheet, which must be adjusted. The range of these adjustments depends on the professional judgment of the valuation expert with respect to significance of the effect on the overall value of the company. We have to focus on the following [2]:

- From the assets should be excluded non-operating assets. These assets are those not directly related to the main operation of the company.
- It is necessary to exclude extraordinary items.
- Assets should be reduced by non-interest-bearing debts in order to avoid problems with the estimation of the cost of capital (in determining the discount rate).
- The accounting assets should be converted into real assets. This will include: goodwill (and depreciation), leasing, hidden reserves dissolving, revaluing of assets connected to the activated costs of long-term anticipated effects (research and development, marketing, training employees) and their depreciation.

## 2.4. NOPAT Calculation

The first principle for NOPAT determination is to achieve symmetry between NOPAT and NOA. If there are certain activities and their corresponding assets included in NOA, it is necessary that the costs and revenues associated with them were included in the calculation of NOPAT. [10]

In our conditions, as a basis for the calculation of net operating profit after tax were made following these steps in adjusting operating profit:

- Operating profit related to the non-operating assets
+ Cost of inoperative property
+ Financial income from financial assets included in the NOA
+ Amortization of goodwill
+ The initial cost of an investment nature
- Depreciation of capitalized intangible assets
+ Lease payments
- Depreciation of assets leased by leasing
- Unusual profits
+ Unusual losses
Elimination of the cost reserves creation and dissolution
Tax adjustments.

***Difference between net and gross value***

Gross and net equity market value is calculated as follows [2]:

Net operating assets at the valuation date
+ Market value added

_____

= Gross value
- The value of an interest-bearing loan capital at the date of valuation

_____

=Value of equity, Net
+ The value of assets which are not operationally necessary

_____

= The resulting value of the company's capital

## 2.5. Eva Equity Calculation

Now, we will calculate value of equity in the certification company XY and it will be based on the information which this company provided to us [7]. Equity calculation begins with the determination of the present value in the first phase. For making input data more exact, we calculated the EVA for each year of this phase. It is good to point out that the net operating assets (NOA) should be taken to the beginning of the calendar year (in the contrast to the other input quantities relating to the end).

| **Year** | **2010** | **2011** | **2012** | **2013** | **2014** |
|---|---|---|---|---|---|
| NOA (in €) | 336 872 | 331 329 | 302 042 | 281 792 | 270 826 |
| NOPAT (in €) | 61 430 | 54 260 | 75 664 | 59 467 | 37 857 |
| WACC | 10.78% | 11.42% | 11.59% | 11.70% | 12.05% |
| Cost of Capital (in €) | 36 315 | 37 838 | 35 007 | 32 970 | 32 635 |
| EVA (in €) | 25 115 | 16 422 | 40 658 | 26 497 | 5 222 |
| Discounted EVA (in €) | 22 672 | 13 228 | 29 260 | 17 021 | 2 957 |
| **Present Value of the first phase (PV I.)** | **85 137 €** | | | | |

**Tab. 1.** Calculation of the first present value in the company XY

The present value of the first phase by 1.1.2015 is 85 137 €.

***Calculation of continuing value and the present value during the second phase.***

Second phase assumption is the stabilization of future profit trend, what is reflected in the growth rate of the adjusted profit. We will use parametric formula for continuing value calculation. Parametric formula [5] is generally seen as a more correct approach for the calculation of continuing value compared to Gordon's formula, because it works with selected factors of value creation, which is the growth rate of adjusted operating profit and the expected return on new net investment.

Calculating the continuing value is based on the input data: the growth rate of 3 % and investment rates 8 %.

| | |
|---|---|
| NOPAT (in €) | 38 993 |
| Cost of capital (in €) | 35 169 |
| EVA (in €) | 3 824 |
| Continuing value (in €) | 269 286 |
| **Present Value of the second phase (PV II.)** | **240 326 €** |

**Tab. 2.** Calculation of the second present value in the company XY

When we have the present values of the first and second phase, it is possible to calculate the value of equity in following way:

$$\textit{Value of equity (net value)} = \textit{NOA} + \textit{PV I.} + \textit{PV II.} - \textit{dept} - \textit{non-operating assets} \quad (2)$$

| | |
|---|---|
| Present Value of the first phase (in €) | 85137 |
| Present Value of the second phase (in €) | 240326.2 |
| MVA (in €) | 325463.2 |
| NOA (in €) | 336 872 |
| Operating net value (in €) | 662 335 |
| Non-operating assets (in €) | 0 |
| **Value of equity (net value)** | **662 335 €** |

**Tab. 3.** Net value calculation in the company XY

As we can see, calculation determined the value of the equity at 662 335 €.

## 3. Conclusion

The main advantage of EVA is the explanatory power, because it shows how much is the company's value composed of an initial investment NOA and what part creates the "goodwill" MVA. [1] We used the EVA method for dividing the future of the company into 2 phases with the different assumptions. Another advantage of the method is the possibility of connection between conventional financial analysis and company valuation.

At the beginning it was important to determine the purpose of the valuation and what kind of value should be the result of this process. This information has to be considered by the evaluator. Choosing any method of valuation, we can always use the general procedure described in the first part of this article. After the calculation is up to the investors or managers how they will work with the results and how they will manage the value.

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# Computerized Maintenance Management Systems

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**Abstract.** The article deals with possible approach to the development trends in the computerized maintenance management system in manufacturing enterprises. The authors emphasize the need for description of CMMS that must meet the needs, constraints, and opportunities of the business and be implemented in a way that users will welcome the technology and have a vision for the benefits it brings. This system regularly monitors changes in the selected diagnostic signals of each machine and the values compared with the specified limits for maintenance. The second part of this article deals with specification of this approach and potential advantages and disadvantages of this system in production systems.

**Keywords:** Maintenance, management system, condition monitoring, manufacturing enterprise.

## 1. Introduction

A computerized maintenance management system (CMMS) is software designed to simplify maintenance management. CMMS solutions empower organizations by streamlining work order management, optimizing preventive maintenance tasks, generating valuable reports, and much more. In establishing the planned maintenance system, if equipment-diagnostic technology is assumed to be hardware for its promotion, system evaluation technology may be regarded as the software that operates that hardware.

System evaluation must be involved studying the reliability, maintainability, economy, and safety of systems in an overall manner under various restrictive conditions. However, in many companies systems are evaluated only fragmentarily.

## 2. Condition Monitoring a Maintenance Systems

Condition maintenance management system provides a range of solutions for multi-channel machinery monitoring, protection, data acquisition and analysis - from portable analysis systems to integrated on-line installations in the field.

The goal of a maintenance manager is to employ a management system that optimizes the use of scarce resources (manpower, equipment, material, and funds) to maintain the facilities and equipment that are the responsibility of the maintenance organization [1].

The advance of equipment technologies was attained almost exclusively by improving on the shortcomings of existing technologies [2].

Activities of persons who are daily engaged in the improvement of equipment bring about the accumulation of extremely valuable technological data [3].

The system should provide for integrated processes giving the manager control over the maintenance of all facilities and maintainable equipment from acquisition to disposal. The advantages of computerized maintenance management system are shown in figure 1.


**Fig. 1.** The advantages of condition monitoring and maintenance system [4].

## 2.1. Potential Disadvantages of CMMS

Potential pitfalls of CMMS are for example:

- Do not go into the selection of a system without a clear definition of requirements - what you expect it to do and how it is to meet your specialized needs. Also, have a clear understanding what metrics you want your CMMS to produce and what the work process is for your organization. You may want to bring in outside professional guidance that is experienced in CMMS but not associated with any particular vendor or system.
- Do not get locked into a structure that is difficult to enter data and lacks the necessary flexibility to be upgraded or modified. Consider who will be entering the data and their computer skills. The CMMS should have the flexibility to enter data from multiple sources and media. The more ease of data entry will improve its accuracy and the resulting output.
- If you are considering replacing your existing system, do not get locked to "lost costs." Don't fall for the logic that what you have now is not doing the job but you have too much time and money invested in it to change. Consider only the time and cost to correct your existing system to meet your needs versus what a new system would cost.
- Do not limit yourself to looking at only one system early in the selection process. Develop a short list each product. Establish rating criteria and score the actual performance of each candidate[4].

## 2.2. CMMS Proactinance

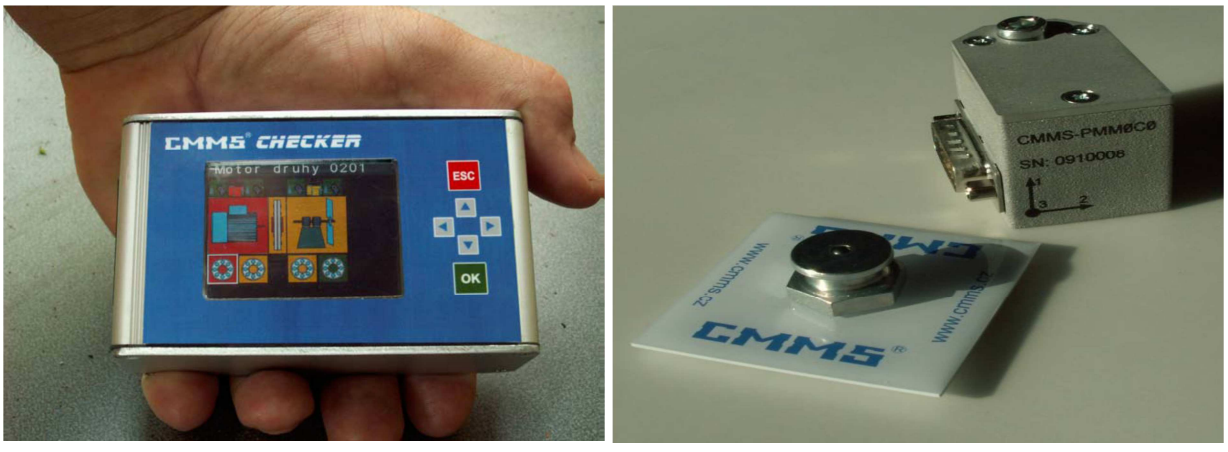
Powerful CMMS Proactinance software packages provides total access to condition monitoring data, and enables long-term analysis and trending of measurement results to ensure the success of your predictive maintenance program.

A complete set of optional software packages, including the fully-networking expert and lubrication system reflects CMMS's total commitment to equipment well-being that is unmatched within the industry [5].

**Fig. 2.** Condition monitoring and maintenance system.

Failure of CMMS implementations is a continuing problem voiced by industry experts [5]. To avoid this pitfall a thorough management study of the system is required to evaluate the use of such a system in their organization and to determine the costs benefits.

Not all maintenance organizations require the use of a complete set of CMMS modules. Those that have implemented CMMS programs without a complete study, typically fail to use the capabilities incorporated in the software and may eventually view the program as a failure [6].




(a) CMMS Checker (b) RFID code

**Fig. 3.** Data collector and analyser [3].

A CMMS can be used to manage simple or complex facilities, from a single building to a complete company. A CMMS can also be used to manage the maintenance program for a grouping of equipment such as a fleet of vehicles [7].

The systems are very versatile since most are in modular form for the various maintenance functions and can be customized to fit the particular application. Whatever system or set of modules are selected for use, careful consideration needs to be given to functional requirements and a sound deployment plan.

The CMMS must meet the needs, constraints, and opportunities of the business and be implemented in a way that users will welcome the technology and have a vision for the benefits it brings. Proper configuration, testing, and training cannot be over emphasized when bringing a new CMMS or upgrading an existing system to an organization.

## 3. Conclusion

Computerized maintenance management system has as an objective to facilitate and clarify the process of maintenance documentation, supports a process approach and a system approach of management; also it enables continuous improvement of maintenance system.

The general principle of computer aided maintenance management based on the principles of logistics management system, which designed to plan, manage and control material and information flow so as to achieve the performance and economic objectives. A substantial part of the control system is an information system whose task is to collect, store, process and transmit of planned and actual data.

## Acknowledgement

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# Energy Resources and Technological Options

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**Abstract.** The paper deals with description of options for using energy in ways that support sustainable development, which are essential to enhancement of efficiency, productivity and profitability in future industrial processes, because today's manufacturing plants provide a number of different processing possibilities for manufacturing a specific product. The second part of this paper deals with specification of significant barrier of greater end-use efficiencies.The last part of paper deals with description of key research issues of energy efficiency.

**Keywords:** Maintenance, management system, condition monitoring, manufacturing enterprise.

## 1. Introduction

Options for using energy in ways that support sustainable development, which requires addressing environmental concerns, include for example:

- More efficient use of energy, especially at the point of end use in buildings, electric appliances and production processes.
- Increased reliance on renewable energy sources.
- Accelerated development and deployment of new energy technologies, particularly next-generation fossil fuel technologies that produce near-zero harmful emissions – but also nuclear technologies.

All this options have considerable potential, but realising this potential will require removing obstacles to wider diffusion, developing market signals that reflect environmental costs and encouraging technological innovation.

## 2. Energy Resources in Manufacturing

Rather, the key concerns are: Can technologies to extract, harvest, and convert these vast energy stocks and flows be developed in time? Will these processes have adverse implications? Will the energy services eventually generated from these resources be affordable? Historical evidence suggests that these concerns may be at least partly offset by technological progress, but that such progress needs to be encouraged – by regulations to improve market performance, temporary subsidies, tax incentives, or other mechanisms – if it is to occur in a timely fashion.

### 2.1. Energy End-use Efficiency

Achieving higher end-use efficiency involves a great variety of technical options, because it has little visibility, or politicians, the media, or individuals looking for recognition and acknowledgement. The significant barriers – primarily market imperfections that could be overcome by targeted policy instruments as prevent the realisation of greater end-use efficiencies. These barriers are shown in figure 1.

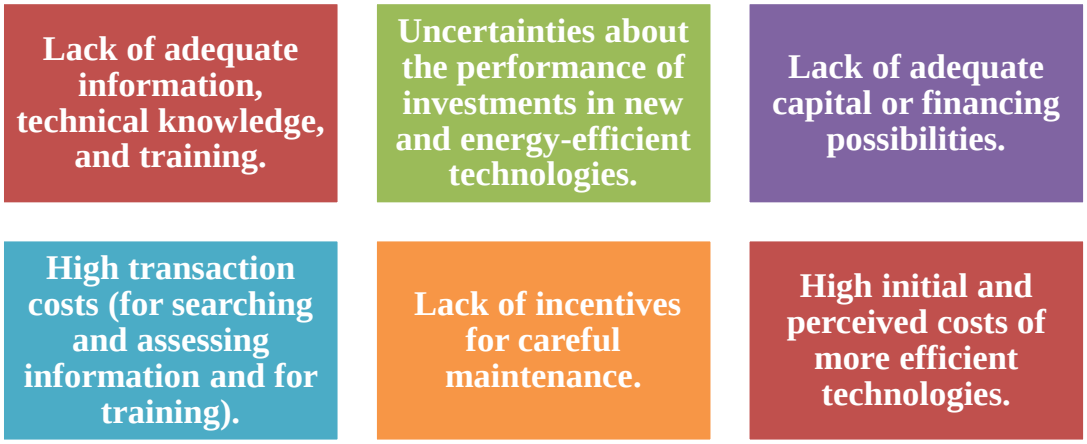


**Fig. 1.** The barriers of greater end-use efficiencies.

Realising cost-effective energy efficiency potentials will be beneficial not only for individual energy consumers, but also for the economy as a whole [1]. For example, saved energy costs can be used to produce energy-saving domestic goods and services. And as cost-effective energy improvements are realised, additional profitable opportunities for improvement will continue to open up as a result of research and development, learning curves, and economies of scale. That means that continual cost-effective energy efficiency improvements can be expected [2].

## 3. Energy Efficient Manufacturing

In the context of this issue, it is necessary to seek answers to the following questions:

What are the industrial problems and needs in terms of integrating energy efficiency in production management?

The aim is that the study of this issue is to identify what the corresponding problems and needs in the industry, which are tied to energy efficiency. To take full options, which are important in designing and designing production processes, for example lighting equipment setup or educating people to not to waste energy. It can be anything, why industrial engineer is scope so that these problems and needs were able to first find, identify, then look for solutions and propose measures.

How can these needs with new concepts of monitoring, management and increasing energy efficiency in the context of energy management in production?

These needs can be satisfied using the tools of industrial engineering, which is achieved by using influence energy intensity. Here is the hidden meaning of the work, which is based on establishing a methodology for reducing the energy intensity of production processes.

Since one of the key areas for achieving energy efficiency was known of how energy efficient production, then the work is specifically within the Department of Industrial Engineering focuses on what in designing production systems and manufacturing processes for their management and improvement can be done to real production was energy efficient.

Research issue of increasing energy efficiency is formulated into five key areas (Figure 2):

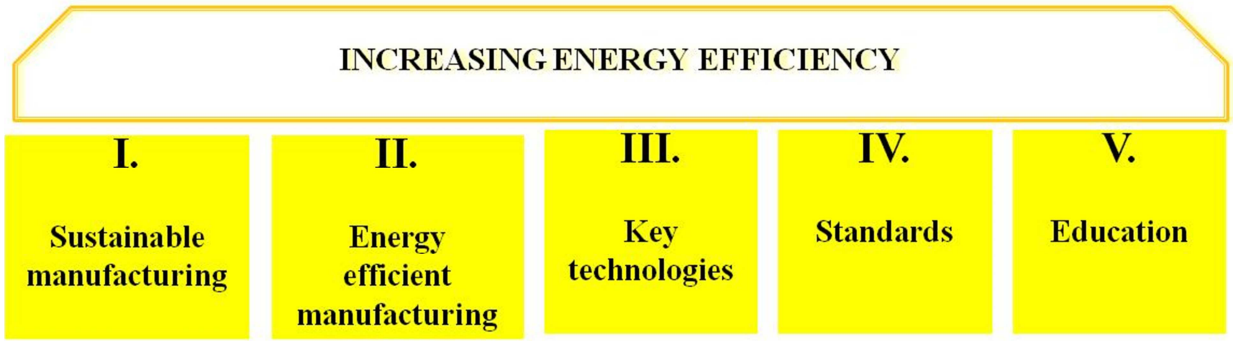


**Fig. 2.** Key research issues of energy efficiency.

### 3.1. Key Technologies

The question of technologies during the development of the whole civilization has been and always will be very important, because once a person some technology can devise and implement, then looking for the possibility of applying for it. Already in the development of technology is important to ensure that energy consumption is as low. It is not an easy task, therefore, is an attempt to information technology and hardware across any technology or equipment designed so that the least energy-consuming.

But it is a matter of design of technical facilities through which those technologies are implemented. It forms one single chapter, because it is the task of those who design technology and equipment, through which these technologies are implemented.

Is an attempt to develop such technology to not only meeting the requirements of the uses of the technology, but also the least energy consuming [3].

### 3.2. Standards

Standards are rules that people, whether in manufacturing or providing services elect. It is a journey where in standards emphasizes that the rules are such that people had in mind the need to reduce energy intensity and to seek such standards which respect the need to reduce energy consumption.

### 3.3. Education

Education is a very important area because it is training or education of people to make really paid attention to the need to reduce energy intensity not only production but also for all activities, the question of removing waste. Therefore, in the operation of industrial engineering include the care of energy because energy is one of the important resources that enter the process [4].

Therefore, in the education of industrial engineers who have the mission of industrial engineering in itself encoded removing all sources of waste, such as waste material removed, unnecessary work, so it is also necessary to pay attention to the elimination of wasted energy consumption. Therefore established the methodology for reducing the energy intensity of production processes, it is necessary to prepare people to be able to these changes.

This paper presents research of energy efficient production in order to reduce of environmental impacts of production systems that have been identified as important for manufacturing enterprises in sustainable production and description of lean processes for reducing the energy intensity and environmental impacts of production processes.

The development of advanced industrial engineering and new energy efficient technologies are essential for security of supply, sustainability and competitiveness of industrial sector .

Energy and environment related research has contributed strongly to energy efficiency. With development of sustainable production is necessary to pay attention of reducing energy consumption and increasing the energy efficiency in manufacturing processes.

On factory side all sensors and control units are elements of the shops and generate information around events. This can be called “a smart factory”. Real time information combined with histories and future (simulation) make it possible to realize a new generation of IT-driven factories and enterprises. With energy and environment remain important global issues and sustainable development becomes increasingly more important, it is expected that energy efficiency and related environmental indicators will continue to play an important role in providing information for policy makers to address national and global energy, environmental, and resource depletion problems. Reduce energy expenditure via a structured approach to identifying, measuring and managing energy consumption. Lean Manufacturing is an operational strategy oriented toward achieving the shortest possible cycle time by eliminating waste. We can identify three options for energy saving positioning in the enterprise. Energy conservation and energy efficiency as:

1. a way to solve particular problems of power supply service. Such positioning implies that energy conservation goals to provide solution to the problems related to rectifying defects in industry’s power supply service. It can result in lowering industry’s energy consumption both in physical and monetary terms, reduction in energy consumption associated with production of certain types of goods, etc.
2. a way to increase the industry’s performance in investment development programs. Energy conservation in that case is regarded as one of many business lines to increase the industry’s performance, together with delivering production technology innovation, upgrading operating machinery, adapting advanced materials, etc. The effect of energy saving declares itself in growing production and commercial performance of the enterprise.
3. a way to solve strategic problems of corporate development. Energy saving and efficiency is considered as a strategic direction to increase competitiveness of the enterprise. Therefore, successful task solution in this field exercises a dominant influence on the corporate strategic targets.

## 4. Conclusion

Information and communication technologies are one of the enablers of energy manufacturing systems and factories of the future. Information and communication technology for manufacturing was one of the main topics in the future visions and road maps. Future visions are influenced by the innovations of information and communication technologies and their applications in the technical development for energy manufacturing systems.

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# Creating the Importance Rankings of Factors Describing the Seventh Principle of Toyota Management

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**Abstract.** The article presents the results in the field of creation of the importance rankings of factors describing the seventh principle of Toyota management based on the results of the company from the furniture industry. In the study the BOST survey was used. The study included the analysis and evaluation the ratings of the structure of the visual control elements, i.e., cleanness, flow, information boards, participation in production places, monitoring, graphical presentation of results. In this aim it was used histogram and pie charts. It was presented the concept of creation the series of importance rankings of factors based on the percentage share for individual factors. It was used the Thurston's method of scale comparative assessments to create the alternative ranking. Two kinds of created rankings were compared. It has been found that the series of validity which were obtained by using these two kinds of method are the same.

**Keywords:** visual control, the BOST research, importance ranking, the Thurston's scale

## 1. Characteristics of the Study

The research subject of this paper was visual control and its elements. Assessment of visual control was made in terms of its elements in the system of visual control. What does visual control means? Why it is important to implement visual control elements in production process? Visual control is known as *visual management*, *visibility management*, *management by visibility and management by sight*. It is a basic principle and element in a many modern management and production and quality improvement conception, ex. *lean manufacturing*, *gemba kaizen approach*, in *Toyota Production System* (TPS). Visual control is any communication device used in the work environment that tells us at a glance how work should be done and whether it is deviating from the standard. It allows for quick intervention at the time of production anomalies. The techniques of visual control included: 5S principle, light signaling so-called andon, sign of the floor, sign boards, the border examples of products, Kanban cards, working instructions. Visual control focuses on the principle that "picture says more than 100 words." Implementing visual control in the plant help to exposing abnormalities, problems, deviations, waste, unevenness, and unreasonability to people, thus corrective actions can be taken immediately to: correct the problems, reduce manufacturing costs, reduce possible waste, shorten production lead time and thus keep the delivery due date, reduce inventory, ensure a safe and comfortable working environment, increase company's profit [7, 8, 9].

Visual control has a special place in the Toyota Motor Company. It is one of the production techniques connected with company's perfection that is integrated with the process of increasing added values. Visual control is a hart of TPS, it is very important element which complete and intensify other elements of this system. The 7$^{th}$ rule of the Toyota management claims: *„Use visual control so that no problems remain hidden."* [6] In the BOST research the Toyota management principles was changed into question. Based on the 7$^{th}$ rule of Toyota management there was elaborated E7 question in the BOST survey. It was established six the most important element of

visual control and it was formulated the question: What element in the most important in the visual control process? Put 1, 2, 3, 4, 5, 6 (6 stands for the most important factor) [1, 2].

| | | | | | |
|---|---|---|---|---|---|
| CS | | Cleanliness | UP | | Participation in production places |
| EP | | Flow | ME | | Monitoring |
| TI | | Information board | GW | | Graphic presentation of results |

The research object was a company located in Czestochowa operating in the furniture industry. The company has been produced upholstered furniture and sells its products in the country and beyond its borders. The BOST study was conducted among 32 employees of the company. The purpose of the research was to determine the validity of the visual control elements in the workers workplace.

## 2. Summary of the BOST Survey Results

Summarizes collected the workers' responses in the field of importance of visual control elements. The structure (numerical) and distribution of responses with using histograms were presented (Fig. 1).

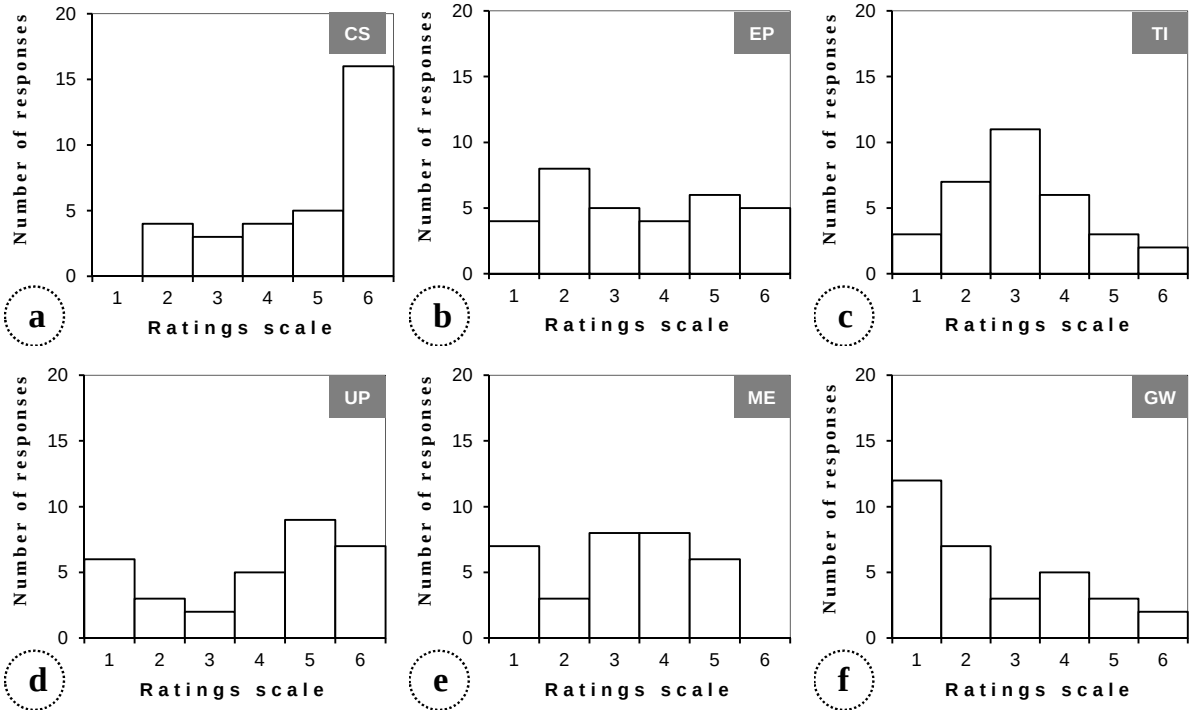


**Fig. 1.** 7th principle. Histogram - the numerical structure of ratings of importance of seventh Toyota management principle factors: a) CS, b) EP, c) TI, d) UP, e) ME, f) GW.

The analysis of the distribution of ratings for the *cleanliness* (CS) factor indicated that this factor has been assessed as the most important (in responses dominated "6" rating) by most of the respondents. In case of the *flow* (EP) factor two ratings were dominant over the other ratings (the ratings distribution is bimodal), these ratings are "2" and "5". In case of *information boards* (TI) the ratings distribution is similar to the normal distribution, it is clearly marked the "top" in the histogram, which indicate on the most frequently occurring rating, i.e. "3" and increasingly droopy "slopes" (from the left and from the right), which indicate less frequently occurring ratings. In case of the *participation in production places* (UP) factor the most common ratings are those with the edge of the scale of ratings, i.e. "1" and "5" . *Monitoring* (ME) factor obtained similar structure of ratings in a cross-section of all ratings, which indicates a large gap in employee opinion on the importance of this factor in the system of visual control factors. Distribution of ratings for the GW factor is right-asymmetric, which means a larger number of lower ratings from the scale.

In the next stage the pie charts showing the ratings percentage structure [3] on individual factors were presented (Fig. 2).

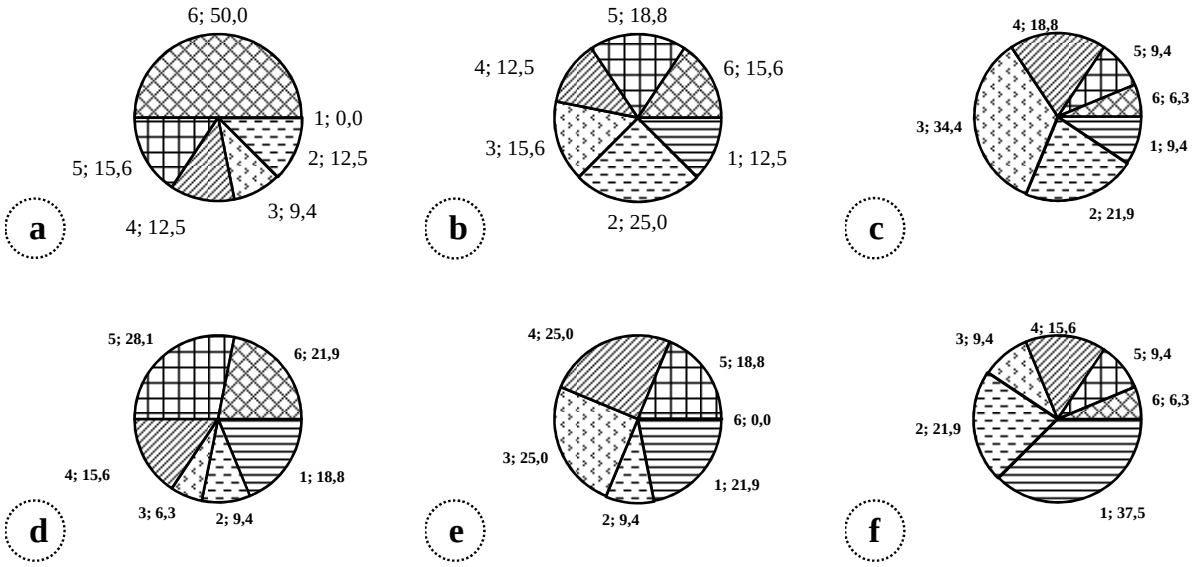


**Fig. 2.** 7th principle. Pie charts – percentage structure of importance ratings of factors from seventh principle of Toyota management: a) CS, b) EP, c) TI, d) UP, e) ME, f) GW.

Structure of the ratings within the various factors was the basis for creation the rankings of the factors (visual control elements).

## 3. Creation the Importance Series of Factors

The basis of creation the importance series of factors in the BOST method are: average values of ratings and percentages share of ratings. This analysis allow to built two types series of importance. On the basis of the percentage share of each of the factors the *partial ranking* is developed. The final ranking (summary) of factors is created based on the average values obtained from all the votes cast for a given factor. Examples of the use of importance series to identify the position of the factors in the BOST method can be found in the works [4, 5].

Based on the percentages share of ratings for the subsequent factors the analysis of the factors place in a series of importance for particular rating was done. Results of the analysis are shown in Table 1.

| Rating | Place of the factors in series of importance | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | *GW* | *ME* | *UP* | *EP* | *TI* | *CS* |
| 2 | *EP* | *GW* | *TI* | *CS* | *ME* | *UP* |
| 3 | *TI* | *ME* | *EP* | *CS* | *GW* | *UP* |
| 4 | *ME* | *TI* | *GW* | *UP* | *CS* | *EP* |
| 5 | *UP* | *EP* | *ME* | *CS* | *GW* | *TI* |
| 6 | *CS* | *UP* | *EP* | *GW* | *TI* | *ME* |

**Tab. 1.** 7th principle. Place of the factors of 7th Toyota management principle in series of importance for particular rating.

Based on the results from Table 1, the *partial rankings* of factors within the individual ratings were presented (Fig. 3).

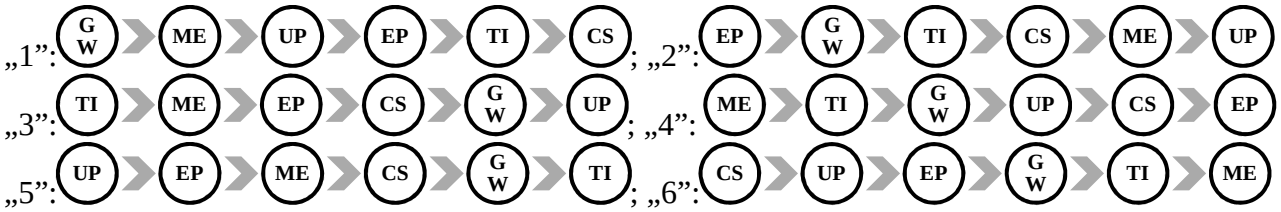


**Fig. 3.** Series of importance for particular ratings.

On the basis of partial rankings it is possible to rate the changing of position of a given factor of visual control in the range of particular ratings.

On the basis of the average percentage shares the final ranking of factors decoding seventh principle of Toyota management was presented (Fig. 5).

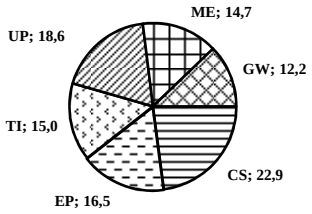


**Fig. 5.** Average share of rating for factors describing 7th Toyota management principle.

The final importance series of visual control factors was shown in Fig. 6.

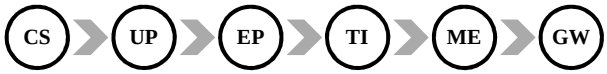


**Fig. 6.** The final importance series of visual control factors.

The most important factor in visual control turned out to be a *cleanness* (CS) factor, on the second place found the *participation in production places* (UP) factor, in third place was the EP factor - *flow*. The least important factor was found to be the GW factor - *graphical presentation of the results*. The closeness between the CS and UP factors indicates that the priority of cleaning in the workplace is resulting from the active managers presence in the workplace. Managers have visited the production hall (“gemba” in Toyota terminology) by walking and search and verify any problems. The analysis also showed a weak way of presenting the results achieved by the teams of workers, often lack of their graphical presentation.

## 4. Analysis of Factors Position in a Series of Importance with the Use of the Alternative Method

One-dimensional Thurston’s scale of comparative assessments was used in order to analyze the position of factors in a series of validity and in aim to determine the degree of their convergence (similarity). The data collected in the ranking scale form for each of the respondents were processed on pairwise comparisons of results for individual factors. Table 3 showed part of the results of comparisons analysis for the *cleanness* (CS) factor with the other factors. The number "1" in the table indicates that in case of the CS factor, this factor was more preferred than the compared factor, in turn the "0" number indicates that the CS factor was less preferred than compared (it granted a lower rank).

| Respondent id | CS:EP | CS:TI | CS:UP | CS:ME | CS:GW | ... |
|---|---|---|---|---|---|---|
| **1** | 1 | 1 | 1 | 1 | 1 | ... |
| **2** | 1 | 1 | 1 | 1 | 1 | ... |
| **3** | 1 | 1 | 1 | 1 | 1 | ... |
| **4** | 0 | 0 | 0 | 1 | 0 | ... |
| **5** | 1 | 0 | 0 | 0 | 1 | ... |
| **6** | 1 | 1 | 1 | 1 | 1 | ... |
| **7** | 1 | 1 | 1 | 1 | 1 | ... |
| **8** | 1 | 0 | 0 | 0 | 1 | ... |
| **9** | 1 | 1 | 1 | 1 | 1 | ... |
| **10** | 0 | 1 | 0 | 1 | 1 | ... |
| **...** | ... | ... | ... | ... | ... | ... |

**Tab. 3.** Table of pairwise comparisons (part).

As can be seen from Table 3, the respondent no. 1 in a couple of factors "CS - EP" prefers more the *cleanliness* (CS) factor than the *flow* (EP) factor. In turn, for the respondent no. 4 the EP factor is more important than the CS factor.

On the basis of comparative ratings the proportion table was created to specify which factor (in column) is preferred over the other (in a row) (Table 4).

| Denotation of factors | CS | EP | TI | UP | ME | GW |
|---|---|---|---|---|---|---|
| | *a given factor in the column is preferred in such value of percent over an element in a row* | | | | | |
| **CS** | *x* | *31,25* | *21,88* | *31,25* | *18,75* | *15,63* |
| **EP** | *68,75* | *x* | *53,13* | *53,13* | *43,75* | *34,38* |
| **TI** | *78,13* | *46,88* | *x* | *65,63* | *56,25* | *37,50* |
| **UP** | *68,75* | *46,88* | *34,38* | *x* | *31,25* | *28,13* |
| **ME** | *81,25* | *56,25* | *43,75* | *68,75* | *x* | *40,63* |
| **GW** | *84,38* | *65,63* | *62,50* | *71,88* | *59,38* | *x* |

**Tab. 4.** Proportion table.

In the table 4 the results of comparisons were presented, that showed that, for example 67.75% of respondents preferred the CS factor than the EP factor, and 84.38% of the respondents considered that more important factor is CS than GW. On the basis of the summary results values of *Z* of normal distribution was calculated, which in the next step was averaged and centered. In the final stage of the analysis, based on the averaged and centered values of Z, a graphical one-dimensional compartmental scale of comparative assessments was created (Fig. 7).

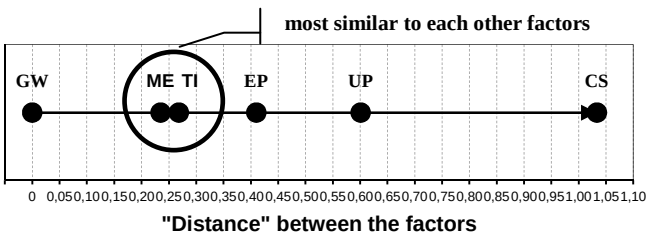


**Fig. 7.** Interval one dimensional scale of comparative assessments.

On the basis of the scale it can be obtained not only the rank of the respondents preferences, but it can be also determined the degree of convergence of these preferences in a range of factors on the basis of the “distance” between the factors.

Fig. 7 showed that in the structure of the factors from seventh principle of Toyota's management can be distinguished four groups of preferred factors. To the first "group" included factor denoted as GW, it was by far the least preferred factor, the second group of similar preferences include the factors identified as ME, TI, the third “group” included the EP factor, to the fourth group contained the factor labeled as UP, the last group (indicating the factor most preferred) was created by the factor labeled as CS. The analysis showed that the highest similarity degree of ratings between the factors presented the factors marked as ME and TI (the smallest “distance” between factors on the preference scale).

## 5. Summary and Conclusions

Due to conducted researches, it was claimed that:

- cleanliness, is the most important element of visual control in the company according to production workers opinion. The reason is because of implementing 5S practices in the company and benefits of this program (good workplace organization, increase the safety, reducing the number of accidents, waste reduction, products quality increase) so workers began to notice a big role of this factor in the visual control,
- the second most important element of visual control in the workers opinion was participation in the production places of managers. Employees noticed that their managers spend a lot of time on the shop floor, actively participating in solving the problems. Visual control performed by them on the basis of visual control tools in the workplace allowed to identify any deviations from the standards and allow to take effective corrective action immediately,
- the least important element of visual control according to staff opinion is graphical presentation of the results, what indicating the need for improvement activities in the topic of presentation of the results achieved by employees,
- building of series of validity on the basis of the average of percentage ratings or according to results of analysis of Thurston’s comparative assessments gave the same results - importance rankings were identical, with the same location of factors,
- on the basis of results of one-dimensional scale of Thurston’s comparative assessments is possible to obtain more information than in case of traditional series of the factors (ex. the final). We know not only the ranking of factors but also the degree of similarity in a range of perception of the importance of each factors and the proximity of the assessed factors.

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# An Identification of Areas Requiring Improvement in the Light of the Fourteenth Toyota's Management Principle

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**Abstract.** In the article was made the identification and the assessment of areas requiring improvement from the fourteenth Toyota's management principle point of view. The research object is company producing lamps and chandeliers. Production workers of the company with the help of BOST questionnaire survey determined, which factors had the greatest potential in the scope of improvement in their company and which the smallest. Research showed about the greatest potential the following factors: quality, cooperation with customers and portfolio technology. The least important factor according to workers is: machines maintenance, cooperation with supplier, partners. In frames of the work it was made characteristics of the research object - producer of lamps and chandeliers, the presentation of research methodology and content fourteenth Toyota's management principle. Were presented results of analysis: percentage - with using circular graphs and statistical - with using of bars chart, analysis of the significance of averages assessments diversifying and analyses of the significance for the correlation relationship between replies to individual factors and personal features (characteristics) of respondents.

**Keywords:** improvement, Toyota's management principle, BOST research

## 1. Characteristics of research

A subject of research is one of the most reputed lighting producers in Poland. Company is competitive with foreign countries - exporting its products to over 35 states worldwide. The company specializes in the production of lamps and chandeliers for internal applying: ceiling chandeliers, plafond, desktop, floor lamps and wall lamps. The offer of lamps of the research company is divided thematically on: modern lamps and classical, plafond from bent glass, the lamp bathroom, lamps to the kitchen, the lamp to the children's room, the lamp to lighting the outside elevation of the house, and the garden lamp. At present an over 2.5 thousand of models are in a trade offer of the company. The scope of the offer incessantly is being supplemented, fulfilling a wide range of needs possibly is a purpose of the company both in the scope of the taste of customers as well as the functionality of lighting covers. The entire production of lamps takes place in Poland in Silesian region, where a production plant is situated. Part of the lamps production also takes place in Czestochowa, where there are the main store and a sales department.

**Advantages of the company are:**

- Professionalism – realized by many years some projects connected with designing and accustoming to the production lighting let the company collect experience that constitute strong capital for the future.
- High standard - the quality control is present at every stage of the production in the company, having conceived from careful selection of sub-suppliers, through the control of materials delivered by them and sub-assemblies, the control of half-finished products processing in

every phase, and on final goods finishing. It is supposed to assure that the product of the company is safe, nice and is characterised by good quality.

- Efficient service - a fact that products of the company are produced in Poland is guaranteeing the efficient and fast order processing. It lets very fast to react on changing needs of customers.

A mission of the company is offering a wide assortment of inexpensive, decorative lighting, dedicated for persons valuing classics as well as modern solutions.

Every process should be still judged and improved in the scope of the required time, the quality and different aspects of production. About this is telling a concept of constant improvement - Kaizen. It is possible to achieve a lot of improvements at small expenses or without them. Instead of investing in investment expenditure, it is possible to invest in people. Masaki Imai, promoter of the Kaizen conception, the author and the director of KAIZEN Institute, in his book titled „Kaizen" stated: „even the fool is in the state to increase the productivity, if will spend the bulk of means appropriately on it. A real art is increasing the productivity without extra investments in new devices and technologies" [5.7]. Properly implemented Kaizen can without large-scale investments or implementing new technologies improve the quality, cut down the costs and to leave opposite for requirements of customers concerning the realization of supplies or the realization of the service.

Kaizen idea is based on involving workers in the process of constant rationalization a production process is second beside *the work standardization* foundation of the Toyota's production system [9]. One of Toyota's principles - the fourteenth principle - is informing that the organization should „*become the trainee organization thanks to indefatigable reflection (hansei) and constant improvement (kaizen)"*. This principle is ordering „after building the stable process to use tools of the constant improvement to the purpose of detecting sources of the lack of the productivity and applying effective countermeasures" [8]. Every organization, in accordance with this principle should be an organization incessantly perfection.

The BOST method (this name derives from the first two letters of the author's surname and name and is legally protected describes Toyota's management principles with its characteristic factors. Their number depends on the scope of such a principle and ranges from 4 to 10. The set of factors is called an area. Some principles are divided into two or even three areas. Toyota's management principles are divided into four sections, while the BOST questionnaire has two versions: a version for employees and a version for superiors. The version for employees contains a set of factors describing principles: 1; 2; 3; 4; 6;7; 14 and elements of the roof of Toyota's house (quality, costs, lead time, safety, morale of personnel). The version for superiors contains a set of factors describing all Toyota's management principles and elements of the roof of Toyota's house. The presented questionnaire has a ranking scale. Respondents may assess the significance of a given factor by placing one of the numbers within the range of scale in an appropriate box. After the description of the main part of the BOST method its further elements will be outlined briefly. The BOST method allows assessing the significance of factors describing the 14 Toyota management principles.

The fourteenth principle teaches us reflection (hansei) and continuous improvement [1]. According to this principle it is crucial to determine causes of a problem by solving technical problems. Continuous improvement of the process and production is very significant for a company, which has been functioning on the market for many years. Constant improvement helps to satisfy customer's expectations. Respondents were asked to provide answers to the following question " Which area can bring the best effects after being improved? [4]. Decide with use of the scale 1÷10 (10 the most important factor) The set of factors was selected for description of the fourteenth Toyota's management principle, which is named in the BOST tests as the E8 area [2].

| | | |
|---|---|---|
| **ZT** | | Employment of workers |
| **SM** | | Incentive system |
| **PT** | | Portfolio of technology |

| | | |
|---|---|---|
| **JK** | | Quality |
| **RE** | | Employee – superior relationship |
| **DA** | | Documentation |
| **PN** | | Flow of information |
| **WS** | | Cooperation with customers |
| **UM** | | Machine maintenance |
| **WD** | | Cooperation with suppliers, partners |

The BOST questionnaire survey was carried out in the researched enterprise producing lamps and chandeliers amongst 32 production workers.

## 2. Presentation of results

At the beginning was made analysis of the structure of granted assessments to individual factors. The percentage structure of assessments was presented in Fig. 1.

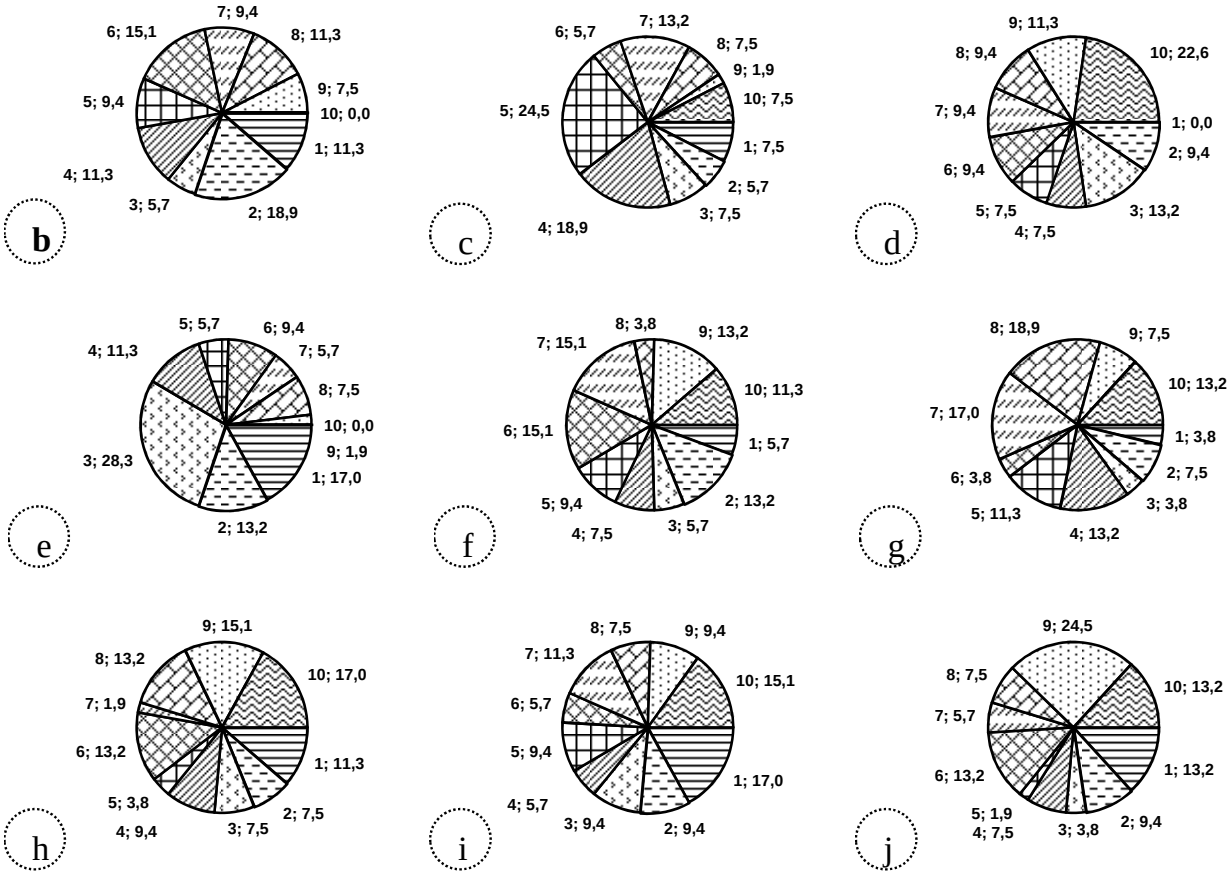



**Fig. 1.** Principle 14. Circular charts - structure of evaluation of the importance for factors in E8 area: a) ZT, b) SM, c) PT, d) JK, e) UM, f) RE, g) DA, h) PN, i) WS, j) WD.

Basing on circular charts a table showing numbers of the factors importance was built in the purpose of locating each of them in frames of next assessments (Table 1). This cell was filled up with the black colour in the tablet which is answering the factor most important for the assessment „1" (first) and next a place of this factor in importance series for next assessments was shown (2 - 10). In white colour in the table was filled up, where the factor is the most important in frames of the assessment „10" and its place was shown in frames of assessments 1 - 9.

| Assessment | Place of factors in the number of the importance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | *DA* | *PN* | *UM* | *WD* | *PT* | *ZT* | *RE* | *SM* | *JK* | *WS* |
| 2 | *UM* | *ZT* | *DA* | *PN* | *PT* | *WD* | *JK* | *SM* | *RE* | *WS* |
| 3 | *ZT* | *DA* | *RE* | *UM* | *WD* | *PN* | *PT* | *SM* | *WS* | *JK* |
| 4 | *DA* | *SM* | *RE* | *UM* | *WD* | *WS* | *ZT* | *JK* | *PT* | *PN* |
| 5 | *WS* | *RE* | *SM* | *PT* | *PN* | *DA* | *UM* | *WD* | *JK* | *ZT* |
| 6 | *WS* | *SM* | *WD* | *JK* | *PN* | *DA* | *ZT* | *PT* | *RE* | *UM* |
| 7 | *RE* | *UM* | *JK* | *PN* | *SM* | *ZT* | *PT* | *WD* | *WS* | *DA* |
| 8 | *JK* | *PN* | *SM* | *WD* | *WS* | *PT* | *ZT* | *DA* | *UM* | *RE* |
| 9 | *JK* | *PT* | *SM* | *PN* | *UM* | *WS* | *DA* | *RE* | *ZT* | *WD* |
| 10 | *PT* | *JK* | *WS* | *PN* | *WD* | *RE* | *SM* | *DA* | *UM* | *ZT* |

**Tab. 1.** Places of the factor for E8 area in importance series for individual evaluations.

As results from data included in table 1 in the case of the assessment „10" is most important, turned out to be the crucial factor (PT) *portfolio of technology*. Degree of series for this factor in frames of next assessments (1- 9) is considerable. This factor fills the more distant position for assessments from „6" to „9", next for the assessment „5" it took the fourth place. In the case of least important assessments, i.e. „1" and „2" this factor was on the fifth place in the importance series.

Was analysed a place in the importance series for factor, which in the number of the importance for the assessment „1" was on the top – (DA) *documentation*. It is visible considerable displacement of this factor in frames of next assessments. This factor was shown as most important for the assessment „4". In frames of assessments from 5 to 10 filled from sixth to the tenth place.

To the purpose of determining ultimate number of the importance series for factors in the examined enterprise a statistical parameter was used – average. A chart was presented (Fig. 2), where were presented average values of assessments for each factor.

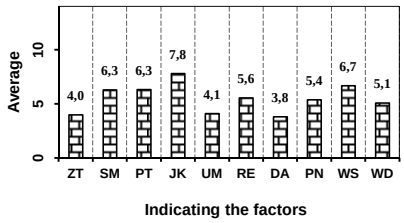


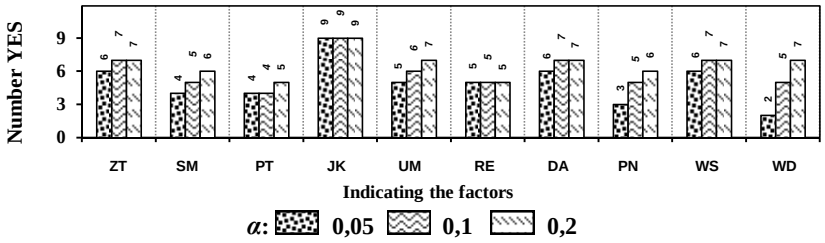

**Fig. 2.** Principle 14. Average values of importance evaluations for factors in E8 area. Summarize analysis.

On the basis of the chart a final importance series for factors which is being introduced as follows:

JK > WS > PT > SM > RE > PN > WD > UM > ZT

The most important factor which is supposed to bring the greatest effects after improvement in the examined enterprise according to the opinion of workers is a factor *quality* (JK). On a second place is factor *cooperation with customers* (WS), on third - factor *portfolio of technology* (PT). According to workers employing is least important factors is employment of workers (ZT), machine maintenance (UM) and cooperation with suppliers, partners (WD).

Analysis of the significance averages for assessments was carried out, on three significance levels: $\alpha = 0.05$, $\alpha = 0.1$, $\alpha = 0.20$. In the purpose of the expression of the examined factor (its assessments) indeed was different from assessments to remaining factors. Results of analysis were presented in Fig. 3.




**Fif. 3.** Number of statistically diversified averages importance evaluations for factors in E8 area (date with repetition).

From analysis results, that large number essential statistically assessments of medium diversities on all three levels of the significance are in the case of the factor *quality* (JK). The low number is factor *portfolio of technology* (PT).

It was made analysis of the significance of the characteristics respondents influence on assessments of the importance factors in E8 area. Correlation analysis was carried out on three levels: $\alpha = 0.2$, $\alpha = 0.1$, $\alpha = 0.05$ [3]. The combination of results was presented in Fig. 4.

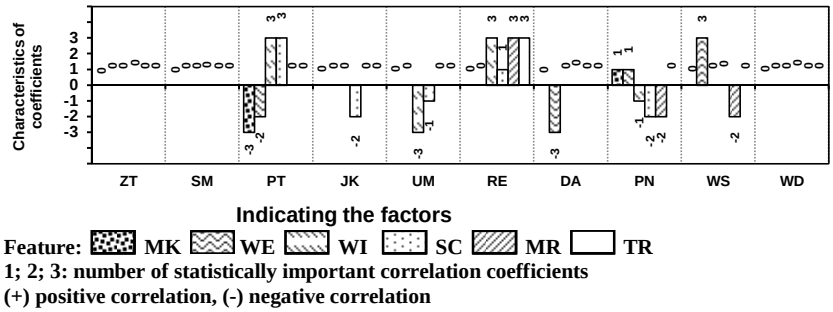



**Fig. 4. Principle 14.** Combination of results for correlation analysis for determining the influence of respondents features on the importance of factors in E8 area.

Analysis of the significance of the correlation relationship demonstrated, that in the case of assessments of the factor *portfolio of technology* (PT) a relation is negative on three levels of the significance between the age (MK), on two levels of the significance between the educations (WI). Positive correlation is on three significance levels for the age (WI) and work experience (SC). In the case of the factor *quality* (JK) a relationship was negative on two levels depending on seniority (SC). In the case of the factor *machine maintenance* (UM) this factor demonstrated strong negative correlation (on three levels) between the age of workers. Weak negative correlation (on the level $\alpha = 0.05$) depending on seniority. The most correlation (all positive) was made for the factor *employee - superior relationship* (RE) depending on the age, the work experience, the mobility of the staff and the mode of employment. Factor *documentation* (DA) negatively is correlated on three levels with the feature education. Large number essential statistically negative correlations are appearing the case of the factor *flow of information* (PN). This factor is correlated most firmly in the case of such personal features of workers, as: the work experience and the mobility of the staff. In the case of assessments to the factor *cooperation with customers* (WS) this factor was correlated positively on all levels with the feature education. In the case factors (ZT), (SM) and (WD) these factors were not correlated statistically with characteristics of respondents.

## 3. Conclusions

To the purpose of determining the rank of factors which have the greatest effects after their improvement in the enterprise producing lamps and chandeliers a BOST questionnaire survey was used. BOST research was carried out amongst production workers of the company. It allowed detailing factors which in the greatest degree can contribute for improvement processes in the company and the ones which have this smallest contribution.

Analysis showed that about the greatest potential in the scope of improvement a factor had a factor *quality* (JK). The factor of the quality strongly influences on decisions of customers as for the purchase of products. The market success of the company in the business of lighting products depends above all on, whether it will be in the state to deliver products about the appropriate quality. The quality level of lighting elements produced by the company is high, but constant improvement is needed.

A particularly important factor in guaranteeing the development of the company is cooperation with customers. The company constantly is watching the market and is trying to meet needs for their customers, with richer offer of products, adapted for changing tastes of customers. The company is using the newest materials, making available new patterns of produced lamps and chandeliers. The company constantly is following often changing trends in the interior decor of insides. The company can show off many awards and distinctions which are providing about the positive receipt of their products by customers. The company reach the third place, in the competition in 2012, organised by the German brand of builders shops in category the most interesting family lamps. Products of the examined brand are enjoying the unremitting interest on the market what is authenticating their prestige, the innovation and the functionality.

Next crucial factor about great effects after improvement in portfolio of technology. Technologies applied by the company (equipping with machines and devices) are attractive, because applying them causes the cost cutting as well as raising of produced qualities. One should be noticed that the present market reality is extorting of delivering products which not necessarily will be used through years. Customers expect better than predecessors products in terms of their form, the lighter bulletin, the reliability in the stated time. These needs influence growing shorter of cycle of the product life of the, but also the cycle of the life for applying technology [6]. To the purpose of producing products the company is using not one, but number of technologies which constitute the technological wallet of the enterprise. In the examined company proportion between old and modern technologies were disturbed, because the share of outdated technologies is high, and they are slowly replaced through modern.

The factor that is the least important, according to workers in the development of their company is *employment of workers* (ZT). They showed that the potential of workers whom the company administers present is enough for taking and the realization of challenges in the scope of improvement. In the company they are employed workers which are able to raise the productivity, develop some new products and to create the peculiar culture, a system of values and the organizational climate. As a result of effective people management in explored company is a qualified managing staff, appropriate capital for development of the staff, capital to rises and time for trainings and motivation.

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# Utilization of Fourth Toyota's Management Principle for Assessment Importance Factors Describing Levelling of the Production

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**Abstract.** In the article was made the identification and the assessment of areas requiring improving from the fourth Toyota's management principle in the company producing carbonated drinks. It was introduced an analysis of results obtained on the base of the BOST questionnaire survey and it was made a statistical analysis. It was made characteristics of the research object, the presentation of research methodology and content of Principle 4 of Toyota's management. They carried out an analysis statistical of get scores. Results of correlation analysis were presented in 3D system.

**Keywords:** improvement, Toyota's management principle, BOST research

## 1. Characteristics of Research

The research was carried out in the company "Jurajska" that producing the mineral water and carbonated drinks. The company is situated Myszkow, near Czestochowa. Land of the Myszkow district is situated near the Jurassic trail was well-known from the output of the calcareous stone used mainly in the building. Additionally the land on whom the city is situated and the district contains natural resources such as iron, molybdenum and coal. In the half of 20th century state institutions strongly became interested in these resources and many boreholes in 70 years was made. The depth some boreholes reached over 1000 metres. In one of such boreholes gushed water about the crystalline cleanness. An effect of this event was idea to build a company of water production. Constant investments as well as new methods of management caused that today the "Jurajska" is one of the largest producers of drinks in Poland. It is possible to find products also outside the country. At present at the unit 4 bottling lines are working, one is the most modern in Poland. The assortment of the workshop is about 80 products in containers about 5 different capacities. Drinks from the logo of the company are enjoying the great interest.

The results of research there is interpretation of BOST questionnaire. It lets better look on the enterprise by eyes of their workers. In the purpose to form an opinion it is essential to know the judgement of workers from different ranks in enterprise [3]. BOST is survey where the questions are matched to judge enterprise and its immaterial stores are possible. Stability of the basic production process is crucial for continuous manufacture of the product consistent with the highest quality standards. The control of its particular elements and the awareness of their significance among employees is the key to optimization of the whole process. The BOST survey was carried out amongst workers of the company "Jurajska" producing the mineral water. 32 workers of the company were subjected to the questionnaire form (both women and men).

The employees of the enterprise have been asked to fill in the BOST survey [1]. They have been asked this question: *"Which elements are the most important in the execution of the production process?"* Enter 1, 2, 3, 4 in the box (4 – the most important factor) [2].

| | | |
|---|---|---|
| RO | | Balanced workload for employees |
| RM | | Balanced workload for machines |

| | | |
|---|---|---|
| KW | | A short series of products |
| RD | | Regularity of supplies |

This question in BOST questionnaire is in accordance with the 4 principle of the Toyota. This principle sounds: „ to level a workload (heijunka)" [5, 6].

## 2. Characteristics of Respondents' Features

The characterization of respondents in the company contains the following features: gender, education, age, work experience, the mobility and the mode of the employment. The presentation of the features' structure of respondents in the form of radar graphs was presented in Fig. 1.

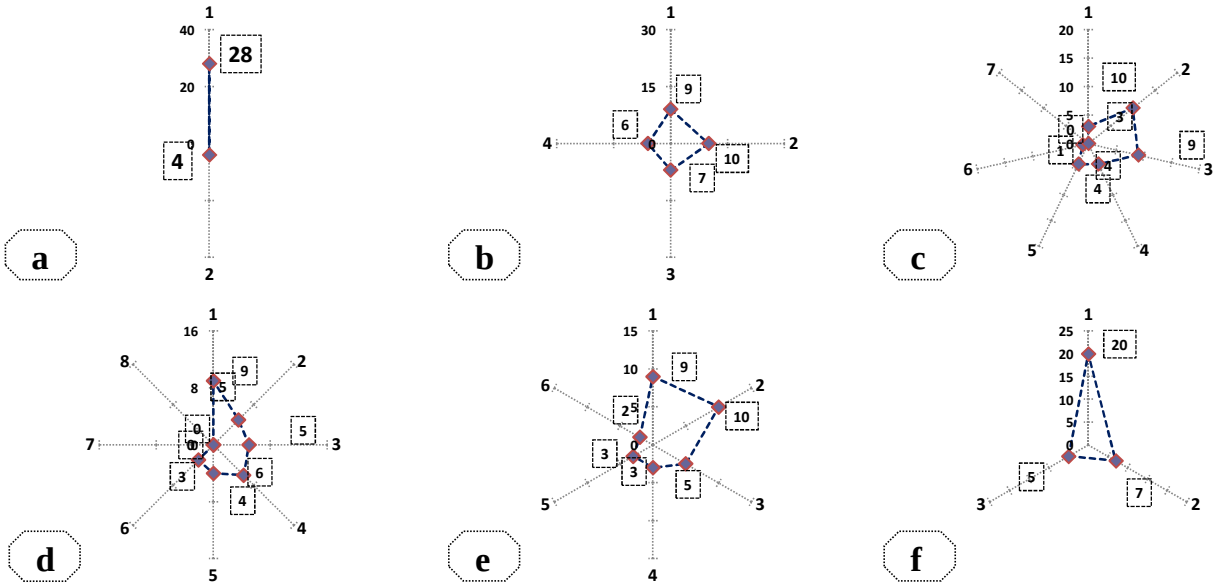


**Fig. 1.** Numerical (radar graphs) characteristics of respondents with taking into consideration: a) gender, b) education, c) age, d) work experience, e) mobility, f) mode of engagement.

From fig. 1a results that 28 men (87 %) and4 women (13%) took part in the BOST survey. In Fig. 1b educating respondents was described. It results that 9 persons (28 %) has a lower than averages, 10 persons has secondary education (31%). The age of respondents was presented in Fig. 1c. The most respondents is in age 31 – 40 years (32%) and 9 (29%) in age 41 – 50 years. In Fig. 1d is shown work experience. It results that majority of respondents – 9 persons (28%) has the smaller than 5 years work experience, and for 6 persons (19%) it emphasized the reply, that their work experience was located in period 6 - 10 years and 16 – 20 years. The biggest work experience in the company has 3 persons (9%). Fig. 1e shows mobility of respondents. Ten respondents (31%) have the mobility level 2 and nine persons (28%) on level 1. In the last Fig. 1f is presented a mode of engagement. It results from these that large number of respondents – 20 persons (63%) is working in the normal mode, 7 persons (2 %) is working in the company on account of moving, and five remaining persons (16%) is working for financial reasons.

## 3. Statistical Analysis of the Results from the BOST Questionnaire

Making statistical analysis of studied area a six statistical tools were used: arithmetic average, variance, standard deviation, coefficient of variation, skewness, and excess coefficient (Fig. 2) [4].

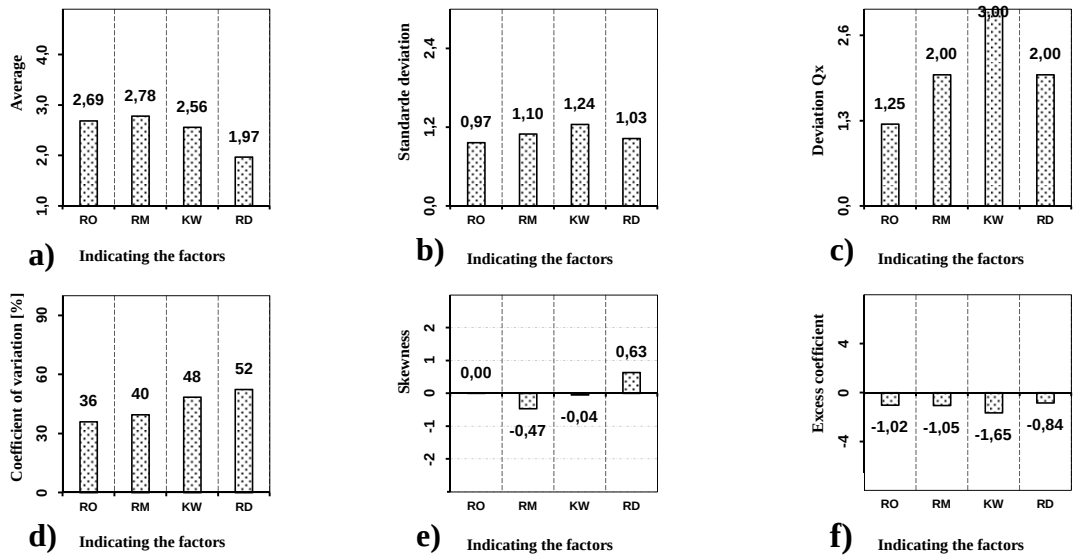


**Fig. 2.** Principle 4. Comparison: a) averages, b) standard deviation, c) deviation Qx, d) coefficient of variation, e) skewness, f) excess coefficient for factors in E5 area.

The average level of the measurable feature was presented with the help of the average. Analysing Fig. 2a concerning the result of average it was taken the conclusion that the majority of respondents judged the response concerning *balanced workload for machines* (RM) on the level 2.78. Reply concerning *balanced workload for employees* (RO) reached 2.69. The smallest value of the average amounting 1.97 fell for *regularity of supplies* (RD).

On Fig. 2b was determined a standard deviations. It described provided all examined individuals features are different from average. It results from them that *short series of products* (KW) having the biggest standard deviation.

Deviation Qx (Fig. 2c) is the biggest for the factor as *short series of products* (KW) – on the level 3.00 and smallest for the *balanced workload for employees* (RO) factor – 1.25.

The fourth analysed statistical measure determining the area of the changeability being a difference between greatest and smallest value is coefficient of variation (Fig. 2d). The biggest diversity it is possible to observe for *short series of products* (KW). It is providing about the nonconformity of polled workers in this topic. Reply concerning *regularity of supplies* (RD) was more explicitly judged through respondents 52%.

Skewness (Fig. 2e) is the simplest measure of the asymmetry for the factors in researched area [5]. After analysing the results it was stated that replies concerning *steady duty of machines* (RM) and *short series of products* (KW) have the disintegration left-side oblique, and another factors is on the right-hand side oblique.

The last factor for analysing is kurtosis (Fig. 2f). It determines the measure of distribution and concentrating the results in surroundings of the average. It is possible to conclude that all factors are characterized by bigger flattening in the attitude to the normal distribution.

## 4. Conclusion

Data obtained from BOST analysis allowed to know the opinions of the representative group of workers in the topic of functioning of the enterprise concerning the competent organization of a production process and its influence on the quality of produced goods. Fig. 3 shows averages of assessments of the importance of factors of analysed area. It is possible to state that the highest average is for factor *balanced workload for machines* (RM) – 27.8% what is saying about the fact that this factor has the greatest significance for respondents. Also high average is for factor *balanced workload for employees* (RO) – 26.9%.

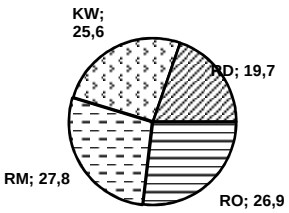


**Fig. 3**. Averages (%) evaluations of importance factors for E5 area.

Correlation analysis was introduced in Fig. 4 in the form of 3D system.

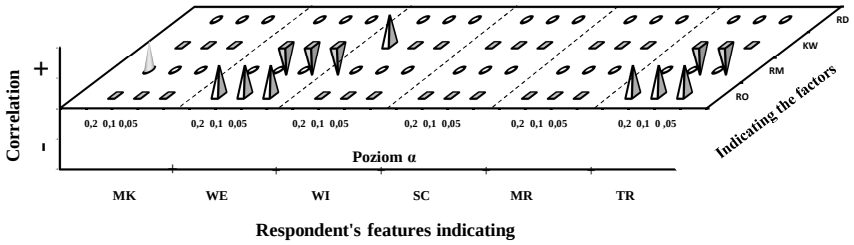


**Fig. 4.** Principle 4. Combination in 3D system for correlation analysis. Influence of respondents features on the importance evaluation of factors in E5 area for different α level.

It is possible to conclude (Fig. 4) that in 13 cases statistically essential correlation is appearing, and 5 cases are negative correlation (tops of figures are directed downwards). The feature *age* is shaping the level of assessments in five cases, where three are positive (influence the level of the factor *balanced workload for employees* (RO) and two negative (influence on the factor regular *balanced workload for machines* (RM).

Data obtained from BOST analysis allowed to know the opinions of the representative group of workers in the topic of functioning of the enterprise concerning the competent organization of a production process and its influence on the quality of produced goods. Results from analysis allowed to state that according to respondents the most important element in the realization of a production process is factor *balanced workload for machines* (RM).

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# Influence of Selected Legal Regulations of the European Competition Law and Specific Cases on Competition

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**Abstract.** This overview article deals with influence of selected legal regulations within the European Union and its influence on trade among member states. Within the EU's goods and services market there are attempts at removal of distortions of market as well as at achieving more efficient competition by means of competition law. The largest issue is cartel agreements preventing small and medium enterprises from participating in a perfect competition. The article also discusses specific decisions of the Court of Justice of the EU providing foundation for new rules based on past cases.

**Keywords:** market, European Union, competition right, movement of goods and services.

## 1. Introduction

Business activities of entrepreneurs and companies are performed within a market environment. The market has its rules and laws. Companies doing their business in the area of a EU member state are influenced by competition environment of companies of the whole Union. Due to the rule of free movement of goods and services the customers can buy a product or service of any company.

The selection can be determined by price, quality or other added value. Free movement of goods and services enables the customer to gain more suitable products. The openness of the market among EU member states must also be regulated not only on the national level but also on the Union level in order for the protection of the market to be efficient.

## 2. Sources overview

Sources define market as "an economic area with mutual exchange of results of activities of economic subjects based on certain conditions resulting from changes in demand and offer" [1] . Every market can be defined by its area, regulation and subject of sales and purchase. As Slovakia is a member of the EU, local businesses are influenced by this market area and its regulations. Every market has its specifics as well as imperfections which must be regulated. Regulation of the market always focuses on preventing distorted competition and on providing equal rights and opportunities for every competitor.

"The Union is a customs union comprising all commerce with goods and prohibition of custom duties related to import and export of goods among member states, prohibition of all fees of the same effect as custom duties, as well as introduction of the Common Customs Tariff for relations with third countries" [2] . This definition of free movement of goods and services points out that the goods and services market of the EU also represents a customs union, meaning it includes protection of companies producing products or providing services on the European level.

The European competition law is governed by following legal regulations:

1. **Treaty on the Functioning of the European Union** (Articles 101 to 109) + Protocol No 27 on internal market and competition

2. **Regulations** – the European competition law is exclusively in competence of the EU / executive rules are solely the regulations (every area of anti-competition behaviour has its own regulation).
3. **Judicial decisions** – decisions of the Court of Justice of the European Union.

The European competition law focuses predominantly on the following relations:

- cartel agreements
- misuse of dominance
- mergers
- state aid.

Each of these areas is regulated separately with specific legal regulations being applicable. For small and medium enterprises without dominant position on the market the regulation of cartel agreements is the most important part.

### 2.1 Cartel agreements

Cartel agreements among businesses arise in several forms:

- agreement among entrepreneurs – concluded by two or more subjects with specific rights and duties the participants are bound by
- decisions of entrepreneur associations – e.g. representative body of association representing all of its members and making decisions which are binding for all of its members
- synchronized procedures – coordination of behaviour of companies based on information they have gained from the competition and adopting their behaviour to these information (strategic information about prices and products etc.)

Apart from cartel it can be an agreement on: prices, selective sales, limiting or regulating production and sales, technical development and investments, division of a market or discriminating conditions.

Furthermore cartels can be divided into:

- **horizontal cartels** – an agreement concluded among subjects on one level of the market (e.g. two distributors)
- **vertical** – concluded among entrepreneurs on various levels of the market (e.g. agreement among a producer, a distributor and a salesman on sales policy contradicting the competition law)
- **decision chains** – combination of horizontal and vertical cartels - therefore the most dangerous form

According to Article 101 Paragraph 2 of the Treaty on the Functioning of the European Union, cartel agreements are prohibited and consequences are as follows[3]:

- invalidity
- taking responsibility, sanctions
- damage compensation

## 3. Case studies

As the Court of Justice of the European Union creates new rules by its decisions which are subsequently applied in the same cases in the future, these decisions can be considered crucial. There have been countless decisions in the area of competition but there are several specific court cases.

### 3.1UNITED BRANDS case (27/76)

The United Brands company is active on the banana market (banana farmers in Central America). Bananas were imported into Europe but were sold in various countries for various prices. The Commission was to judge whether such actions are anti-competitive and represent a misuse of

dominant position via price discrimination. United Brands claimed in their defence that there is no dominant position since bananas are in competition with other fruits such as apples, grapes etc.

However, the Court of Justice of the European Union ruled that due to its appearance, taste, digestion-friendly qualities and popularity among children, elderly and sick people excludes exchangeability with any other type of fresh fruits which is why the banana market is a separable relevant market. The dominant business therefore has to act in a way preventing distortion of the competition rules. [4]

**This case shows that individual products which might give the appearance of competing with others can represent a separate market.** This is why in this case the competition right was violated as the products were sold for different prices.

### 3.2 Magill case

It was a case concerning actions of British and Irish television companies. Within the British system of provision of broadcasting services every television published its own TV magazine, meaning there was a separate weekly magazine for each TV station about its broadcast programmes.

Magill came up with an idea of a new product – publishing a magazine including the TV programme of all stations. In relation to this idea the company addressed all television companies asking them to submit information about their broadcast programmes (in this case a unique facility of non-infrastructural nature). However, the companies refused to provide this information claiming it is a part of their intellectual property.

Magill submitted a complaint to the Commission which rules that together these television companies have a dominant position on the market of TV programmes and information on TV programmes represent a right (as a unique facility) and it is impossible to run business without access to this right. What Mr. Magill wanted was to undertake business activities in an area which had yet not existed and at the same time there was unsatisfied customer demand which he was unable to satisfy by means of his product. Therefore the Commission ruled that competition was being restrained by refusing to provide access to a unitary facility. [5]

**The CJEU also stated that in this specific case protection of competition right is prior to protection of intellectual property.**

This decision of the CJEU was of great significance. The information the television companies refused to provide can be called unitary facility – an object available to the dominant party without access to which we cannot undertake business or process a product. The dominant party usually refuses to grant access to this special facility, leading to limitation of competition.

There are two reasons why a unique facility must not be made available:

- if the subject lacks sufficient education
- if it would lead to devaluation.

A unique facility can be of following nature:

- **infrastructural nature** – a typical infrastructural unique facility is railway, meaning the railway operator and owner is obliged to grant access to the railway. An example of infrastructural nature in Slovakia is that of private transport companies who are allowed to execute their business on railways which do not belong to them.
- **non-infrastructural nature** – a non-infrastructural unique facility may be of legal nature (e.g. the Magill Case).

This decision of the CJEU made way for new business ideas and execution of activities which had not been previously possible.

## 4. Conclusion

The European competition law contributes not only to protection of the consumer but predominantly regulates market distortions such as cartel agreements. These prevent the perfect competition in which consumers are to choose from plenty of provided goods and services. Apart from that, competition contributed to more quality and cheaper products as well as higher added value for the customer.

The decisions of the Court of Justice which are binding have also created better conditions by ruling in specific situations and by interpreting the European law in specific conditions. As it has been pointed out, the decisions have created many possibilities for entrepreneurs and companies to carry out their ideas.

## Acknowledgement

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# New Generation of Manufacturing Systems

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**Abstract.** This article describes basic information about new conditions for an autonomous production design. In the introductory section there are described origins of ideas concerning manufacturing systems simulation. The core contribution consists of description of the Internet of things and autonomous production. Currently existing, advanced software allow faster and more accurate data and information exchange, facilitate planning and monitoring during project work. These conditions create basics of the autonomous production.

**Keywords:** Autonomous production, simulation, the Internet of Things

## 1. Computer simulation

Computer simulation is one of decision support methods. The basis is to capture current state of real production system and significant relationships within the system, connection to external systems that may influence the production system. After collection, these relationships are transferred in form of a computer model in computer where experimentation with the system runs. During experimentation parameters or functioning of the system vary to achieve desired result. Testing of individual variants is very fast, which allows you to dynamically test large number of changes and from this quantity of options choose the most appropriate. If we have chosen the change, in which computer model achieves desired result, modified parameters are transferred to real system. Most of problems that may arise in implementation of change is detected in virtual world and therefore, the implementation of changes in real terms is quicker.

### 1.1. Modeling and simulation of the production system

Today's manufacturing systems are characterized options and features to process any type of components, parts, pre-established production processes and customer requirements. An essential feature of the production system is flexibility. And aspects, which characterize them are:

- Continuous exposure and adaptation to change manufacturing operations.
- Completion and assembly of product requires no longer complete big deliveries of parts of same type. Individual components in specific order are required in deliveries, corresponding to composition of products. This helps not to form too large stocks in workplace or in stock.

The new generation of production is all about production systems that can think independently, as well as persons who individually control car. For example company Siemens has been equally innovative in terms of bold vision on future state of production and manufacturing At present, contribution made to our production capacity - digital production software, automation or using communication protocols for production facilities. In latest project Siemens want to achieve, how to learn to produce smarter and keep their customers in future production.

## 2. Manufacturing systems that think

Many literatures refer to scenario as "self-organized production processes for highly customizable products." They liken it to global recovery of manufacturing industry, which may be driven by government funds, market forces and technology megatrends.

### 2.1. First scenarios

From perspective view of industry, production of the next generation offers way to meet customer demands for new, high quality production method adapted to meet requirements of even shorter intervals. It has potential to decrease use / surplus resources that can help producers cope with increasing pressure to reduce costs.
From another perspective, another factor is fact that people in emerging markets still need a lot of things as soon as possible.

Countries like the US and Germany would like to have these products manufactured within their boundaries. This brings more benefits for their employees and their economy. In this way countries will spend millions of dollars in 2025 according to McKinsey Global Institute diverting. Factories capable of autonomous production will be able to quickly adapt products to wide range of consumer preferences found in emerging market countries.

### 2.2. Internet of Things (IoT)

The current digital time is heading to self-organizing manufacturing process called as "the autonomous production." Key technology for management of autonomous production is through the Internet of Things.

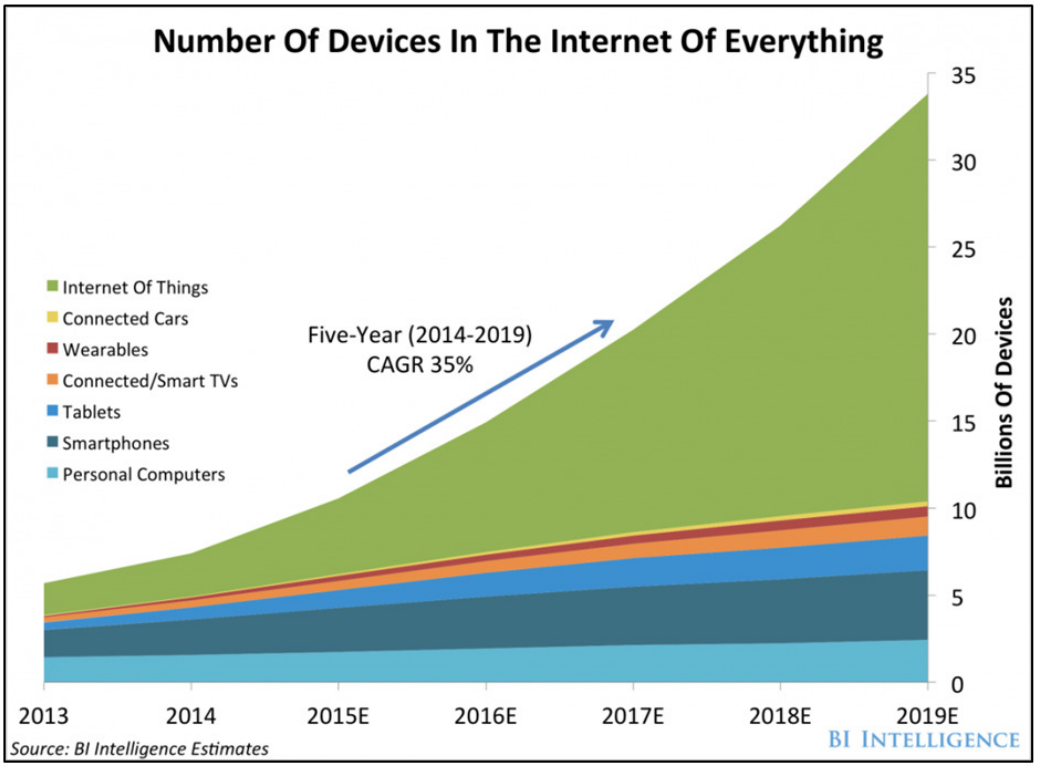


**Fig. 1** Number growth of devices in the Internet of things (John GREENOUGH, Business Insider, 2015)

Internet of Things refers to "things" like equipment for glucose condition monitoring, cars with sensors for collisions detecting, even pets with embedded microchips – it means that, information is shared via Internet with someone, or more precisely, we "shuttle" it to any computer, that uses information in an intelligent way.

Internet of things is not limited to consumer products. Aviation industry, such as undergoing revolution in connection with the Internet of Things, based on using information generated by sensors of the engine. Thus airlines have access to enormous amounts of data about engine in flight, by which they can find ways to reduce for example fuel consumption.

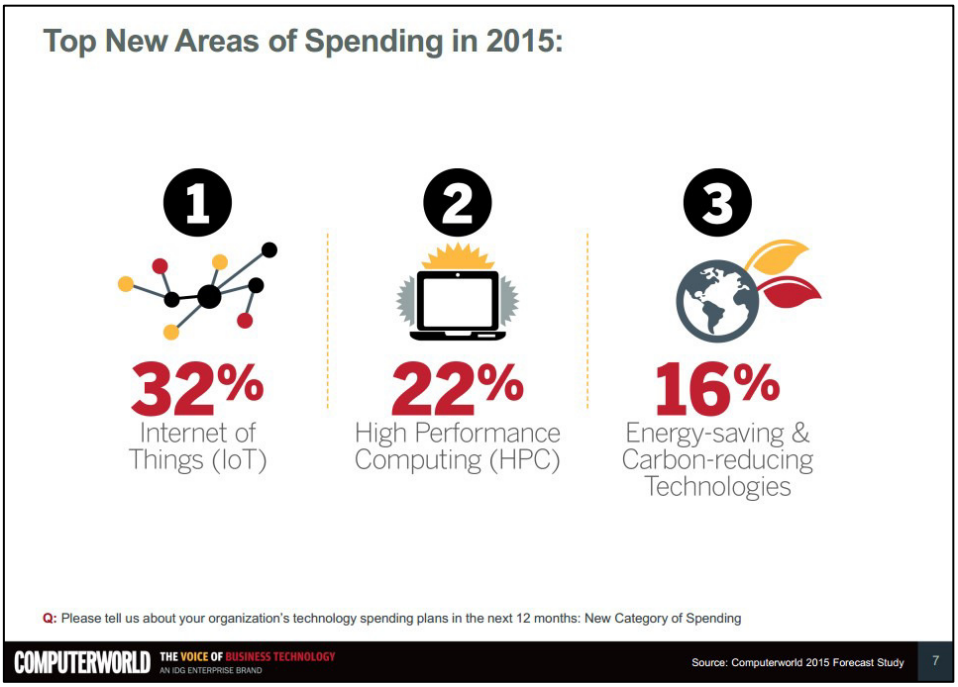


**Fig. 2** Computerworld's 2015 Forecast Predicts Security (Louis Columbus, Forbes, 11/26/2014)

## 2.3. Consequences of the "Internet of Things" for autonomous production

Internet of Things can be used thanks to massive development of technology and increased computing power software, miniaturization of wireless sensors, high-capacity networks and analysis of large amounts of data. Another important element is that each of these technologies is linked to availability through cloud, that it means its use can spread more quickly.

All of these technologies - calculation type, miniaturized wireless sensors, high-capacity networks and large number of analytical data - are already in operation, to some extent, in production itself. This makes possible to see link of IoT with production. In reality it was already made verbal term - the Industrial Internet of Things.

Setting the Internet of things in manufacturing plants allows you to extract much more information on the manufacturing process than was previously possible, even if producers can now collect relatively high amounts of data. Bigger set of data obtained with IoT can lead to the manufacturing of autonomous production by allowing you to quickly update production model and adapt it to changing conditions. These ideas and proposals are compared with current practice whereby production system designed and optimized to perform exactly the same process again and again. Autonomous scenario of production systems will be able to adapt and optimize for each type of task.

For example today robots are programmed to perform specific tasks. If there are same pre-defined environmental conditions and requirements, robot will always run the same job. In future autonomous robots production gets task to do and it will have to figure out how to perform in optimized way.

### 2.4. Present

Even with increasing spread of the Internet of things, we are not yet in times, where autonomous production is widespread, but there are factories that meet certain elements of autonomous production. Digital manufacturing solutions provide manufacturers with options for design and evaluation of the process almost immediately after creation of simulation model. In digital manufacturing environment, such as planning and management are now managed and data written to company`s database.

The result of this effort is comprehensive virtual model of production process, which is used for process improvement, logistics and product quality. Digital Factory and simulation tools allow to verify and optimize the processes, tools and management algorithms and interactions between them. And you are able to test this changes in virtual environment, before putting changes to production system. Such digital factory can be divided into several layers of technology. Plant also requires infrastructure for connecting devices - possibility of finding where connection adds added value, and where connections are annoying and software platforms are overloaded with data processing.

Before digital factory will really become autonomous, enterprises must improve their production flexibility, because this is critical element of autonomous production. Traditional production uses sequential flow of material between production modules, where each module has task that must be carried out in specific order. Type of production, which is more resistant to change and allows greater variability in production of various scenarios, is more suitable for laying basic elements of autonomous production. Digital Factory and various types of software allows you to optimize production assets and it continually monitor, manage and analyze.

### 2.5. Next steps

Before autonomous production will become reality, it still needs to use complementary technologies. For example Siemens PLM Software and their customer Bentley Systems, introduced new point in cloud technology, which allows you to capture exact location of production and logistics resources in company area.

Scan data of machines is used widespread in production halls and this is point for using cloud form, scanned data can be translated into virtual data of simulation environment for accurate and timely analysis. Now it is necessary and frequently used manual scanning and measurement of production facilities, buildings and production halls. New technology would eliminate this step what would allow faster changes that are critical requirement for autonomous production.

Similarly, event-driven simulation (also known as discrete event simulation) that are already available, will be essential tool for enabling autonomous production. Autonomous companies need strict rules and methods to control themselves to avoid damages. For example self-propelled vehicles - without strict rules can be dangerous. Therefore computer simulation and testing iv virtual world can be suitable for controlling future states of autonomous companies.

## 3. New Possibilities

At a time when the Industrial Internet of Things will lead to the emergence of new hybrid industries, such as digital medicine, precision agriculture and smart production. These new industries will generate new jobs, but will require new skills, more analytical abilities and skills in the use of digital technology. As machines take over routine tasks, companies will rely on people as individuals who provide creative solutions to problems, new forms of communication, cooperation and the ability to adapt to unfamiliar situation.

For example, in a highly automated factory may require fewer production workers at manufacturing facilities. But at the same time will be an increased need for experts and analysts,

who will have the ability to focus on tasks that can be automated, including system planning, engineering, process changes, coordination.

To support the hybrid industry, there are new opportunities for example. medical robots designers, intermodal transport network and others. More and more traditional companies creates demand for traditional professions.

## 4. Conclusion

Manufacturing is main driver of economic growth, attract investment, the incentive for innovation and job creation in high value.

All points on turn and developments that are happening now are building blocks for autonomous production, which already added economic value. Question is what happens when even autonomous production will be routine. I can cause that industry will be revived. In many articles it states that autonomous production could solve many global challenges such as growing population and aging population, climate change and resource scarcity.

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# Strenghts of Virtual currency Bitcoin and its position in the Monetary Area

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**Abstract.** Virtual currencies have become under the most significant innovation in the monetary area for the past 40 years. Transactions through them are almost free of charge, anonymous and fast. The article deals with the position of the virtual currency Bitcoin in monetary world and examines the strengths of virtual currency Bitcoin.

**Keywords:** Virtual currencies, bitcoin, strenghts of bitcoin, transaction fees.

## 1. Introduction

It attracted the attention of computer scientists for its structure and functioning. It attracted the attention of entrepreneurs for a minimum of transaction costs and investment opportunities. It attracted the attention of speculators and mafia for anonymity payments. It attracted the attention of governments, for example, for tax evasion. It attracted the attention of central banks due to its competitive advantage.

TechCrunch Best Technology proclaimed it for the best technology of 2013 on February 10, 2014 [1]. It was the first time when no one came for the prize, because its creator is unknown. Almost no one had heard of it on February 10, 2013. American economist and Nobel laureate in economics Paul Krugman wrote about it for New York Times on December 31, 2013. And what he wrote was really compelling:

*BitCoin looks like it was designed as a weapon intended to damage central banking and money issuing banks, with a Libertarian political agenda in mind—to damage states ability to collect tax and monitor their citizens financial transactions* [2].

Is this technology evolution, or revolution in the world of money?

Yes, we are talking about Bitcoin virtual currency, which will be discussed in this paper. In the first chapter we explain the basic starting points and characteristics of bitcoin, in the second chapter we focus our attention on the strengths of this virtual currency.

## 2. Virtual Currency Bitcoin and its Position

Bitcoin does not represent the first attempt to create a virtual currency, as is often mistakenly stated. In 1998, computer scientist Wei Dai published an article with vision of creating a currency that will circumvent the governments or banks and transaction fees will be minimal [3]. On the basis of this publication, currencies as DigiCash, Pecunix, or Web-money had been created.

There were 217 virtual currencies in March 2014. To date (March 25, 2015), we have been registering 592 virtual currencies, representing an increase of over 100%. The most widely used is the virtual currency Bitcoin.

| | Market capitalisation (USD millions) ▲ | Price (USD) | Available supply (number of units) | Volume traded in last 24 hours (USD) |
|---|---|---|---|---|
| Bitcoin | 3 444 | 246,05 | 13 997 775 | 25 467 000 |
| Ripple | 275 | 0,009 | 31 908 551 587 | 800 260 |
| Litecoin | 63 | 1,67 | 37 716 204 | 1 482 860 |
| Dash | 23 | 4,43 | 5 239 512 | 275 332 |
| Bitshares | 17 | 0,007 | 2 504 975 101 | 36 575 |

**Tab. 1.** Key figures on the largest virtual currencies [4]

Bitcoin is the first virtual currency, which experienced global success associated with global media coverage.

Bitcoin is a decentralized digital currency, often referred to as a virtual currency that is not covered with gold or other precious metal. It takes the form of a computer file and its mechanism of circulation creates for its users a relatively high degree of anonymity. Bitcoin works as a self-contained system based on a mathematical formula. It exists due to our confidence and thanks to the fact that we use it and accept as proper means of payment [5].

Bitcoin is not controlled by any authority. As mentioned above, it is a completely self-contained system. For this reason, the virtual currency is often referred to as fiat money 2.0.

Virtual money are classified as non-regulated digital money.

| | | | |
|---|---|---|---|
| The legal status of money | Regulated | Banknotes and coins | Electronic money Deposits in banks |
| | Unregulated | Local currency | Virtual currency |
| | | Physical | Digital |
| | | Type of money | |

**Tab. 2.** Type of money [6]

Virtual money forms a marginal amount of all money. Their significance can be estimated by comparing the market capitalization of the money aggregate M1 currencies such as the euro or the dollar.

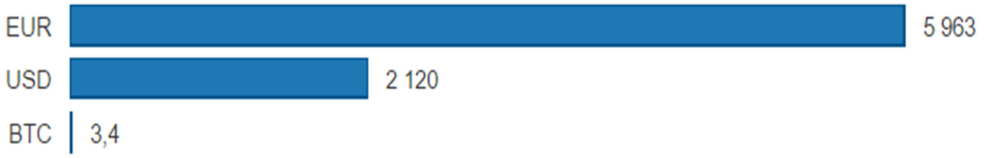


**Fig. 1.** Market capitalization of bitcoin and money supply (M1) of EUR, USD (EUR billions) [7]

Monetary aggregate M1 forms a currency in circulation and demand deposits. These are called narrowly defined money. From the graph we can see that the market capitalization of virtual currency is not equal to 1% of the market capitalization of M1 euro (in fact, it constitutes about 0.05% of the market capitalization of the euro). Closest to the market capitalization of virtual currency bitcoin is boliviano at the time of writing.

There are many differences between virtual and electronic money. The basic differences are in the particular technological parameters, such as the technology transaction, speed, and transaction fees. In the table we can see the number of electronic payment and virtual money per day.

| Way of payment | Volume of global daily transactions (EUR billions) |
|---|---|
| Visa | 12,34 |
| MasterCard | 7,37 |
| Paypal | 0,3 |
| Bitcoin | 0,1 |

**Tab. 3.** Volume of global daily transactions with bitcoin and with well-established payment solutions [7]

The most significant differences include, in particular, the legal regulation of electronic money and virtual currencies. Decentralization of virtual money belongs to the most popular bitcoin strengths from the perspective of its users. Decentralization is proportionally related to distrust of the banking system. For illustration, this graph is showing the market value of bitcoin to USD.


**Fig. 2.** Market price BTC / USD [8]

From the graph we can see the growth of the market value of virtual currency, which occurred at the time of formation and duration of the Cypriot bank crisis (crisis ensured strong media coverage of bitcoin). Gallup annually conducts research about confidence in the banking system. In recent years the values are the histrical lows when the average of the last few years shows that only 18% of respondents trust the banking system [9].

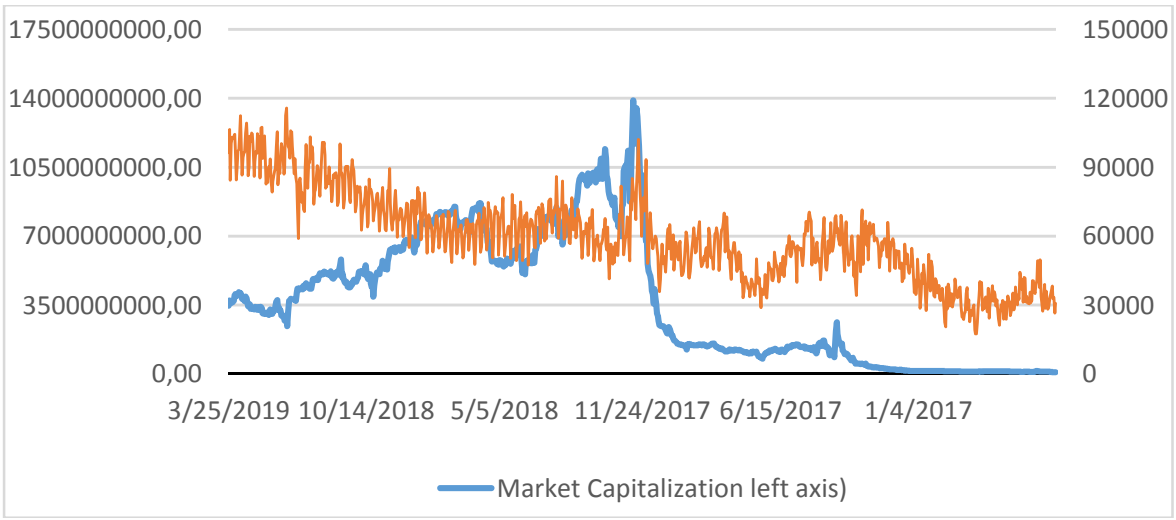


**Fig. 3.** Market Capitalization and Number of transaction per day of bitcoin [8]

The market capitalization of virtual currency Bitcoin represents 3,444,540,541 dollars. In November 2013 it was more than $ 13 billion. Average number of transactions of virtual currency transactions was 97794 transactions in March.

## 3. Analysis of the Strengths of Virtual Currency Bitcoin

In this chapter, we will focus on the analysis of the strengths of virtual currency Bitcoin. At the beginning of this section we present a table with the fundamental strengths of the currency, which will be discussed subsequently. The table also includes weaknesses of virtual currencies.

| strengths | weaknesses |
|---|---|
| transaction costs | deflationary gist |
| speed of transaction | ecology |
| decentralization | decentralization |
| anonymity | anonymity |
| | speculation |

**Tab. 3.** Strengths and weaknesses of virtual currency bitcoin

### 3.1 The Speed of Transaction, Anonymity and Decentralization of Bitcoin

Bitcoin transaction takes place after the end of bitcoin block. This closure of block lasts ten minutes, which means that payment bitcoin will take at most ten minutes. Payment by bank transfer, as we know, usually takes a few days. Payment by bank transfer abroad for even longer. It means that payment by bitcoin from Bratislava to Sydney will take at most ten minutes.

Anonymity bitcoin is also regarded as one of the advantages of virtual currency. But it also constitutes one of the weaknesses of the bitcoin (eg. Silk Road, evasion of taxes, etc.). Anonymity of payments provides the ability to support international projects which in other circumstances could not support. We can mention NGOs in China which are prohibited from accepting donations from abroad.

Decentralization, like anonymity, is given between the advantages and disadvantages of virtual currencies. One of the main advantages of decentralization is the certainty that nobody manipulates with the amount of currency in circulation. The amount of Bitcoins in circulation is predetermined and known. The final amount of Bitcoins in circulation is set at 21 million, and this number should be filled in 2040 (Nádaský, Pénzeš, 2013, p. 26). The size of the money supply of Euro cannot be assumed. In addition, earlier this year, the European Union launched quantitative easing, which means that each month 60 billion euros will be added to circulation.

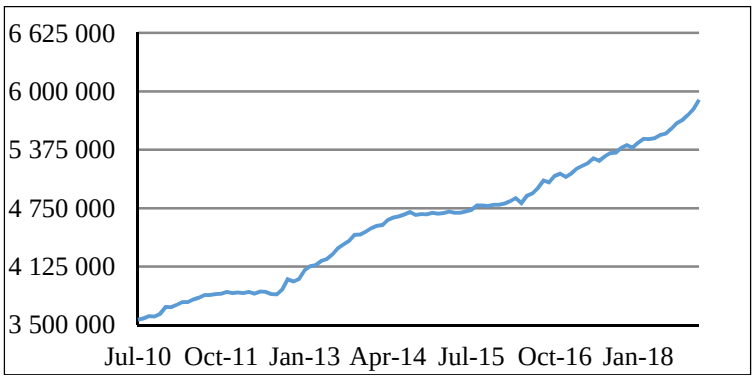


**Fig. 4.** Money Stock in Euro zone [8]

The second advantage of decentralization is that the owner of the money are you. We know many cases where the bank did not give money to their owners from the past. Whether this was due to the bankrupt (Lehman Brothers), financial problems (Cypriot banks), or due to external pressure. As an example we can mention the company WikiLeaks, which were blocked all money in banks.

### 3.2 Transaction Fees

One of the biggest advantages of virtual currencies are low transaction costs. Annual bank fees in the United States exceed the amount 60 billion USD. This amount includes the cost of processing and tallying of money, their transport management and security. For comparison, this figure is higher than the GDP of Bulgaria, and Slovenia (GDP Slovak Republic is in the amount of € 97.71 billion).

While the average bank transaction costs are between 2% and 4%, transaction costs of virtual currencies are at lower levels. Transaction costs can be calculated with volume of transactions (in USD) and transaction fees (in US dollars) on a given day.

| Date | Transaction Volume (USD) | Total Transaction Fees (USD) | Average Transaction Costs (%) |
|---|---|---|---|
| Friday, March 27, 2015 | 56 541 941 | 3 823 | 0,007 |
| Tuesday, March 10, 2015 | 87 360 262 | 4 943 | 0,006 |
| Tuesday, March 03, 2015 | 65 278 663 | 4 227 | 0,006 |
| Friday, February 13, 2015 | 56 852 658 | 3 824 | 0,007 |
| Monday, January 26, 2015 | 96 483 300 | 4 433 | 0,005 |

**Tab. 4.** Percentage of transaction costs [8] + own processing

From the table we can see that the transaction costs of virtual currency bitcoin were ranged from 0.005% of the daily volume of transactions to 0.007%. Transaction costs are demonstrated on the example payments from America to Brazil.

From the figure we can see that the payment from the US to Brazil passes through four banks. The final fee is in the amount of $ 324.6, which is a fee of 3.38%. If the payment has been done through virtual currency Bitcoin, the fee would be in the amount of $ 0.000063 (using the average percentage fee obtained from the table). The supplier would earn $ 324.59994 more than before.

## 4. Conclusion

Bitcoin virtual currency is one of the most interesting events in the monetary area for last 40 years. It has many disadvantages, such as too volatile course, not stored value, its formation consumes a lot of electricity, etc. Despite this fact, the technology is a groundbreaking model of the functioning of the transaction. Their rate of fees is more efficient than banking transactions. It is an easier and cheaper alternative. People with the status of low-income, working in the US each year sent $ 400 million to their families especially in South America, according to the World Bank. The amount of fees for such transactions can range in the amount of 10% of the transaction, sometimes more. Payments virtual currency should guarantee these people increase in their standard of living.

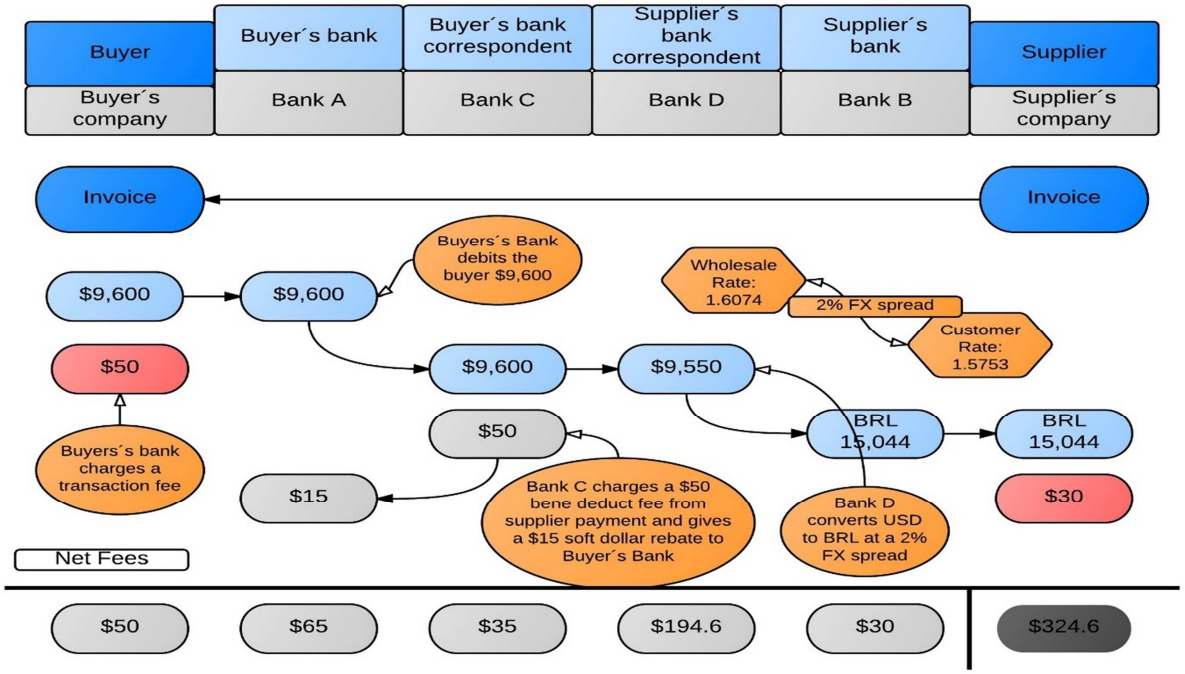


**Fig. 5.** Payments from America to Brazil [own processing]

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University of Žilina, Žilina, Slovak Republic

# Knowledge as an intangible asset of the company

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**Abstract.** This article defines views on the benefits of knowledge management in the various areas of the company. Also, it describes the possible fields that are linked to knowledge management, or knowledge sharing and describes the results of these measurements that affect the selected partial indicators. The article describes real measurement in various companies with relevant results in different areas (cost, teamwork, business opportunities and others). This article intends to refer in particular to the importance of knowledge in the context of human activities in each company.

**Keywords:** Knowledge, Knowledge Management, Knowledge Sharing.

## 1. Introduction

Nowadays it is not uncommon for companies to diversify, change their strategic position, core business, the country in which they operate, or the people they employ. They try to adapt to market conditions and at the same time, to be efficient, to maintain their market position.

Despite the rapid development of information technology and all means for achieving this aim, the potential for their development still remains on the people, because the work, thoughts and knowledge of workers form a substantial part of the system based on knowledge.

Work with knowledge is now considered a key capability for creating relatively sustainable competitive advantage. Expression of the benefits of working with knowledge in specific values and indicators brings us valuable information and feedback on the effectiveness of the knowledge management.

## 2. Knowledge in Different Areas

From our perspective, knowledge sharing or the implementation of knowledge management and impact on the work in terms of efficiency and productivity positively affects mainly the following areas:

- improvement of communication between workers or workplaces,
- direct communication with customers,
- improvement of teamwork between employees, workplaces and departments,
- increase of awareness of the company (whether inside or outside),
- more efficient work of employees (in terms of documentation, design, information search, communication, etc.),
- more efficient use of resources (internal),
- building of knowledge-based society and knowledge workers,
- improvement of company processes (e.g. administration, project management, human resources, etc.),
- improved relations between workers,
- use of modern trends in education, collaboration, educational system interactivity,
- cost savings related to these activities.

Building a knowledge management and sharing knowledge are possible in any company, regardless of the business sector. Currently, the trend is the development of knowledge management in large software companies and multinational corporations.

In our opinion, the use of knowledge management has significance mainly for companies:

- with multiple branches located in different parts of the country, or the world,
- focused on a number of fields (with multiple divisions),
- producing intangible assets (advertising agencies, software companies, nonprofit organizations, schools, foundations),
- with space for creating apprenticeships, communities, with workers willing to share knowledge,
- operating on the principle of project activity,
- with open corporate culture and adequate technical equipment needed to build sufficient network for the knowledge base.

The implementation of knowledge management does not represent a universal solution for incurred company problems. If the company decided to deal with a particular situation using knowledge management, it is appropriate within the primary considerations to specify bottlenecks in the company and subsequently expectations on the knowledge management.

In other words, to propose appropriate solutions to problems through knowledge management and not with it alone.

### 2.1. How to Guantify Knowledge

In determining the benefits of knowledge management, it is necessary to take into account the fact that many of them are of a qualitative nature and therefore their financial statement cannot be directly expressed.

Many experts and practitioners however specified the benefits of knowledge management and allocated them according to various criteria, e.g.:

- In relation to business processes (increase of company performance, profit increase, revenue maximization, cost reduction, new work methods implementation, new market opportunities creation).
- According to the nature of the benefits (qualitative and quantitative).
- According to the business processes (process results, such as communication and overall higher efficiency, which represents a shorter time period for problem solving, shorter period to design, faster results and delivery on market and organizational results, where finance, marketing and general fall under).

In the perception of the benefits of knowledge management for the company as a whole, five general areas were allocated: growth and innovation, flexibility, customer perspective, internal quality and support of stakeholders [1].

The division of these benefits varies. It also differs in the specifications made by individual experts in the area (as an example Alavi, Leidner, Breu, Kim, Hřebíček and others.)

Generally, the main motive of focusing on knowledge management for most companies is cost reduction (44%) and reaction to increasing competitiveness in the knowledge management field (42%). These two factors suggest that companies respond to the importance of working with knowledge, whether from the perspective of their own savings and greater efficiency, or because of the risk of lagging behind the competition.

Other motives for working with knowledge management are higher expectation of teamwork in the organization (30%), increase of actual value of the company (31%), cost reduction (26%) and easier search for new business opportunities, but this is hardly expressible and measurable [3].

In setting specific values to the benefits of knowledge management we may encounter two categories of indicators - hard and soft metrics.

Hard metrics represent objectively measurable indicators that track the development of company objectives, activities and processes, and therefore they can be transferred to the financial statements. Soft practices are used to measure and evaluate the level of individual processes or functional areas of the company by audit methods, such as expert assessment, questionnaire surveys, and interviews with competent staff.

### 2.2. The Measurement of Knowledge Management Benefits

In companies hard metrics are preferred because of their clarity and better comparability, but their use is more difficult. On this basis, a number of methods were created in pursuit of metrics and indicator design that would better reflect the specifics of knowledge management in companies, for example Scandia Navigator, Intangible Assets Monitor, IC index, Balanced Scorecard, Benchmarking, Return of Investment, Knowledge Management Assessment Tool, or Cost Benefit Analysis. Of course, these methods differ in the purpose of their use, orientation on the hard or soft metrics, or their complexity.

Benchmarking remains the most used method of performance evaluation (56%). In the soft metrics, the most used is the cost calculation ROI, internal rate of return IRR, and also the economic value added (26%).

Balanced Scorecard (BSC) mentioned in the previous section also belongs to the selected methods. This method was created in response to the need of companies to remain competitive in the long term and also to complement management model focused on the development of future growth opportunities, and not just financial indicators. The chosen method was modified by the author Amrita Tiwana, to meet the needs of knowledge management, where four fields are being specified with complementary questions:

- financial aspect (Are our investments into knowledge management profitable and do financial benefits sufficiently cover the cost?)
- human capital aspect (Is the work of our employees more efficient and are they better cooperating in knowledge sharing?)
- customer-investment aspect (Did we improve customer relationships by implementing knowledge management, did we gain new customers?)
- organizational-investment aspect (Do we have due to knowledge management more efficient work with knowledge and better ability to innovate than our competitors?

## 3. Conclusion

Management can effectively support the innovation process in terms of cooperation between workers who take part in it. This form of support is efficient because it saves time and money while ensuring continuity of business development. In the innovation process, which is supported by knowledge management, knowledge is automatically created, stored and shared. Knowledge management is not concentrated in one process of the company, but is distributed to all cooperating processes. At the same time, employees are interactively involved in the creation of knowledge. This causes significant reduction of the financial cost on creating the knowledge base. Employee participation on innovation is often very strong motivation. Transformation of enterprises into innovative societies requires also focus on the development of the organization in the processes and procedures, human resources management and technology.

Improvements of processes and workflows enable the company development of knowledge, its sharing and re-use, particularly in areas such as company strategy making, culture and customs of

company, work procedures, staff leadership, return on investment, productivity, laws, risk management, etc.

The result of development of an organization is the introduction of new and effective elements for collaboration and support of innovative processes that automatically collect knowledge. The effective elements include: communities of interest or profession, specialized knowledge networks or matrix organizations. These elements can be effectively integrated into the existing organization.

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# Knowledge transfer at the university and its relation with KIBS

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**Abstract.** The paper illustrates the importance of universities playing role in knowledge intensive services business as its outcome and the final stage. Described individual phases in this paper show the transfer of knowledge into practice. Created knowledge on the territory of the university, which subsequently may be imported into the process of patenting would be success for both the author, as well as for the university. Knowledge is taken as the first stage of the process. In the case that knowledge is a revolutionary and innovative it can be transferred to intellectual property. One of the measurable successes of universities is granted patents.

**Keywords:** knowledge transfer, Intellectual Property, university, management of IP, knowledge intensive business service, KIBS, lifecycle of the Intellectual Property.

## 1. Introduction

Knowledge transfer is a term used to encompass a very broad range of activities to support mutually beneficial collaborations between universities, businesses and the public sector. It's all about the transfer of tangible and intellectual property, expertise, learning and skills between academia and the non-academic community. [9]

Implementations phase outputs from scientific and research activities in the business sector are marked as knowledge transfer. [1]

The outputs of scientific and research activities on university is intellectual property (IP). Authors or originators are staff and students, or collaborating institutions. The IP should be properly protected and implemented not only into educational process, but also into practical. The exact verification of IP in terms of experience and market brings to university, originator and authors the technical and economic benefits. It is also a way to raise the results of the research and development of the university and to attract the university among prospective students, investors and partners of the research.

The way to achieve this is to apply the process of transfer knowledge in terms of the university.

## 2. Knowledge transfer process at the university

Transfer of knowledge is a process that consists of several phases and related professional activities which are necessary in different stages of the process carried out. The transfer of knowledge is a process that consists of various phases of advertising related professional activities, which are necessary in the different stages of the process performance.

Implementation of transfer is a typical object of project management. Transfer is based on the professional follow-up, from which the time line is needed. [1]

The aim of the transfer knowledge is to cover it legally, economically and administratively, where it's important for authors and inventors to understand the process, to know its various phases and to provide the necessary synergies to the University for its Implementation.

## 2.1 Institutional protection transfer of knowledge

Slovak conditions provide support to universities and scientific research organizations in knowledge transfer Centre of Scientific - technical information in the national project of the national infrastructure for technology transfer in Slovakia - NITT SK, operational programme: Research and development. Project NITT SK is financed by the European Regional Development Fund. The strategic objective of the project is the creation and implementation of national support transfer of knowledge research and development activities in the economic and social practice.

Support for applied research and the transfer of knowledge in universities to practice brings many changes in control / managing IP as a result of research and development.

For the academic and scientific - research institutions are shaped centres for technology transfer (CTT), which aim is to ensure commercial application of university knowledge, research and development results into practice. In some cases, the centres are created as one of the structures of the university, elsewhere there are created separately which are specialized business entities in which the University has an interest or have signed cooperation agreement and through this organization there is the commercialization of intellectual property of the university.

These centres are highly specialized departments to allow their complexity, flexibility, faster decision-making, back control and continuity of entire management of intellectual property.
We can define tasks of CTT as follows:

- comprehensive support management of IP rights in the organization's environment,
- transfer of learning, research and development into practice.

The following main tasks can be arranged through the following professional activities:

- management of IP from phase of the subject creation IP up to commercialization or extinction,
- legal services for the management of IP,
- project activities,
- communication and cooperation with the Industrial Property Office in SR, centres for technology transfer of other universities and colleges, etc.,
- economical, technical and administrative guidance in the development of start-up, spin-off companies or leadership incubator.

## 2.2 Phases process transfer of knowledge

The process transfer of knowledge can be established on the life cycle of the IP, it means different phases of the transfer knowledge copy the phases of the IP life cycle.

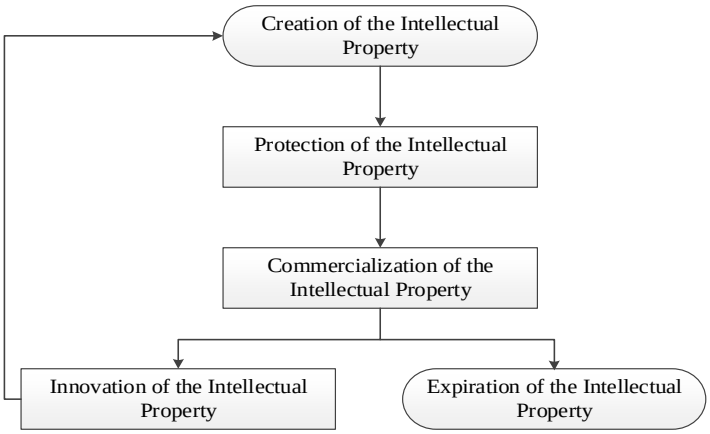


**Fig.1.** Phases of the Intellectual Property life cycle – created by author

Knowledge transfer processes shown in FIG. 1 shows the intellectual property generated directly by the university staff, students, as well as by the third parties. Of course, universities use the objects of intellectual property acquired through purchase or in form of license. These are usually used as inputs to its own research and development.

**A brief description of the different stages of the knowledge transfer process:**

**1. phase - Creation of the intellectual property (IP)**

The legal status of the author / originator to the university is an essential factor affecting the further treatment of the IP subject. In the first phase, it is necessary to identify the legal status of authors in order to determine whether the IP is created in the employment regime or according to contract research. The university through its employees, or in collaboration with external operators with the necessary specialization, consider the novelty IP and its commercial potential. In this phase of the transfer of knowledge it is necessary to determine the method of financing research and development IP, funding sources and associate contractual relationships.

It is important to check the inputs used in the research of IP, whether they are legally and economically settled relationships with authors and suppliers.

**2. phase - Protection of the intellectual property**

The form of protection depends on subject of intellectual property, its novelty level of development and applicability in the market. If the IP has the potential to be protected by a patent, utility model, design, topography of semiconductor devices, the procedure shall be governed by the applicable laws by government. Protection is here based on the principle of registration.

In case that its author's work, it is not possible to use the principle of registration, protection may be provided contractually binding the parties to secrecy and etc.

The third case is unregistered objects of industrial property rights, for example, know - how, logo, domain name. In this case, the protection is under contract, especially committing stakeholders to secrecy.

**3. phase – The commercialization of the intellectual property**

Commercialization can be realized in the form of licensing, the creation of spin-off companies, the transfer of rights, contract research, cooperation on projects and etc. At this phase it is necessary to use the experience and knowledge marketers who on the basis of information from the authors and the manager determine the appropriate form of IP on market.

At the phase of commercialization the subject IP it is necessary to determine its value, not only for the purposes of licensing or transfer of rights or deposit to spin-off companies, but also to settle the property into university. Assessment of individual solutions and categorizing the results obtained for the purposes of settlement and entered into the property of the university is a challenging process that requires the collaboration of technical and economic experts. To determine the value of IP for the purposes of settlement, transfer of rights or determining the amount of royalties can invite an expert from the Department of Industrial property who, in accordance with the purpose of the expert assessment and submitted supporting materials provides a general value.

**4. phase – Extinction of IP or innovation**

The last phase of the process of knowledge transfer is phase extinction or innovation. Extinction should be seen as a loss of rights, rather than physical destruction. The Extinction of IP can occur for various reasons, the basics are:

1. expiration of the protection period,
2. expiration, respectively the completion of commercial application on market
3. giving up the rights - if the object IP is not commercially applicable, it is not necessary for the university to continue to pay maintenance fees, or otherwise invest into the protection and confidentiality,
4. the loss of rights - found legitimate interests of third parties in IP (lawsuit, proceedings in the patent office, claims contractor, etc.).

This last phase can occur at any point in the process of knowledge transfer. Innovation is another option, as an existing object IP "expires". Its disappearance in this case is the beginning of a

new development; the original IP is input into research, looking for the path of improvement, qualification, utilization in other sectors or activities. Innovative solution then re-enters the first stage of the process of knowledge transfer.

## 3. Knowledge intensive business services as an important output of universities

Knowledge transfer can be seen in many ways especially when they are applied in practice. One of the most important transfers is knowledge intensive business services (KIBS), which mostly is supported from university. Knowledge intensive business services (KIBS) are considered important because they represent an important source of job growth and value – added. Moreover, they act as potentially and thus directly shape the competitiveness and performance of manufacturing and service firms, as well as organizations administered by local a central government. [10] Another concept that as recently got some attention is Knowledge Intensive Business Services (KIBS). KIBS produce and diffuse knowledge, which is crucial for the innovation processes. The increasing importance of knowledge intensive services constitutes one of the characteristics of the raise of the so-called "knowledge economy" [11].In general terms, KIBS are mainly concerned with providing knowledge intensive inputs to the business processes of other organizations, including private and public sector clients [12]. KIBS are based on professional knowledge resulting from research and development. Many of professional researches and developments are processing at university, which subsequently result the outputs. Those outputs might be transferred as patents, or it might be used as valuable intellectual property.

## 4. Conclusion

This paper briefly describes the process of knowledge transfer and its different phases. As each IP is unique as it is the result of creative intellectual activity of authors or producers, as well as the actual process of knowledge transfer cannot be generalized. Given the outcomes of individual steps and professional activities to be carried out (analysis, research, etc.), it is possible that the process of knowledge transfer does not pass all its stages. It will not meet the protection and commercialization of the IP or the transfer of knowledge into practice. The reason is that this knowledge is not new, it is not relevant to the practice, violates the rights of third parties, it is mistaken etc. If the process of knowledge transfer is not always comprehensive, just quick and successful does not mean that there is no need to maintain it and follow it. It is essential to go through the process to demonstrate that, despite our best efforts, it was not possible to meet the different phases; it is not permissible to leave out mentioned phases from its time, legal, economical or administrative reasons. Neglecting the preparation and performance of professional activities in various phases may have negative impacts on law and economic consequences for university inventors / authors and on subject of IP. The important aspect of output knowledge transfer is knowledge intensive business services (KIBS). This output provides better position in the market, improve services and accelerates its other outputs. Universities' supported outputs such KIBS are considered also as outputs that are measurable by university such as granted patent. All these positive factors on universities are mentioned in annual reports of university. Such a measurable process can only have a positive impact on the overall university and attracts new students or new cooperation's between universities and private sectors.

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Endogenous factors of the IPR intensive Industries in the regional enterprise environment in Slovak Republic (01.01.2015 – 31.12.2017)

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# Modelling of wages impact on strategic position of industries in Slovak economy

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**Abstract.** Strategic position of industries in the structure of national economy is rated as a share of volume of production of a particular industry in financial expression in generation of national economy output, i.e. by the contribution of each industry in creation of gross domestic product, added value or employment. Structure of national economy changes dynamically and develops under the influence of different factors affecting economic processes and economic subjects either from the point of view of demand or supply. The impulse to change the proportion of the industry in general output creation may be presented by the growth of wages in a particular industry which influence the price of its production. This primary impulse will cause a chain reaction in economy while in consequence of close interindustry flows, the prices of production in other industries will be modified as well. The price model determined on the base of input-output model enables to quantify the response of production to wages growth in a selected industry.

**Keywords:** Interindustry flows. Leontief input–output model. Price model. Production prices. Wages.

## 1. Introduction

The structure of national economy is constantly changed and modified under the influence of exogenous and endogenous factors. Change of position and importance of individual sector may result from implementation of state interventions to economic processes or may occur as a consequence of market forces effect on the side of demand or supply. Primary impulse of changes in the share of individual sector in production of economic output is usually presented by changes in consumers behavior or business subjects. With reference to M. Uramová et al. [6] reasons of changes in the structure of economy consist in changes of economic activities of market subjects and are followed by changes in social division of labour and its performance resulting in cooperation and specialization of production factors. Also government belongs among the subjects which may initiate structural changes in economy development. One of the reasons of intentional influence to transform the structure of national product and employment on the part of government is discrepancy between the determined social goals and consequences of natural functioning of market mechanism which may result in breaking of economic development stability and economic growth slow-down.

To study the structure of national economy means to quantify the share of individual sector in production of gross domestic product, added value, export or employment. Growth, stagnation or decline of economic activity makes itself felt not only directly, i.e. through changes in contribution of a particular industry in the total creation of production or employment, but due to the interdependence of industrie activates induces changes in an indirect way, and in another sector of national economy, which relate with provision of material inputs into a production process either of dynamically developing or declining industry. Leontief input-output model or its modifications - which with reference to M. Goga [1] are used for example to evaluate the impact of price changes on consumers expenses, changes in added value on prices of industries production, the effect of increase or introduction of a new type of taxes in a selected industry on changes of prices of

production in another sector of national economy – makes it possible to analyze and measure mutual connections between economic sectors. Growth or decline of production prices in a particular sector influences competitive advantages also in other sectors, brings changes in demand for their products, what is in the end reflected in financial value of executed outputs, it means in strengthening or weakening of a particular industry in the structure of national economy.

### 1.1. Factors of structural changes in national economy

One of the aspects concerning economic processes which are constantly in progress are changes in the structure of national economy. Irregularity is a characteristic feature of a process of structural changes which means that in the period of expansion production and employment do not grow in all industries on the contrary some industries may stagnate or even lose their competitive position and cease to exist gradually [7]. With reference to A. Slaný et al. [5] structural changes are related to movement of production factors, from the sectors being in the phase of loss to quickly developing industries having economic growth potential. Development and dynamics of structural changes depend on production factors elasticity, i.e. ability of elastic and effective adaptation of production factors to new production conditions.

The factors of structural changes result from the demand as well as from supply while the primary impulse may be impulses influencing economic industries from the internal or external environment [5]. Among (internal and also external) factors on the part of demand changes in consumers preferences, changes of households disposable incomes, changes of relative products and services prices, fluctuations of exchange rates, demographic development or style of life are included. Among the key supply factors the following items may belong: changes of raw materials on world markets, introduction of technological, product, marketing or organizational innovations related to changes in the process of transformation of inputs to outputs which bring for companies economic advantages form of lower costs, rationalization and higher effectiveness of production processes or higher productivity of production factors. With reference to A. Slaný et al. [5] impulses supporting the most important structural changes are formed on a micro-economic level while in the case of industries in the phase of loss they are related to direct financial losses, unemployment or costs caused by impossibility of flexible use on labour market. So structural changes might be desired from the macro-economic aspect but for the employees of the industry which ceases to exist, managers and capital owners they present net loss. Slowing down or finishing of economic activity of an industry has also an impact on performance and employment in other industries which through their production ensured inputs into the process of the industry which stops to exist.

In this way changes of the shares of individual industries on generation of gross domestic product, added value or employment may bring demand or supply shocks influencing all economic subjects by different intensity. After some time disruption of market balance can be seen in the change of the price of production of the industry which was affected by the market forces most intensively. Since the industries of national economy are closely connected the price is modified also in other industries especially in the ones which consume this production in creation of their own outputs. Increase of input price can be transferred by the company partially to a consumer, which means that the price of outputs goes up or the company may compensate increase of its costs at the expense of its profit, reduce capacity of provided products and services, or substitute more expensive production factor by the cheaper one but to risk the worsening of products quality. Increase of selling price of products with inflexible elasticity may cause decline of demand which consequently negatively influences revenues and profits of their producers, brings worsening of economic situation in a particular industry and weakens its strategic position in an industrial structure of national economy.

## 1.2. Price – index model establishment process based on input-output model

To quantify the response of production price of selected production industries of Slovak economy to a 5 % wages growth the price – index model developed based on data in financial form which will be obtained from the input-output table published by Eurostat for SR for 2010 will be used. The input-output table is the base of the model of W. Leontief, which will be applied to measure the impact of changes in added value on products and services prices of industries.

Leontief input-output model presents practical application of Walras general economic balance, it is made of a system of simultaneous equations which describe mutual interactions between various domestic industries expressed by interindustry flows of commodities from industries which produced them to industries which consume them in the process of products or services production for final consumers. It concerns formalized record of economic cycle representing connections between economic subjects on the side of demand and supply, which on one hand enables to monitor interindustry flows interchangeable transactions of commodities entering the process of production (interindustry demand) and on the other hand consumption of products and services demanded by final consumers [8]. The base of input-output models are tables of deliveries and utilizations which in a form of matrix express the structure of primary processes necessary for production of a particular industry providing validity of Leontief´s short-term production functions based on the hypothesis of fixed ratio between the number of inputs and outputs [2].

Leontief input-output model shows economy as a system whose elements are presented by individual industries. Production of all n industries may be recorded by means of column vector x, whose element e.g. $x_1$ presents total production of agriculture, $x_{55}$ total capacity of accommodation services used by visitors and so on. A part of production of national economy industries satisfies the needs of economic subjects, which is presented by the values of column vector. Other products which were manufactured in the particular year are consumed either as inputs to production processes or are not consumed resulting in the growth of unplanned investment of companies, i.e. stocks. Matrix Z presents the interindustry transactions table and its dimension is i x j, at which individual commodities i are in lines and in columns of an industry j (valid is that i = 1...n and j = 1...n). Each matrix element expresses how much of the commodity was consumed as input to a process of products or services production of a particular industry j, or more precisely what volume of input i from domestic production was used in production of the goods, i.e. to satisfy the final demand after one unit of industry production j [4]. Structure on economy may be formulated in a matrix record as follows:

$$\begin{pmatrix} x_1 \\ \vdots \\ x_n \end{pmatrix} = \begin{pmatrix} z_{11} & \cdots & z_{1n} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nn} \end{pmatrix} \times \begin{pmatrix} 1 \\ \vdots \\ 1 \end{pmatrix} + \begin{pmatrix} y_1 \\ \vdots \\ y_n \end{pmatrix} \quad (1)$$

By means of normalization of interindustry transactions table according to columns the matrix of technical coefficients A is calculated and it provides data concerning structure and volume of direct inputs of various commodities necessary to produce one unit of output in an industry j:

$$a_{ij} = \frac{z_{ij}}{x_j} \quad (2)$$

Methodology of M. Goga [1], was used to establish the price model, due to who the basis of establishment of price model is the general price equation, whose basement is costs equation from the input-output table which expresses the relation between the value of total production of industry $x_j$, material costs $x_{ij}$ and newly created value $z_j$. Set of costs equations is in an analytical form:

$$\sum_{i=1}^{n} x_{ij} + z_j = x_j \quad (3)$$

Costs equations are consequently modified by production prices indexes in j-th industry $I_{pj}$ and by indexes of added value $I_{zj}$. Quantification of influence of 5 % wages growth on production prices in selected sectors of Slovak economy requires disaggregate added value to its individual

components which means to include indexes of wages $I_{mj}$, profit $I^{z}_{zj}$ and fixed capital consumption to a set of costs equations. Price equation based on indexes looks as follows:

$$x_j \cdot I_{pj} = \sum_{i=1}^{n} x_{ij} \cdot I_{pi} + z_j \cdot I_{zj} \tag{4}$$

$$x_j \cdot I_{pj} = \sum_{i=1}^{n} x_{ij} \cdot I_{pi} + z_j^m \cdot I_{mj} + z_j^z \cdot I_{zj}^z + z_j^o \cdot I_{oj} \tag{5}$$

Equation (5) expresses the relation in which the value of production of j-th industry in new prices is equal to material costs in new prices and modified (increased or decreased) labour costs, profit and fixed capital consumption. After substitution of relation (2) in the equation (4), or (5) and by means of consequent algebraic modification we will get the final price-index model, which can be recorded in a vector – matrix form:

$$I_{pj} = \sum_{i=1}^{n} a_{ij} \cdot I_{pi} + a_j^m \cdot I_{mj} + a_j^z \cdot I_{zj}^z + a_j^o \cdot I_{oj} \tag{6}$$

$$I_p = (I - A^T)^{-1} \cdot \left(\hat{A}^m \cdot I_m + \hat{A}^z \cdot I_z^z + \hat{A}^o \cdot I_o\right) \tag{7}$$

With reference to J. Husár et al. [3] price – index model may take the following form:

$$I_p = (I - A^T)^{-1} \cdot \hat{X}^{-1} \cdot \hat{Z} \cdot I_z \tag{8}$$

$$I_p = (I - A^T)^{-1} \cdot \hat{X}^{-1} \cdot \left(\hat{A}^m \cdot I_m + \hat{A}^z \cdot I_z^z + \hat{A}^o \cdot I_o\right) \tag{9}$$

Price – index model in a formal record (9) will be utilized to quantify the impact of wages which form one of the elements of added value, price of performance of production industries of Slovak economy provided that no change in the structure and output of individual industries will arise. Obtained results are presented in the following chapter.

## 2. Application of price – index model in SR conditions

Position of an industry in national economy predicts volume of production in financial expression by which the industry shares in the generation of national economy output and employment. A lot of factors influence the value of an industry production among which the price of production and production factors, labour costs, capital and material demandingness of production process, level of sale, etc. may be included. Increase of inputs prices, e.g. wages in agriculture causes with reference to M. Goga [1] growth of production costs and at the same time growth of agricultural production what results in the growth of inputs into food industry and also increase of food industry products. It means that the change of production prices in one industry causes corresponding modification of production prices in other industries. In the table 1 we show the influence of 5 % wages growth in a selected industry of Slovak economy on the change of production prices in all analyzed sectors. New production prices are calculated so that unit column vector of wages index Im is gradually for all the industries modified up by 5 % and in this way the final change of production prices in industries covered in price – index model is obtained.

| Matrix of indexes of new production prices of selected industries | 5 % - wages change in selected industries | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Agriculture | Extraction and mining | Industry | Delivery of electricity, gas and water | Building industry | Trade, repair of motor vehicles | Transport and stock-keeping | Accommodation and hospitality services | Financial, communication and other services |
| Production prices index ($I_{p)}$ | | | | | | | | | |
| Agriculture | 1,4097 | 1,4026 | 1,4030 | 1,4008 | 1,4007 | 1,4018 | 1,4010 | 1,4004 | 1,4018 |
| Extraction and mining | 1,2698 | 1,2848 | 1,2718 | 1,2702 | 1,2701 | 1,2705 | 1,2704 | 1,2697 | 1,2711 |
| Industry | 1,0144 | 1,0174 | 1,0238 | 1,0142 | 1,0141 | 1,0146 | 1,0144 | 1,0138 | 1,0147 |
| Delivery of electricity, gas and water | 1,3343 | 1,3369 | 1,3360 | 1,3472 | 1,3352 | 1,3351 | 1,3353 | 1,3342 | 1,3365 |
| Building industry | 1,4603 | 1,4624 | 1,4647 | 1,4605 | 1,4697 | 1,4618 | 1,4610 | 1,4601 | 1,4620 |
| Trade, repair of motor vehicles | 0,6210 | 0,6211 | 0,6165 | 0,6210 | 0,6212 | 0,6347 | 0,6211 | 0,6209 | 0,6226 |
| Transport and stock-keeping | 1,7384 | 1,7430 | 1,7411 | 1,7389 | 1,7388 | 1,7564 | 1,7787 | 1,7384 | 1,7423 |
| Accommodation and hospitality services | 1,3156 | 1,3165 | 1,3177 | 1,3156 | 1,3154 | 1,3164 | 1,3159 | 1,3285 | 1,3179 |
| Financial, communication and other services | 1,1962 | 1,1972 | 1,1973 | 1,1965 | 1,1965 | 1,1969 | 1,1969 | 1,1963 | 1,2155 |

**Tab. 1.** Own processing by MATLAB program, 2015.

Based on calculated prices indexes it can be stated that the growth of wages by 5 % in one industry (neither wages of other industries nor prices of other primary inputs – fixed capital consumption, profit and taxes were changed) generated the increase of production price of all the industries included in the price – index model excepting the industries wholesale trade, retail trade and motor vehicles repair, which recorded decline of services price in average by 37,8 %. The change of production price was the most distinctive in the traffic and storage industry, reaching in average it grows by 74,6 %. On the contrary the price of industrial production responded to labour costs increase by 5 % only moderately, i.e. in a form of an average growth by 1,6 %. New price in building industry went up in average by 46,3 %, prices of agricultural production increased by 40,2 %, prices of energies, accommodation and hospitality industries grew by 32,7 %. Prices of financial, communication, educational and other services as a result of wages growth by 5 % went up in average by 19,9 %. Apart from the size of relative work price change sensitivity of price respond of industry output to wages growth depends also on the share of particular input in company production costs, resp. on industry demandingness on workforce.

## 3. Conclusion

Response of production price of selected sectors in national economy provided that 5 % increase of wages in a particular industry will arise was reviewed in the paper. To quantify price indexes the price-index model was applied, while provided no change in prices of other primary inputs, volume and structure of production process. It results from the calculated prices indexes that the growth of wages in one industry will cause not only increase of sale price of production of a particular industry but will generate pressure on modification of prices in all other sectors of Slovak economy. In sectors like agriculture, industry, building industry, transport and stock-keeping the input increased price would make the price of output higher, while the final price change would

depend on e.g. demandingness of production process on capital or workforce or the share of the interindustry demand inputs. In case of industries like wholesale trade, retail sale and repair of motor vehicles the price of output goes down. Different reaction of industries to a primary price impulse would imply the change in final consumers´ demand which would impact revenues and profits in the industry also in consequence of decline of competitiveness of domestic producers on foreign markets. Changes at the level of companies and industries would be reflected at macro-level as well so that the share of individual industries in generation of gross domestic product and employment would be modified.

Growth of wages would cost movement especially on the labour market. In an industry in which wages grow the demand for workforce would probably go down. Since the higher prices as an adequate counter-value for acquired goods or services would be accepted only by consumers whose disposable incomes are higher it would make entrepreneurs to modify their own pricing policy. Searching for savings especially in the area of costs might lead to for example decrease of wages or reduction of number of employees in other sectors of national economy what might be followed by structural changes also in the area of employment.

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# New Approaches in Modeling and Simulation of Holonic Agent

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**Abstract.** The behavior of systems based on the agent's approach is not deterministic. Therefore, simulation is used to remove the negative effects arising from the phenomenon of the emergence. This article describes a new approach for modeling and simulation of manufacturing resources. A new complex model, which is part of the architecture of the holonic agent, consists of three models, namely graphical, mathematical and physical. This approach will bring simulation closer to reality and will provide better testing of the behavior of the manufacturing system for specific failures.

**Keywords:** holonic agent, architecture, physical model, multi-agent systems,

## 1. Introduction

The behavior of manufacturing systems, which are based on the agent's approach, is not deterministic. Experimental testing of these systems on the shop floor / management level would be not only very expensive but also unrealistic. Our aim is to bring the properties of the simulation closer to the reality, and thus get more realistic behavior of the manufacturing systems and consequently appropriate responses of multi-agent system.

## 2. Architecture of Holonic Agent of Manufacturing Resource

Design and implementation of holonic and multi-agent systems for real applications requiring risky and reasonable decisions to ensure highly-automated production system, which is able to meet the growing demands of customers. The behavior of manufacturing systems, which are based on the agent's approach, is not deterministic. Experimental testing of these systems on physical shop floor / management level would be not only very expensive but also unrealistic [1]. Therefore, companies need methods and tools for modeling and simulation of these complex systems in rapid, inexpensive and risk-free way [2].

Holonic architecture agent is according to [3] control architecture, which is composed of the upper (HLC High-level control) and lower (LLC Low-level control) layer control. An agent in terms of MAS usually represents the upper layer of control and therefore it could be considered as intelligent autonomous unit with its own decision-making, communication and cooperation properties.

For the simulation, respecting the holonic agent architecture, we created modified architecture of agent manufacturing resource suitable for simulation (Fig. 1). The modified architecture of holonic agent was developed to extend the properties of the manufacturing resource model. Thus, we obtained a more realistic behavior during the simulation.

HLC consists of an agent capable of making decisions. In addition to communication with other units, it communicates with the lower layer through emulated tag table. LLC is in the case of simulation represented by the model of manufacturing resource control.

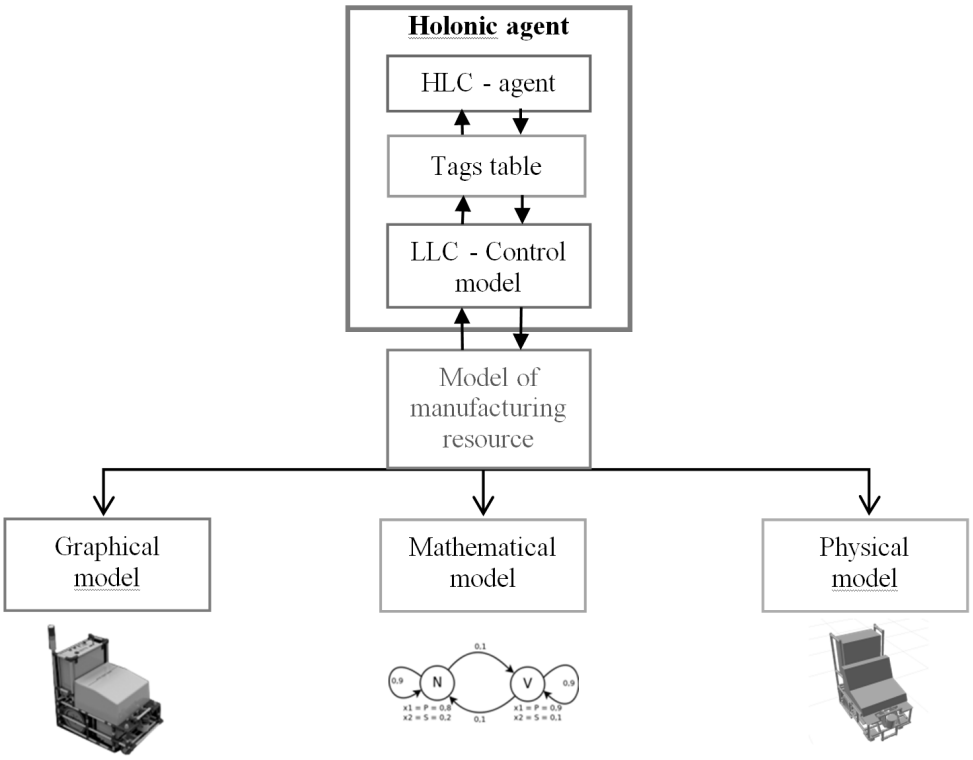


**Fig. 1.** Architecture of the holonic agent modified for simulation

## 3. Modeling of Manufacturing Resource

The actual model of manufacturing resource, which is used for simulation, contains three models, namely physical, mathematical and graphical.

### 3.1. Physical Model

To create a physical model we use a GUI (Graphical User Interface) which combines chosen features of the Bullet Physics library [4] that we implemented into our Ella Software Platform. This model represents the physical embodiment of manufacturing resource in its pure sense. It not only represents the allocated space in the virtual factory, which is bounded by the collision shape, but also adds other properties such as mass, friction, linear and angular velocity, dynamics, damping, etc. This will contribute with physical characteristics by which it will be possible to achieve the mentioned properties (Fig. 2). Model of manufacturing resource could be extended with the following features:

- Rigid body, collision shape,
- gravity, friction, mass,
- linear velocity, angular velocity,
- sliding joints, rotary joints,
- sensor, distance, gyroscope, pressure contacts,
- definition of collisions
- etc.

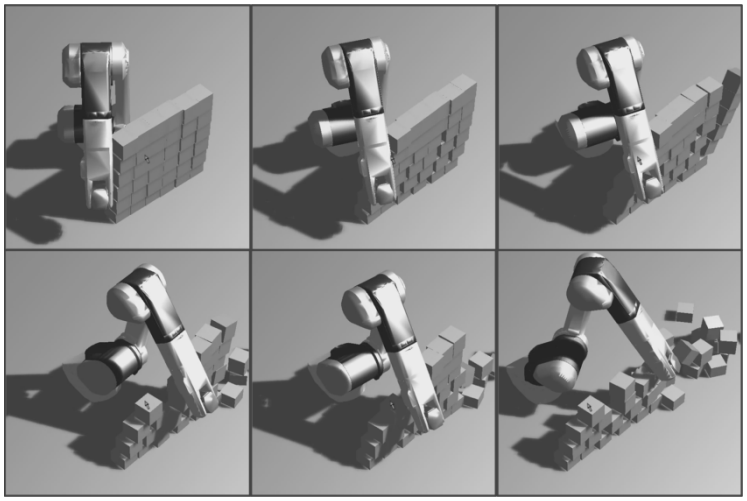

**Fig. 2.** Testing and implementation of the physical model

Rigid body is concept known in physics. A rigid body is an idealization of a solid body in which deformation is neglected [5]. Using only the collision shape, the physical model becomes static. Our implemented collision object class combines the properties of a rigid body and collision shape.

With these advanced features of manufacturing resource model, there could be simulated situations such as overloading of an AGV or robotic arm by too much heavy material, material outage from a cart, or other activities where it is possible to use a physical model.

In the first step of creating the physical model, there should be identified the individual physical parts of the model which will be during the simulation in the motion. In our case, the AGV divided into wheels and body. In the case of a robotic arm, we identify the individual segments between joints as moving parts.

In the second step, there is the effort to physically “fulfilled” identified parts. There are several ways to do this.

It is possible to generate the physical body from the graphical model (from the identified parts), but this form is computationally intensive. Another possibility is to generate physical shape, as was done the previous case and this physical shape algorithmically by V-HACD (Hierarchical Approximate Convex Decomposition) [6] divide into less computationally intensive parts. Minor drawback is that the resulting shape may have missing or additional physical parts, which differs from the original model. The last option is to fill the part by physical geometric primitives (cube, sphere, capsule, cylinder and cone). This option is the least computationally intensive. We use this last method with geometric primitives but gradually we move to the method with V-HACD algorithm.

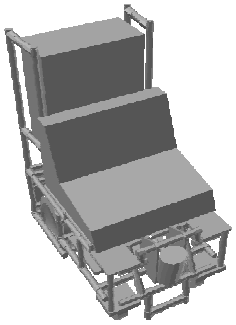

**Fig. 3.** Physical model of AGV created with V-HACD

Next step is to set up the physical links between physical parts by using joints. In option is a joint with 6DOF, which combines three translational and three rotational axes. Each axis includes a motor that can operate in two modes. The first is the angle (positioning control) and the second

velocity control. In the implementation of the robotic arm model, we have used the positioning method control. The velocity control method is used by AGV systems.


**Fig. 4.** GUI of basic physical elements in Ella Software Platform

Before the last step of the first phase it is necessary the completion of the model sensors. As a safety scanner of the AGV we have implemented distance sensor and as the detection of the overload of the AGV the pressure sensors in its carts.

The last step is to create the physical model of the factory. This means creating static model of walls, columns and other stationary objects located in the real factory. The advantage of this step is the possibility of using of different physical sensors with environment interaction. For example, a safety scanner of AGV vehicle could detect the walls and columns and then avoid them. The factory is generated from graphical shape and approximated by V-HACD. Control scripts (or control algorithm programmed in C++) connect inputs (sensors) and outputs of the joints (drives).

## 3.2. Graphical Model

The second phase is "sticking" the graphical model to the physical model. In a first step, similar to the physical model, are identified the moving parts.

In the second step, are identified the functional elements of the manufacturing resource, motion unit, security scanner, magnetic sensor etc. A module that cannot be graphically distinguished from other systems, such as communication unit, does not have to be considered. This graphical identification is used to visualize and localization the faulty subsystem. If the subsystem cannot be graphically distinguished, it faulty state is visualized over the system.

Next, graphical parts are separated and after that "glued" to the physical model by using tools of Ella Software Platform.

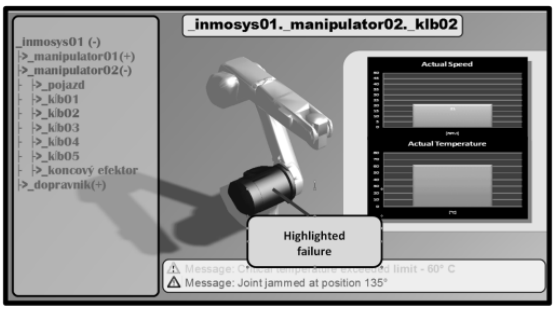


**Fig. 5.** Visualization of the failure [7]

## 3.3. Mathematical Model

Markov chains (Fig. 6) represent the mathematical model. In our case, these chains describe safety-relevant conditions of manufacturing systems and their subsystems. Different types of failures at the level of subsystems can be simulated or manually triggered. This model improves the possibility of testing the fault tolerance of the entire manufacturing system. It is possible to test how holonic agent will behave if the non-functional communication and motor unit. Those states are already evaluated by diagnostic unit.

```
self.markovChain = {}
self.markovChain["operational"] =      {0.95, 0.02, 0.02, 0.01}
self.markovChain["fuzzy"] =            {0.20, 0.30, 0.25, 0.25}
self.markovChain["still_occupied"] =   {0.10, 0.10, 0.40, 0.40}
self.markovChain["not_working"] =      {0.01, 0.02, 0.02, 0.95}
```

**Fig. 6.** Implementation of mathematical model

Our mathematical model of the safety scanner for AGV has four safety-relevant states. The first state is a where the sensor is in "operational" use. "Fuzzy" state indicates unclear, noisy (changing) signals. "Still_occupied" is a state where the sensor signals that area in front of the AGV is occupied for period. Finally, state "no_working" is a state where it is obvious that the scanner is faulty or broken.

## 4. Conclusion

Design and implementation of holonic and multi-agent systems for real applications requiring risky and prudent decisions to ensure highly-automated production system, which is able to meet the growing demands of customers. The behavior of manufacturing systems, which are based on the agent's approach, is not deterministic.

For this reason, we have proposed complex manufacturing resource model that consists of three models, namely graphical, mathematical and physical. This approach will bring simulation closer to reality and better testing of the behavior of the manufacturing system for specific failures.

## Acknowledgement

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# Application of Economic Value Added and Its Interpretations

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**Abstract:** This article is focused on the evaluation of an enterprise by means of Economic Value Added (EVA) and its use. EVA indicator evaluates financial performance of an enterprise, especially its intrinsic value for owners, the shareholders. The main thesis is that the invested capital (by shareholders and creditors) must yield more than the costs spent on this capital. If the result is positive, the enterprise efficiently valorizes its capital; if the result is zero, exactly what has been invested returns without valorization; in case of a negative result, it leads to the destruction of the invested capital. The aim of this paper is to compare EVA indicator according to Kislingerová and according to Neumaier & Neumaier, who evaluate this indicator in terms of INFA benchmarking method, and to determine which method has a better predictive value for the owners.

**Key words:** EVA, performance, ROE, owners, financial controlling, INFA

## 1 Introduction

Evaluation of enterprises is gaining importance and there are many uses of the various methods of assessment. The need for evaluation is important for company management, but especially for the owners who invested in the company and monitor whether their company valorises and grows. One of the tools of financial analysis, which is becoming increasingly popular in the field of management and company valuation, is Economic Value Added (EVA). EVA is an indicator interpreted by authors in various ways and the results therefore differ significantly.

Brealey, Myers, Allen (2014) says, that EVA sends a message to managers: Invest if and only if the increase in earnings is enough to cover the cost of capital. For managers who are used to cracking earnings or growth in earnings, this is a relatively easy message to grasp. Therefore EVA can be used down deep in the organization as an incentive compensation system. It is a substitute for explicit monitoring by top management. Instead of telling plant and divisional managers not to waste capital and then trying to figure out whether they are complying, EVA rewards them for careful and thoughtful investment decisions. Of course, if you tie junior managers' compensation to their economic value added, you must also give them power over those decisions that affect EVA. Thus the use of EVA implies delegated decision-making.

This article aims to compare different interpretations of Economic Value Added (EVA) and to determine which of them has a better predictive value for owners.

### 1.1 EVA - Economic Value Added (Kislingerová)

Kislingerová (2010) states that the main objective of a company is to maximize profit; however, not accounting profit, but the economic one. The main difference between economic and accounting profit is based on the fact that economic profit represents the difference between revenues and costs. The economic costs consist of accounting costs and opportunity costs. The opportunity costs represent the costs of lost opportunities, in particular the resources (capital, labour) that were lost and in fact had not been incurred on the best alternative use. Economic profit can only be achieved when its scope extends beyond a normal profit derived from the average costs of capital invested by creditors and owners.

EVA indicator is based on the following values:

- Net Operating Profit after Tax (NOPAT)
- overall invested capital (Capital - C)
- Weighted Average Cost of Capital (WACC)

$$EVA = NOPAT - WACC * C \quad (1)$$

$$NOPAT = EBIT * (1 - t) \quad (2)$$

where EBIT (Earnings before Interest and Taxes) is operating profit,
t – corporate tax rate.

$$Invested\ Capital = Liabilities\ - Short - term\ Trade\ Payables \quad (3)$$

$$WACC = r_d(1 - t) * \frac{D}{C} + r_e * \frac{E}{C} \quad (4)$$

where WACC are invested long-term capital costs,
$r_d$ - costs of outside capital (interest),
t - corporate tax rate,
D (Debt) - outside capital (debts),
C - overall long-term invested capital,
$r_e$ - costs of equity,
E (Equity) - equity.

Result values of EVA focusing on the financial performance of the company in the reference period should always be positive for the company to create value for its owners, the shareholders.

## 1.2 EVA - Economic Value Added (Neumaier & Neumaier)

Neumaier & Neumaier's conception of EVA is expressed in the benchmark model INFA, which serves businesses to analyze the financial health and to compare their results with the best companies in the branch, or the average in the branch.

$$EVA = (ROE - r_e) * VK \quad (5)$$

where ROE is return on equity,
$r_e$ – alternative cost of equity
VK – equity.

Assessment of a company's performance constitutes the priority perspective of the owner and return on equity (ROE) is crucial in financial controlling.

$$ROE = \frac{EAT}{VK} \quad (6)$$

where EAT represents economic results for a financial year,
VK - equity.

$$r_e = \frac{WACC * \frac{UZ}{A} - \frac{CZ}{Z} * UM * (\frac{UZ}{A} - \frac{VK}{A})}{\frac{VK}{A}} \quad (7)$$

where WACC represents average cost of capital,
UZ - pecuniary resources (VK + BU + O), i.e. capital necessary to be paid for,
A - total assets,
$\frac{CZ}{Z}$ - net profit share in the overall profit, i.e. the actual effect of taxation,
UM - interest rate,
VK - equity.

The estimated opportunity cost of equity relates to a classification of companies into four categories (see. Fig. No. 1). Companies can be unquestionably included into the 3rd and 4th group, but in the 1st or 2nd group this inclusion is debatable because the probabilistic nature has the estimate of the risk margin (RP).

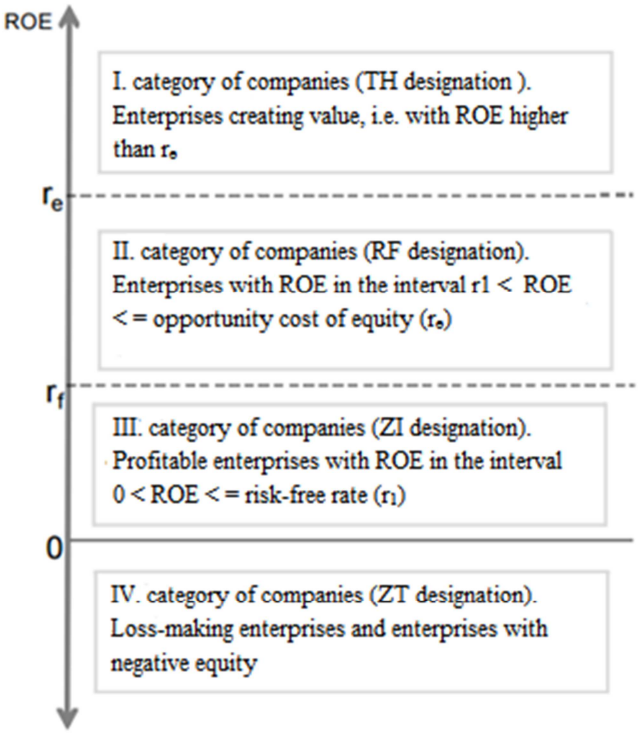



**Fig. 1.** Classification of companies by EVA

## 2 Methods and Data

For the evaluation of EVA according to Kislingerová in comparison to EVA indicator by Neumaier & Neumaier, Ferona a.s. was chosen, on which data from 2013 annual report as well as differences in the interpretations of these indicators will be tested.

For the calculation of EVA according to Kislingerová, CAMP model that estimates the cost of equity was used when calculating weighted average cost of capital (WACC).

$$r_e = r_f + \beta * (r_m - r_f) \tag{7}$$

where $r_f$ is risk-free rate of return, using figures from the Ministry of Industry and Trade websites for 2013,

β - coefficient expressing the rate of market risk through weighing the shares sensitivity to the changes of market portfolio, beta coefficient was found on Damoradan website,

$r_m$ - $r_f$ - Risk Market Premium (RMP), found on Damodaran website.

$$r_d = \frac{Interest\ Expenses}{Bank\ Credits} \tag{8}$$

For the calculation of EVA according to Neumaier & Neumaier the Ministry of Industry and Trade websites were used, where it is possible to run the benchmarking method with CZ-NACE classification. The advantage is entering the necessary characteristics from a balance sheet and from profit and loss accounts, where we can see the specific EVA indicator compared with the branch.

# 3 Results

## 3.1 Calculation of EVA Indicator (Kislingerová)

**Net Operating Profit after Tax (NOPAT)** represents the economic result related to the main economic activity of the enterprise, which actually reflects the economic benefit for the company owners. Corporate earnings represent a crucial indicator for the evaluation of return on investments for investors.

$$NOPAT = 155585 * (1 - 0.19) = 126023.85 \; in\ thousand\ Czech\ crowns \quad (9)$$

**Invested chargeable capital (C)** is the value of financial resources invested in the company by investors using a calculation over liabilities.

$$Invested\ Capital = 9305452 - 1181034 = 8124418 \; in\ thousand\ Czech\ crowns \quad (10)$$

**Weighted Average Cost of Capital (WACC)** represents the efficient use of outside and own resources.

$$WACC = \frac{92376}{3475034}(1 - 0.19) * \frac{5292071}{(9305452-1181034)} + [0.0226 + 0.0126 * (0.0743)] * \frac{3980948}{(9305452-1181034)} = 2.56\ \% \quad (11)$$

**Economic Value Added (EVA)** should be positive, however, Ferona a.s. has negative results, i.e. the company does not increase its intrinsic value.

$$EVA = 126023.85 \; - 0.0256 * 8124418 = -81624.5 \; in\ thousand\ Czech\ crowns \quad (12)$$

## 3.2 Calculation of EVA Indicator (Neumaier & Neumaier)

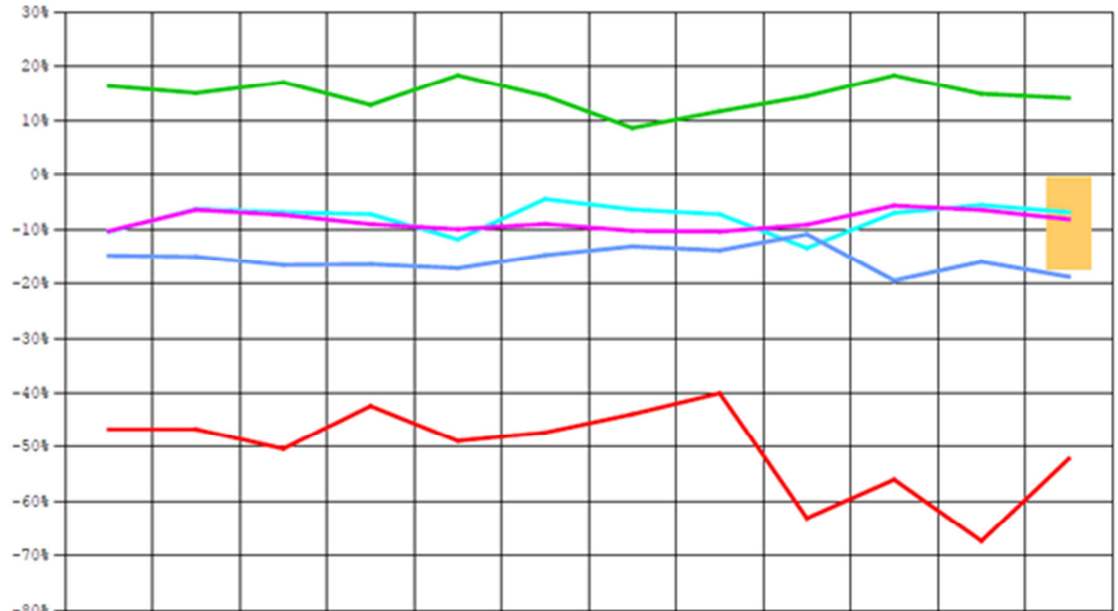
Conception of INFA model which includes a pyramid decomposition of annual EVA is a performance indicator, and along with the other indicators it estimates risk. Performance is the priority for owners; therefore, from the perspective of financial controlling, return on equity (ROE) is the most important. Its mathematical expression is as follows:

$$ROE = \frac{CZ}{Z} * \frac{\frac{EBIT}{A} - (UM * \left(\frac{UZ}{A} - \frac{VK}{A}\right))}{\frac{VK}{A}} \quad (13)$$

After substituting into formula EVA with (ROE - $r_e$) forming so-called *spread*, it shows a negative value, and therefore the result is not very favourable to the owners of the company in terms of profitability.

$$EVA = -0.1742 * 3980948 = -693481.1416 \; in\ thousand\ Czech\ crowns \quad (14)$$

In comparison with companies in the branch, see. Fig. 2 (Ferona a.s. is highlighted in orange) the company can be categorized into the third category (ZI designation), which ranks among profitable companies with ROE in the interval 0 < ROE < = risk-free rate ($r_f$).




| | 2011 1Q | 2011 1-2Q | 2011 1-3Q | 2011 1-4Q | 2012 1Q | 2012 1-2Q | 2012 1-3Q | 2012 1-4Q | 2013 1Q | 2013 1-2Q | 2013 1-3Q | 2013 1-4Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company | | | | | | | | | | | | -17,42% |
| Branch | -10.43% | -6.23% | -6.85% | -7.19% | -11.77% | -4.45% | -6.34% | -7.21% | -13.35% | -6.96% | -5.54% | -6.84% |
| TH | 16,30% | 14,99% | 16,99% | 12,83% | 18,30% | 14,46% | 8,62% | 11,64% | 14,42% | 18,28% | 14,83% | 14,06% |
| RF | -10.26% | -6.39% | -7.32% | -9.01% | -9.93% | -8.98% | -10.20% | -10.35% | -9.12% | -5.64% | -6.43% | -8.11% |
| ZI | -14.76% | -14.98% | -16.53% | -16.41% | -17.12% | -14.67% | -13.05% | -13.77% | -10.85% | -19.38% | -15.93% | -18.71% |
| ZT | -46.79% | -46.78% | -50.40% | -42.48% | -48.96% | -47.38% | -43.97% | -40.11% | -63.08% | -56.03% | -67.30% | -52.24% |

**Fig. 2.** Spread

## 4 Conclusion

This article aims to compare different interpretations of Economic Value Added (EVA) and to determine which of them has a better predictive value for owners.

After comparing the two EVA indicators, Neumaier & Neumaier's model INFA has a more complex mathematical expression of ROE indicator for the owners in terms of company financial performance. It does not only provide better surveys (indebtedness, profitability, liquidity, activity, etc.), but also focuses on the following three basic groups:

1. formation of productive forces (EBIT/assets), providing a view of what the company produces irrespective of the origin of capital and the level of taxation,
2. distribution of EBIT between creditors (interest), the state (taxes) and owners (net profit),
3. financial stability, i.e. the relation of the life of assets to the life of liabilities.

Neumaier & Neumaier are fully aware of the relationship in the hierarchy of financial indicators in each group, and therefore they use pyramid decomposition for individual groups. Thanks to this decomposition the Ministry of Industry and Trade in the Czech Republic prefers this method of evaluation of EVA indicator within their own financial policies.

Neumaier & Neumaier's model INFA cannot be used abroad because of accounting in the Czech Republic is different from International Financial Reporting Standards (IFRS).

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# Management system performance

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**Abstract.** Practically all standard-based management systems base their evaluation on the performance and effectiveness of the management system. Current trends towards unifying the structure of requirements in management systems are increasing the potential for system integration. This will create an automatic demand for the joint assessment of management systems' performance. This paper considers the significance and potential of support for the integration of management systems and joint management of performance and risk.

**Keywords:** integrated management system, standardization support of implementation, performance management.

## 1. Introduction

The design, implementation and improvement of management systems is supported by international standards, at the core of which are definitions of requirements. These requirements are designed to ensure that the system satisfies the expectations of the customer and other stakeholders. The ISO standards body issues a special group of standards for the following management systems:

- quality management (ISO 9001),
- environmental management (ISO 14001),
- information security management (ISO/IEC 27001),
- occupational health and safety management (ISO 45001),
- energy management (ISO 50001),
- business continuity management (ISO 22301),
- event sustainability management (ISO 20121).

Performance can relate to the management of activities, processes, products, systems or organizations. Every organization that implements a standardized management system needs to evaluate the performance and the effectiveness of its management system. The new approach in recently revised standards includes several references to "management system performance":

- the organization shall determine the necessary competence of person(s) doing work under its control that affects its management system performance;
- persons doing work under the organization's control shall be aware of the implications of not conforming with the management system requirements;
- the organization shall determine contribution to the effectiveness of the MS, including the benefits of improved performance.

The standards for management systems are generic, i.e. they should be applicable to any organization regardless of its size and organizational structure. Some management systems include guides for implementation in specific areas such as education, healthcare or the aviation industry. Although these guides explain the requirements for the specific use, they do not set out procedures for implementing the given management system. Certification of these systems evaluates the reality of fulfilment of the requirements and evidence of implementation, i.e. the approaches designed and put in place. Certification pays less attention to the evaluation of performance and effectiveness and nearly none to the method used to implement the management system. This paper will therefore

focus primarily on the aforementioned deficits and the opportunities that are being created in this area by the revision of the standards for management systems.

## 2. The status of performance in management systems

The term performance was not included in terminological standards until 2015, the only reference being in the glossary for the Common Assessment Framework "Performance = a measure of attainment achieved by an individual, team, organization or process". A comprehensive overview of performance and related terms is given in figure 1, which also illustrates the relationship between efficiency and effectiveness in accomplishing a given task. [1]

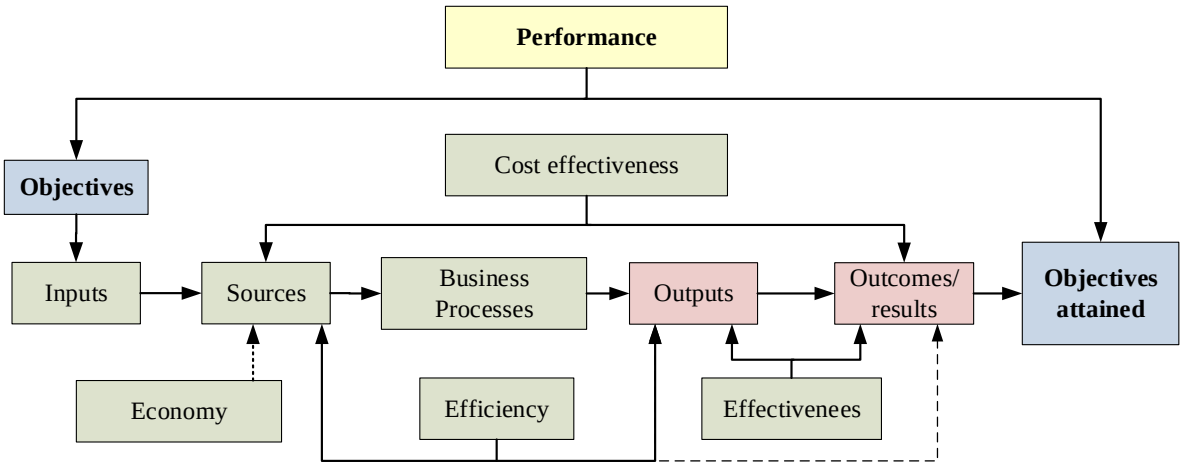


**Fig. 1.** Concepts and relationships connected with management system performance (based on [5])

It is particularly important to emphasize the differences between the concepts of "outputs" and "outcomes/results". An example of an output would be the issuing of a decision (e.g. a new regulation or piece of legislation). Results/outcomes are thus the overall effect that outputs have on direct beneficiaries and stakeholders. We all know from experience that it is possible to produce outputs without achieving any results.

The new version of the ISO 9001 standard for 2015 introduces a very simple definition of "performance" as a "measurable result". A note on this definition indicates that performance can relate either to quantitative or qualitative findings. The organization must therefore establish "performance standards", which may have the character of "key performance indicators (KPI)". KPI are those measures that are most critical, and measure the performance of those key processes which are most likely to influence the effectiveness and efficiency of our key performance outcomes. A good example of customer satisfaction in public sector may be measurements in customer/citizen results of the performance of the processes organization have put in place to deliver customer/citizen products and services [7].

Although there may be value in improving the system elements alone, the intended outcome of planned actions and other MS changes is an improvement in the organization's performance.

### 2.1. Performance and risk

The standards laying down requirements for management systems strengthen a performance and results orientation through a process approach supported by the PDCA cycle and risk-based thinking. Risk-based thinking in particular has a strong connection with performance, as can be seen in the definition of risk as the "effect of uncertainty on an expected result" and the definition of performance as a "measurable result". From these definitions it follows that if an organization wants to achieve its expected results, it must incorporate risk management into its performance management since risk has an effect on the achievement of results.

Risk-based thinking should be more explicit and incorporates it in requirements for the establishment, implementation, maintenance and continual improvement of the management system in an organization.

It is important to identify which processes represent the highest level of risk in terms of the organization's ability to attain the expected results (meet its objectives), because the consequences of process, product, service or system nonconformities are not the same for all organizations. For some organizations, the consequences of delivering nonconforming products and services can result in minor inconvenience to the customer; for others, the consequences can be far-reaching and fatal.

Risks affecting the organization must be identified, evaluated and managed. Risk management involves the planning and implementation of measures to prevent risks, avoid them, transfer them or eliminate them. If risk management is linked to performance management, it increases the probability of achieving the organizations objectives.

## 2.2. Implementation of performance management having regard for the need for integration

The requirements of management are mainly oriented towards achieving better performance in the organization through accurate and timely information on processes, their results and the scope for improvement. Organization management is open to investments that bring quick benefits for the organization's business results. A deeper understanding of the performance outcomes associated with opportunities allows managers to better decide when, how much, and where to invest resources to enhance management systems [2]. Decision-making must take into account the organization's overall objectives and current and future contexts. The design and implementation of an organization's performance measurement system is influenced by the context of the organization and the changes in that context, particularly with respect to:

- its specific objectives and the risks associated with its context and objectives;
- the needs and expectations of its customers and other relevant interested parties;
- the products and services it provides;
- the complexity of processes it employs and their interactions;
- the competence of persons within or working on behalf of the organization;
- its size and organizational structure.

A key factor in implementing management systems that affects performance is the integration of the quality management system requirements into the organization's business processes

Depending on the initial situation an organization can benefit from implementing a performance measurement system in a variety of ways including:

- better designed management and control mechanisms in the organization, driving behavior to align with the organization's core values, goals and strategy;
- improving communication between employees and managers - better access to information for faster and more accurately targeted measures for improving performance;
- a better-tuned system for motivating employees and clarifying job responsibilities and expectations - enhancing individual and group productivity.

Managers have various expectations ranging from easier access to orders that require certification with a specific management system, to efforts to improve processes with the support of a systematic approach. The extent to which expectations are satisfied depends to a large extent on getting the system's implementation right. Approaches to the implementation of management systems can be generalized to the implementation of various management models and methodologies. The development and maintenance of a performance management system proceeds from the organizational to the individual level.

The basic scheme for management system implementation should be built on the following principles having regard for the need for integration:

- establishing a clear management decision accompanied by a statement of what is expected from implementation, the formulation of a commitment on resource allocation and management participation and a decision on the method of implementation;

- ensuring the integration of the management system requirements into the organization's business processes;
- communicating the meaning of implementation of the performance management system for stakeholders and training for employees and members of the project implementation team;
- analyzing processes in terms of the requirements for the measurement and information gathering system;
- specifying measures for harmonizing the requirements for the performance management system;
- ensuring the effectiveness and continuous improvement of the performance management system [3].

It is necessary to ensure at all times that performance management in an organization focuses not only on improving the organization's products but above all on improving processes and their efficiency and effectiveness. At the same time it is necessary to ensure that the integrity of the management systems is maintained when changes to the certain management system are planned and implemented.

## 3. Conclusion

Performance management is an agreement-based interactive control model. Its operational core is in the ability of the agreement parties to find the appropriate balance between the available resources and the results to be attained with them. The basic idea of performance management in operations is, on the one hand, to balance resources and targets as well as possible, and on the other, efficiency and quality; ensuring that the desired effects are achieved in a cost-efficient manner.

A robust integrated management system can help an organization to improve its overall performance and forms an integral component of sustainable development initiatives.

Management system standards make the cases for a well-defined management system based on a framework that integrates established fundamental concepts, principles, processes and resources to help organizations realize their goals. They aim is to make top management aware of their duties and commitment in achieving their customers' and stakeholders' needs, expectations and satisfaction with their products and services.

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# Data collection for Technical Services

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**Abstract.** Data collection is a systematic approach to gathering information from a variety of sources to get a complete and accurate picture of an area of interest. Is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions. In the article are describe two forms of data collection. In the first part is a description of Readers equipment. In the second part are describe three forms coding of information. The article deals with the development of QR Codes.

**Keywords:** Data collection, barcodes, QR codes, RFID chip, versions of QR codes.

## 1. Technical support in data collection

More plants at home and abroad still fing the paper form of data collection. This form was once standard, but today it´s insufficient. While the complexity of manufacturing, assembly is growing, with the amount of information, on one hand. On the other hand, it also increases the complexity and amount of work for maintenance. The maintenance is more and more employing a variety of CMMS systems, barcodes or QR codes, that facilitate and accelerate the work of maintainer, because they have clearly defined what they performed.

The modern trend is maintenance organization computer management system (CMMS). However, if we are in maintenance management confusion, the introduction of this system will further increase the confusion. Here run phrase: bad input information = bad output information. Such solutions are used in various industrial PCs, smartphones, tablets, and other sensors.

### 1.1. Data collection system

Basic data collection systems are commonly used as electronic and paper. Each of these systems has one´s advantages and disadvantages. At the present, it´s better to use an electronic system that allows you to work with data in real time. These systems can be divided into manual and automated data collections.

In the paper data collection system, there is a lack of data, the data are unreadable, bad archiving, data loss and so on. These problems are removed by electronic collection, which clearly records your data and employee knows exactly what to do. After the capturing there are often displayed images, that clearly color highlight, what to do.

For systems of data collection is preferred to use complex systems for automated data collection. At that time, the maintenance is done better and faster with the aim of reducing costs and downtime and increasing availability of equipment.

### 1.2. Readers equipment

As mentioned in the introduction, the readers are industrial PCs, smartphones, tablets, and other sensors (Fig. 1). These hardware solutions must be equipped with specific software or more precisely maintenance application. This helps you better manage and perform maintenance process on machines and equipment. An example is, once the scanning of bar code on the device is made, the industrial PC displays the following information:

- Machine lubrication schedule.
- Automatic identification of machines by RFID tags.
- Output data in the form of charts and forms.
- Work orders and reports.
- Collection of operation data.
- Automatic evaluation of the data collected.
- Automatic generation, rounds planning and requirement planning for job data.

Mobile terminals are usually delivered in formats for online communication with radio data transmission or in batch format in which the data are stored in its own memory and can be transferred to / from the PC using the serial interface. The communication unit can be used for data transmission directly through a cable connection between terminal and PC or other devices and for batteries recharging also.

**Fig. 1.** Examples of industrial PC and data reader.

### 1.3. Benefits

The usage of maintenance systems in plants has many advantages. One of the biggest is the elimination of paperwork and manual tracking activities, leading to the already mentioned greater productivity and cost reduction. The functionality of these systems is to collect and store information. The advantages in creating automated data collection systems, their transmission and processing are as follows:

- Correctly data.
- Clearly defined and readable.
- Considerable time savings and costs.
- Rapid ROI (return on investment).
- Elimination of errors caused by human factor.
- Clarity records.

## 2. Description and use of codes of practice

The most commonly used code type in practice is a bar code. In maintenance, it is placed on the machine or production line. It can be mounted or printed and is usually remotely scanned by laser scanner. This sensor is always staff on hand and the data are transferred to an industrial PC, which knows what to do. Using the registration system, the data can be used to check the work performed by workers, the number and types of the intervention, evidence of the person, who performed the manufacturing operation and the like. The information obtained can of course also be used for many other applications.

Differently these codes fall within the district so-called "Automatic Identification" or in other words to the "data registration without key using". The most important practical parameters of the codes is their density and contrast. The amount of encoded information per length unit determines the density and type of code. Linear codes are used for encoding fewer characters, a larger volume

of information has been successfully encoded into a two-dimensional codes. Nowadays, there are used different codes, whether 1-D, 2-D, 3-D, of different color and the like.

## 2.1. Barcodes

Different information sources indicate that the use of these codes can increase employee productivity by at least 30%. It is also possible in real time and in really detailed to see exactly which actions have already been performed or not. As long as the activities of work are performed without standardization and introduction of such as system, it can assume the productivity growth higher than 30%. The three main characteristics of the barcode are:

- Accuracy - Using barcodes is one of the most accurate and fastest methods for registration of large amounts of data. With the manual data entry, errors occur on average at each three hundred entry, at using the bar code, the number of errors is reduced to one millionth, where most errors can be eliminated if the code in embedded with control character for verifying the accuracy of reading all the other characters.
- Speed - Comparing the speed of data entry from barcode keyboard typing, we find that even the best typist is at least three times slower than any scanner.
- Flexibility - barcode technology is a multi-purpose, reliable and is easy to use. Barcodes can be used in a variety of extreme environments and terrains. They can be printed on the heat-resistant material, or hand the extreme cold, the acid-resistant materials, organic solvents, abrasion, high humidity, and the like. Their size can even be adapted to be able to use them on miniature electronic parts.

The most commonly used codes in the industry are in Fig. 2.

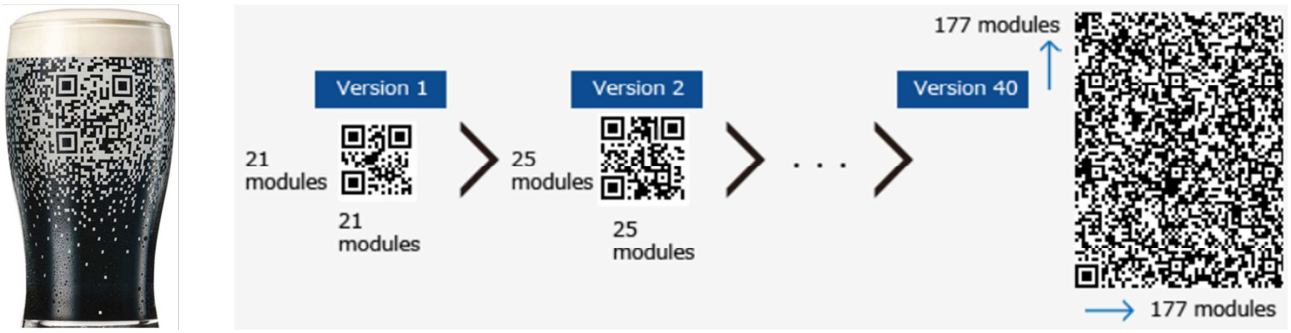

**Fig. 2.** Code ITF and Code 39.

## 2.2. QR Codes

QR Codes (Quick Response) are nowadays very popular, and every company uses them in various ways. This is a specific image (a two-dimensional bar code), which is formed by black and white squares. It may contain various information such as instruction execution activities, small picture, the phone number for the service technician and the like. It allows a very efficient approach to maintenance workers, to the implementation of maintenance without having to carry a variety of instructions or procedures. The QR code should be only taken as a picture and the smartphone will take care of the rest.

This revolutionary QR code is linking the real world with the digital. The advantage is that with this code there can be written more data than with conventional barcodes. Currently there are freely available various generators of such codes. The generated image should be then just placed in the right place at the factory. The use of QR codes is versatile not only in the production and maintenance but also in the advertising industry.

The symbol versions of QR Code range from Version 1 to Version 40 (Fig. 3). Each version has a different module configuration or number of modules. (The module refers to the black and white dots that make up QR Code.). "Module configuration" refers to the number of modules contained in a symbol, commencing with Version 1 up to Version 40. Each higher version number comprises 4 additional modules per side. Each QR Code symbol version has the maximum data capacity according to the amount of data, character type and error correction level. In other words, as the amount of data increases, more modules are required to comprise QR Code, resulting in larger QR Code symbols.




(a) (b)

**Fig. 3.** (a) QR code in the advertising industry (Glass filled with Coca-Cola), (b) Version of QR Codes.

## 2.3. RFID chip

RFID (Radio Frequency Identification) is an identifying element for the identification of (not only) goods, operating in the high frequency band. It is a "continuation" of barcodes. The initiator of the development was, as in the case of barcodes, company WalMart.

There are two types of RFID chip - active and passive. Active is used less often than passive RFID system. It´s difficult and expensive, because they contain a power source and are able to broadcast their identification alone - is therefore used for active localization. Passive transmitter (sensor) periodically sends pulses to the surrounding area. If a passive RFID chip appears closely, it uses the received signal to charge its power capacitor and sends a reply. Scanning scheme is shown in Fig. 4.

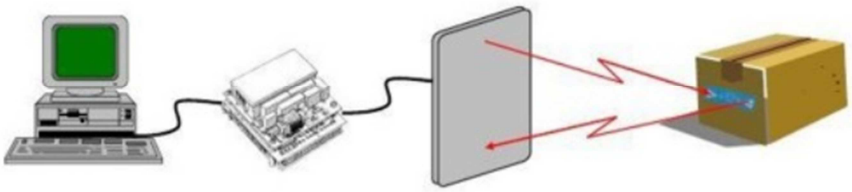


**Fig. 4.** PC + reader + antenna + RFID tag.

The following table contains more information about RFID chips.

| Frequency | Characteristic | Application |
|---|---|---|
| Low frequency - LF<br>125 – 134 kHz | - range < 50 cm<br>- can be read through the fluid<br>- a small amount of data at low speed scanning | - attendance systems<br>- identification of employees who came to perform maintenance<br>- scanning chips to the machine |
| High frequency - HF<br>13, 56 MHz | - range < 1 m<br>- can be read through the fluid | - smart cards<br>- condition monitoring of machines |
| Ultra high frequency - UHF<br>860 – 868 Europa<br>902 – 928 USA<br>950 – 956 Japan | - range 1 - 6 m<br>- can´t be read through the fluid<br>- high speed scanning | - monitoring the machine when moving |

**Tab. 1.** Distribution by frequency.

## 3. Conclusion

Nowadays, there is a large number of materials situated in the production that has a rapid transition from the past. It is clear to us, greater equipment care, in terms of their technical condition. Big problem is the failure of the human factor. Another essential element is to reduce the total cost during the machine operation. Those new principles will not only enrich modern maintenance, but also represent a great potential for savings. Based on these assumptions automatic data collection and various types of codes seem as one of the best solutions for condition monitoring of machines and equipment. Companies through the maintenance management system will get a comprehensive picture of the maintenance functioning in company.

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# Prosperity and Crisis from the Point of View of Business Diagnostics

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**Abstract.** Understanding the crisis in enterprise as an opposite of its prosperity allows us to focus in management not only on the consequences of the crisis or how to deal with the crisis, but primarily on the prevention and on the detection of the factors of business prosperity. Business diagnostics offers to managers this comprehensive view on the enterprise.

**Keywords:** Crisis. Prosperity. Business Diagnostics.

## 1. Introduction

Sustainable business development is a concept that is now increasingly inflected. The question is how to maintain what it stands for, and whether and how it can affect. This paper provides insight into the problems of the interconnection of the business diagnostics. It contains the view on the issues of the business prosperity and factors that it is affected with an emphasis on business diagnostics, which provides a comprehensive view of the company and for reasons of a crisis in the company and options to address. Business diagnostics can detect problems early and thus avoid the negative consequences that could reduce the prosperity of the company.

## 2. Business Diagnostics, Prosperity and Crisis in Enterprise

Business diagnostics as a relative young scientific discipline has no stable position in management. However, business diagnostics can by correct implementation promptly recognize symptoms of the crisis in the enterprise and avoid crisis and its negative consequences in enterprise.

### 2.1. Business Diagnostics

The term diagnostics means a process of recognition and evaluation. This term is primarily used in medicine, where the doctor assesses the symptoms of a sick man based on the knowledge of healthy man. Business diagnostics is based on the same principle - knowledge of normal, healthy condition the enterprise and the recognition and evaluation of deviations from normal. Kašík, which contributed to the development of diagnostics business with us, defines it as “the doctrine dealing with the recognition and evaluation of :

- the level of the functioning enterprise as a whole,
- the total creditworthiness enterprise,
- strengths and weaknesses of the enterprise,
- missed opportunities and potentials,
- problems and crisis events in the enterprise, including its eventual demise.” [1]

### 2.2. Prosperity of the Enterprise

Business prosperity is a positive development, success and profitability of the company. This term and especially the assessment of the term in the company are individual. For the prosperity of

the company affects many factors and is difficult to determine only one that the prosperity of the company would affect the most. Company is therefore necessary to understand as a whole and look for the link between factors. This is a view of business diagnosis. From the perspective of business diagnosis we could explain prosperity as a result of positive synergistic effect in the company resulting from the cooperation of individual functional areas of company.

### 2.3. Factors of the Prosperity in Enterprise

Many factors affect the competitiveness of the enterprise. It is appropriate to subdivided them to internal and external. This is appropriate because some of the facts in enterprise can be affected and some not. According Pirožek [2] the internal factors of the prosperity include flexibility, staff qualification, innovative activities, customer care etc. Then we have to mention some of the external factors that affected the prosperity of the enterprise. According Pirožek and Karpisová [2] the external factors are the corruption rate in country, support from government for enterprises, competition etc.

The enterprise needs to deal with these factors. There are necessary some others analyses to find out the situation of the enterprise. These analyses are SWOT analysis to determine the strengths and weaknesses of the company, its opportunities and threats, PEST analysis business environment and financial analysis as well. With these problems deals business diagnostics across the enterprise, so we are talking about the global diagnostics, or at the level of functional areas. Structure and direction of the business diagnostics are shown in the following scheme. [3]

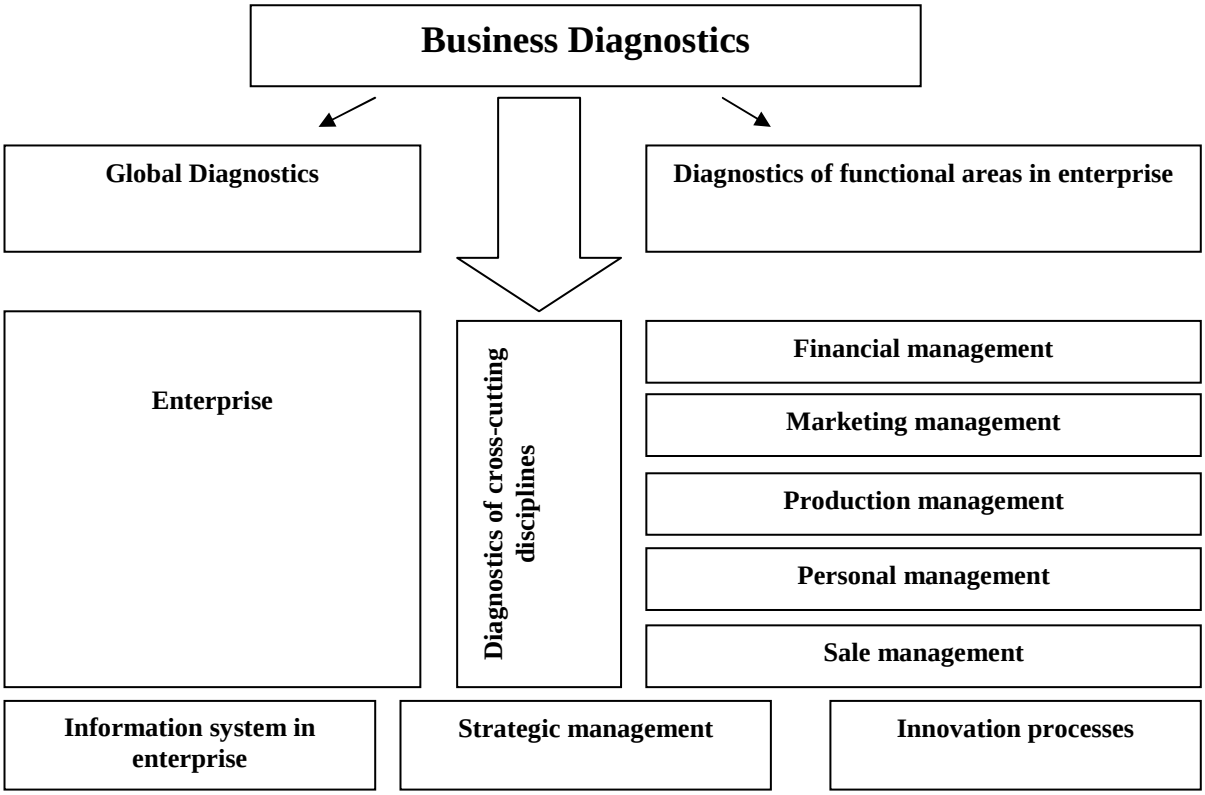


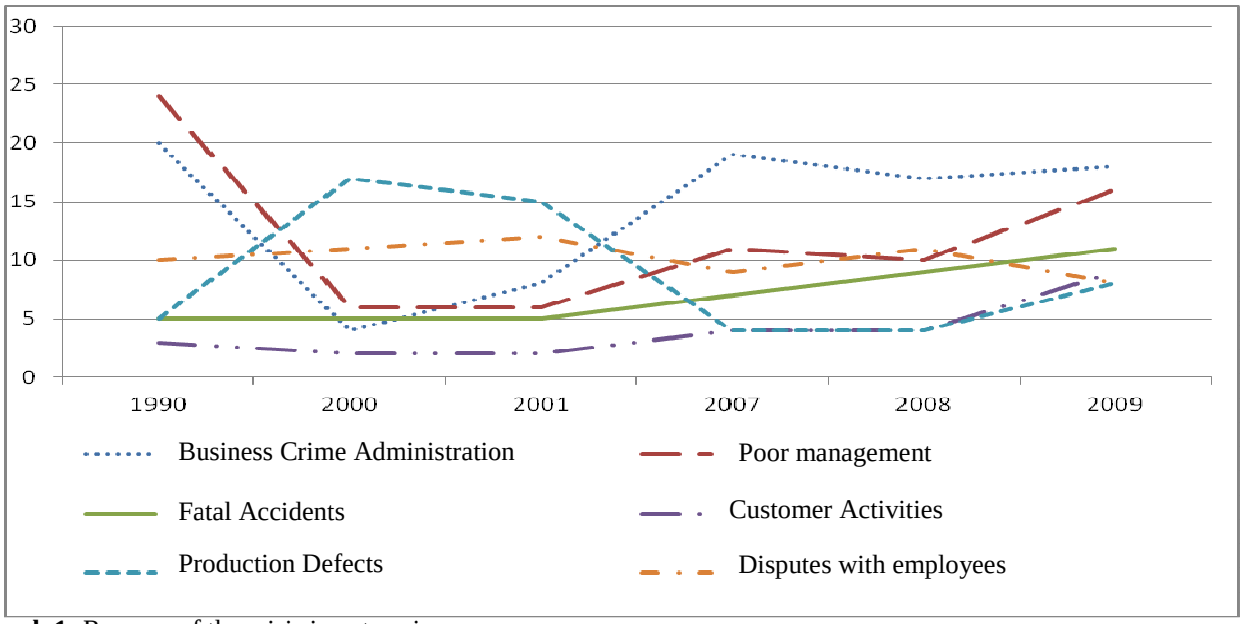

**Fig. 1 :** Structure of business diagnostics

## 3. Crises in Enterprise

In business environment, the term crisis usually means the financial crisis, but in real the enterprises have to face not only to a financial crisis. According to research of Institute for Crisis Management based on information from more than 100 000 cases of enterprises during 1990–2009 top six reasons of the crisis in the enterprise are:

- business crime administration,
- disputes with employees,
- poor management,
- consumer activities,
- fatal accidents,
- production defects. [4]

These facts and their trend over the period 1990 - 2009 are illustrated in the following graph.




**Graph 1:** Reasons of the crisis in enterprises

Thus we see that most significant problems of the company at the end of the reporting period crime business administration and poor management the company. Unlike other depicted in these reasons for the crisis, we see the possibility of eliminating them, if management of these risks will pay sufficient attention.

The appropriate management we consider just using business diagnostics. Companies have in this area are two possibilities, either the risk of managing and face the crisis and its negative consequences, or to manage risk and prevent crisis. Again, if we manage risk, we must be able to quantify. According to Augustine [5] it is possible to distinguish five levels of risk management:

1. Prevention
2. Preparation for crisis management
3. Recognition of the crisis
4. Grounds crisis
5. Solving the crisis

Business diagnostics is according Bartošova focused primarily on prevention of crises and problems in the company and they are trying to predict, it has therefore prophylactic nature, if we use the analogy of a human body as well as the company.

The prevention of disease is cheaper and easier than its treatment. Thus, we consider it important to pay particular attention to prevention. It is therefore necessary to identify the crisis phenomena and factors rather than escalate into a crisis.

## 4. Conclusion

In this paper we have tried to provide a view of the company crisis as an opposed to its prosperity and exploring the possibilities of prophylaxis in terms of business diagnosis. Integrating business diagnostics in the company management is considered as a benefit for the company.

Prevention is also a crisis of company cheaper than its treatment. Therefore, companies should address factors affecting the prosperity of the company and thus help prevent crises.

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# Cycle times evaluation of generated manufacturing configurations

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**Abstract.** The article deals with the problem how to generate manufacturing configurations. In the first section is presented mathematical formulation of manufacturing configurations from which are then derived the other sections. The main contribution of article is the design of manufacturing configurations generator. Through this generator we can evaluate cycle times of configurations. Generator offers us a quick representation of data that provides us overall overview about states of configurations. The objective of configurations evaluation is to select the most suitable variant that could be taken into account. Evaluation of manufacturing configurations is visually presented by graphs. The evaluation of manufacturing configurations cycle time has helped us to reduce the possible selection. The proposed solution allows us the advantage that we can quickly design new productive manufacturing system.

**Keywords:** Configuration, Reconfigurable manufacturing system, Evaluation.

## 1. Introduction

Levitt and Porter as the first draw attention to the ongoing process of globalization and its impact on competitiveness on the global market. The process of globalization is characterized by increasing convergence of requirements and product variability. These aspects are increasing intensity of communication (enterprise-to-enterprise and enterprise-to-customer).

For global manufacturing systems, responsiveness is an essential feature that can be achieved by developing reconfigurable manufacturing system (RMS) that have a production capacity that is highly adaptable to market demand. Possession of RMS enables companies to adjust their capacity (i.e., volume per product variant) to quickly match market demand, rapidly change for new products, and upgrade with new functionality to produce different product variety [3].

### 1.1. Configurations of reconfigurable manufacturing systems

Professor Y. Koren from the University of Michigan as first tried to mathematically describe a method of generating manufacturing configurations. We can calculate the required number of machines Sn, in response to changes on demand by Eq. 1. In the design of RMS, there can be used Pascal's triangle, which is a good way how can we determine the number of all configurations, which are composed from calculated number of machines. This calculation method of manufacturing configuration is shown in Fig. 1. Next step is to assign a certain number of machines into various arrangements. Here we can use mathematical combinatory. For calculation the number of machines we can apply the following formula:

$$Sn = \frac{\sum_{i=1}^{N} Ot_L K_J}{C_t} \tag{1}$$

Where:

$C_t$ – Required cycle time

$Ot_L K_J$ –Time required for the manufacturing of instance L of module K
We can also calculate the required cycle time:

$$Sn = \frac{Td}{V_j} \tag{2}$$

Where:
$Td$ – Delivery time of order
$V_j$ – Required production volume of product variant

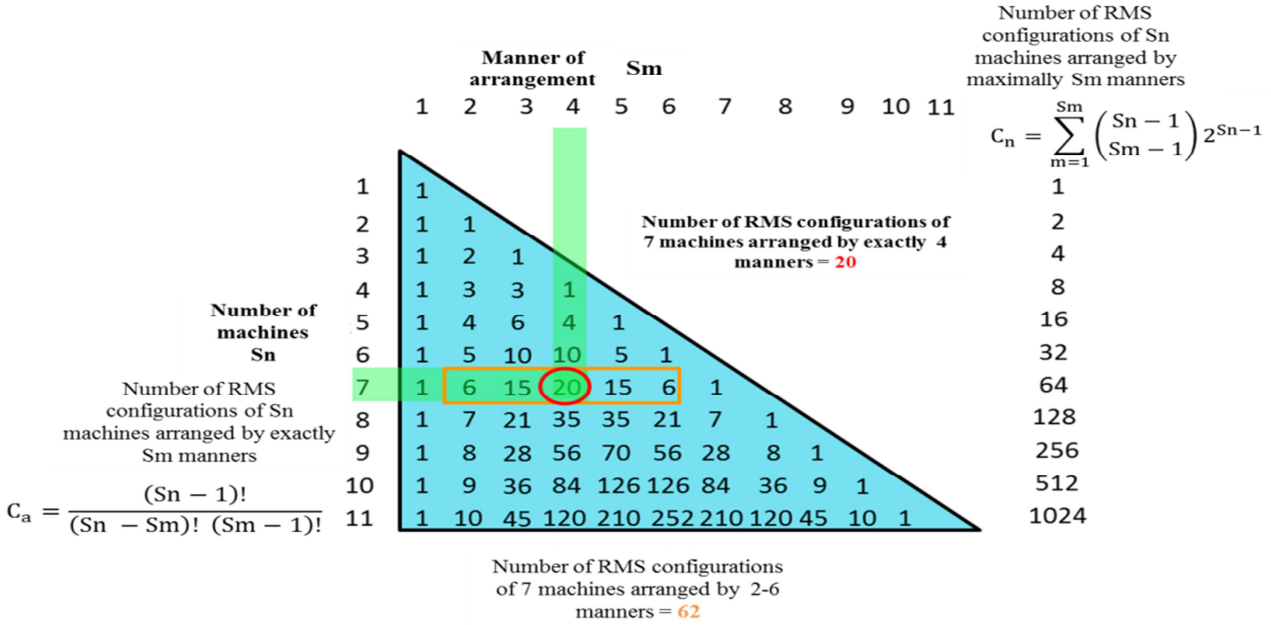


**Fig. 1.** Pascal's triangle for computing manufacturing configurations [3]

Production of 150 parts in 2000 minutes requires a cycle time of 13,33 seconds per part. The first step is to determine the minimum number of machines. We know that the time required for manufacturing of part is 90 seconds. Then we can use Eq. 1 for calculating the machine number. But we must round the number up, it gives us Sn = 7 machines.

According to Fig. 1, for seven machines and number of possible arrangements from 1 to 7, there exist exactly 64 possible configurations. We can also reduce the number of configurations on the basis of available tasks. Since the product variant has four manufacturing tasks, than the maximum number of arrangement can be only 4. If the module of product variant has two faces and each requires a different setup, the minimum number of arrangement must be 2. When we look in the Pascal's triangle we can see, that for seven machines, in the range between two and four arrangements, we need exactly only 56 configurations.

## 2. Generator of manufacturing configurations

The structure of manufacturing configurations must be, within the RMS, generated depending on the requirements, which are based on demand for the offered product variants. These variants are formed within a product family. Generator is able to calculate, on the base of demand for product variants, the required number of machines and also generate their all possible configurations. The decisive factor for the evaluation of generated configurations is the priority of the manufacturing operations, which are based on manufacturing procedures. By using the calculation of cycle times, it can be easily determined which manufacturing configurations can be adopted. Detail algorithm, which has been made in order to create the generator, is shown in Fig. 2.

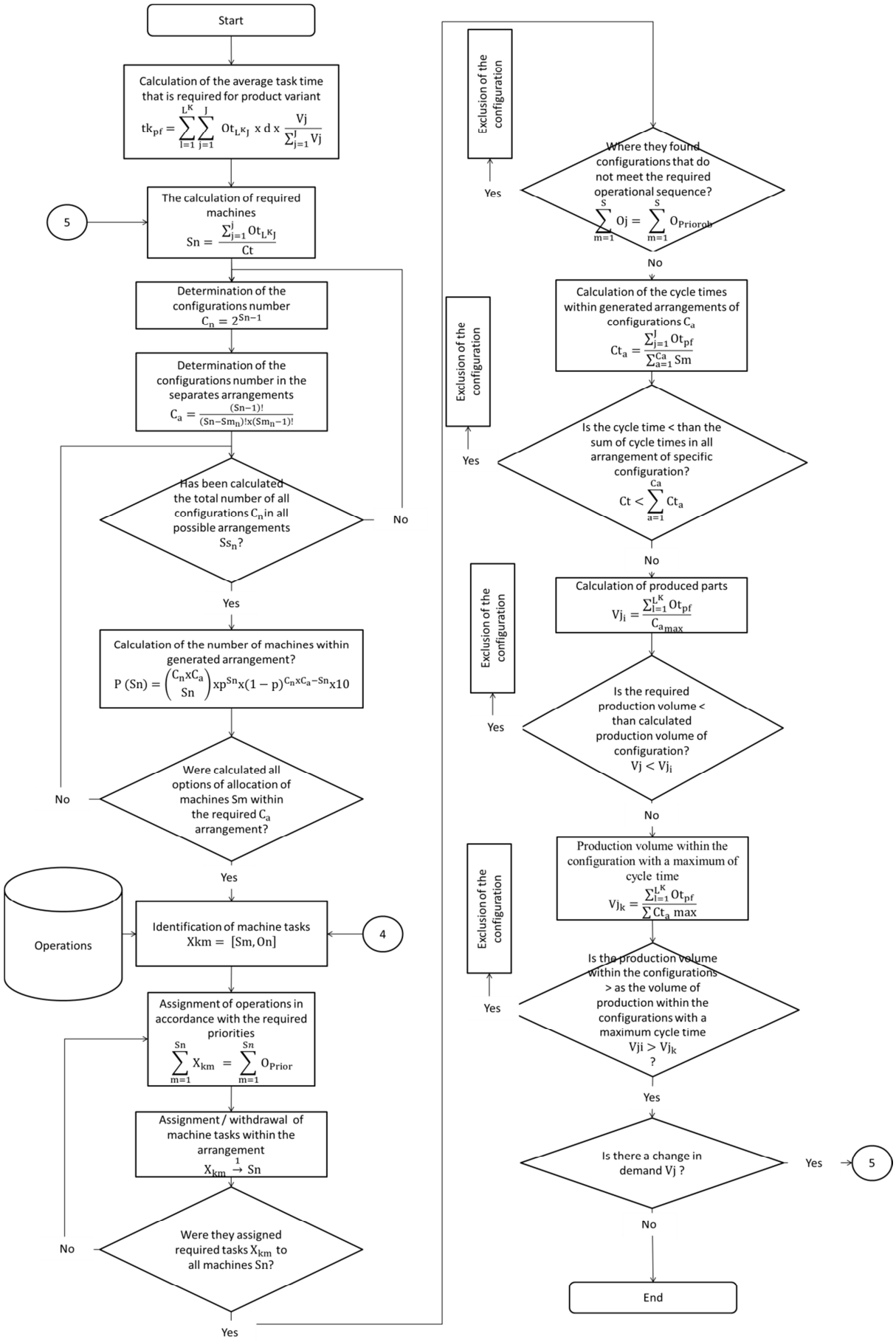


**Fig. 2.** Algorithm for generating of manufacturing configurations

Let:

$tk_{pf}$ : Weighted average of the task times required for each product variant

$Ot_L K_J$ : Is the time required for the manufacturing of instance *L* of module *K*

d: 1 if instance *L* of module k is required

$V_j$ : Production volume which is attributed to product variant *j*

$On$ : Type of available operations under machines *Sn*

$O_{\mathrm{Prior}}$ : Operational constraint which were formed from priority tasks

$C_n$ : Number of RMS configurations of *Sn* machines arranged by maximally Sm manners

$Ss_n$ : All possible arrangements

$C_a$ : Number of RMS configurations of *Sn* machines arranged by exactly Sm manners

$P(Sn)$ : Calculation of quantity of machines generated within the arrangement $Sm_n$

$X_{km}$ : Machine task

$Ct_a$ : The cycle times within generated arrangements of configurations $C_a$

$Ct$ : Required overall cycle time

$V_{ji}$ : Number of produced units within generated configurations

$V_{jk}$ - Production volume within the configuration with a maximum of cycle time

## 3. Numerical illustration

The main role of generator is to identify a change in the demand for offered product variants. This change is characterized by requirement to change the current production volume. Generator must take into account the date of delivery and the total operating times which are necessary for making the desired variant. These factors have an impact on the calculation of the number of machines which may be included in the future manufacturing configurations. It is necessary to recalculate the total required cycle time and average duration of tasks, which will play an important role in assessing the future manufacturing configurations. The generator input parameters are shown in Tab. 1.

| Product family | Demand (parts) | Delivery time | Operation time Module 1 | Average task time | Operation time Module 2 | Average task time | Required cycle time | Required number of machines |
|---|---|---|---|---|---|---|---|---|
| Variant 1 | 1800 | 60000 | 51,2 | 24,252632 | 40 | 18,947368 | 32,89474 | 6 |
| Variant 2 | 2000 | 65000 | 51,2 | 26,947368 | 50 | 26,315789 | | |

**Tab. 1.** Representation of the input data

The input parameter for generator of manufacturing configurations is the calculation of the necessary machines. Generator can subsequently calculate all possible configurations. This calculation is based on the number of required machines. The generator also calculates machine configurations in all possible arrangement. On the basis of the previous conversion are generated serial numbers which represent individual configuration. The main task of the generator is to calculate the number of machines which are situated in the different arrangement. This method of calculation is based on a binomial distribution of the total number of machines. The next step in new configuration design is to quantify the total cycle time of generated configurations as well as the maximal cycle time within each arrangement of configuration. Then it is possible to quantify the total production volume of product variants, which can be filled within the generated configurations. The goal is to minimize work in progress of the resulting configuration. The above calculations are shown in Tab. 2.

| Number of machines | Number of configurations | The number of configurations within the arrangement | Configurations | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Serial number of configuration | Number of Sn machines arranged by Sm manners | | | | | | Overall cycle time (seconds) | Maximal cycle time | Overall production volume | Production volume in arrangement with maximal cycle time | Work in progress | Production volume – Variant 2 | Production volume – Variant 1 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | |
| 6 | 32 | 1 | 1 | 6 | 0 | | | | | 16,08 | 16,08 | 7773 | 7773 | 0 | 3731 | 4042 |
| | | 5 | 2 | 5 | 1 | | | | | 55,51 | 45,27 | 2251 | 2761 | 510 | 1080 | 1170 |
| | | | 3 | 4 | 2 | | | | | 35,44 | 22,64 | 3527 | 5521 | 1994 | 1693 | 1834 |
| | | | 4 | 3 | 3 | | | | | 32,16 | 17,07 | 3886 | 7322 | 3436 | 1865 | 2021 |
| | | | 5 | 2 | 4 | | | | | 36,92 | 25,6 | 3385 | 4882 | 1497 | 1625 | 1760 |
| | | | 6 | 1 | 5 | | | | | 60,26 | 51,2 | 2074 | 2441 | 367 | 995 | 1078 |
| | | 10 | 7 | 4 | 1 | 1 | | | | 78,28 | 45,27 | 1596 | 2761 | 1165 | 766 | 830 |
| | | | 8 | 3 | 2 | 1 | | | | 66,83 | 45,27 | 1870 | 2761 | 891 | 897 | 972 |
| | | | 9 | 3 | 1 | 2 | | | | 57,67 | 26,95 | 2167 | 4638 | 2471 | 1040 | 1127 |
| | | | 10 | 2 | 3 | 1 | | | | 66,38 | 45,27 | 1883 | 2761 | 878 | 903 | 979 |
| | | | 11 | 3 | 2 | 1 | | | | 66,83 | 45,27 | 1870 | 2761 | 891 | 897 | 972 |
| | | | 12 | 3 | 1 | 2 | | | | 57,67 | 26,95 | 2167 | 4638 | 2471 | 1040 | 1127 |
| | | | 13 | 1 | 4 | 1 | | | | 76,26 | 45,27 | 1639 | 2761 | 1122 | 786 | 852 |
| | | | 14 | 1 | 1 | 4 | | | | 62,52 | 26,95 | 1999 | 4638 | 2639 | 959 | 1039 |
| | | | 15 | 1 | 3 | 2 | | | | 55,87 | 24,26 | 2237 | 5152 | 2915 | 1073 | 1163 |
| | | | 16 | 1 | 2 | 3 | | | | 52,82 | 24,26 | 2366 | 5152 | 2786 | 1135 | 1230 |
| | | 10 | 17 | 3 | 1 | 1 | 1 | | | 80,3 | 26,95 | 1556 | 4638 | 3082 | 747 | 809 |
| | | | 18 | 2 | 2 | 1 | 1 | | | 70,87 | 26,32 | 1763 | 4749 | 2986 | 846 | 917 |
| | | | 19 | 2 | 1 | 2 | 1 | | | 74,87 | 26,95 | 1669 | 4638 | 2969 | 801 | 868 |
| | | | 20 | 2 | 1 | 1 | 2 | | | 71,18 | 26,95 | 1756 | 4638 | 2882 | 842 | 913 |
| | | | 21 | 1 | 3 | 1 | 1 | | | 78,5 | 26,32 | 1592 | 4749 | 3157 | 764 | 828 |
| | | | 22 | 1 | 1 | 3 | 1 | | | 83,84 | 26,95 | 1490 | 4638 | 3148 | 715 | 775 |
| | | | 23 | 1 | 1 | 1 | 3 | | | 78,92 | 26,95 | 1583 | 4638 | 3055 | 760 | 823 |
| | | | 24 | 1 | 2 | 2 | 1 | | | 73,52 | 26,32 | 1700 | 4749 | 3049 | 816 | 884 |
| | | | 25 | 1 | 2 | 1 | 2 | | | 69,84 | 24,26 | 1789 | 5152 | 3363 | 859 | 930 |
| | | | 26 | 1 | 1 | 2 | 2 | | | 73,84 | 26,95 | 1692 | 4638 | 2946 | 812 | 880 |
| | | 5 | 27 | 2 | 1 | 1 | 1 | 1 | | 108,59 | 26,95 | 1151 | 4638 | 3487 | 552 | 598 |
| | | | 28 | 1 | 2 | 1 | 1 | 1 | | 108,59 | 26,95 | 1151 | 4638 | 3487 | 552 | 598 |
| | | | 29 | 1 | 1 | 2 | 1 | 1 | | 107,25 | 26,32 | 1165 | 4749 | 3584 | 559 | 606 |
| | | | 30 | 1 | 1 | 1 | 2 | 1 | | 111,25 | 26,95 | 1123 | 4638 | 3515 | 539 | 584 |
| | | | 31 | 1 | 1 | 1 | 1 | 2 | | 107,56 | 26,95 | 1162 | 4638 | 3476 | 557 | 604 |
| | | 1 | 32 | 1 | 1 | 1 | 1 | 1 | 1 | 147,67 | 26,95 | 846 | 4638 | 3792 | 406 | 440 |

**Tab. 2.** Generator of manufacturing configurations

Within the evaluation of generated manufacturing configuration were analysed their total cycle times, which had to meet the total required cycle time. From the Fig. 3 is clear that these conditions meet only configuration number 4.

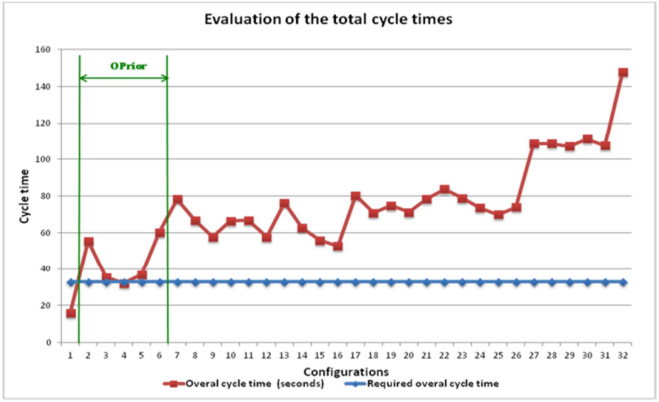


**Fig. 3.** Evaluation of maximum cycle times of manufacturing configurations

The evaluation of manufacturing configuration takes into account, cycle times within an arrangements and their required cycle time. From the graph Fig. 4 is clear that these conditions meet only configuration number 3,4,5.

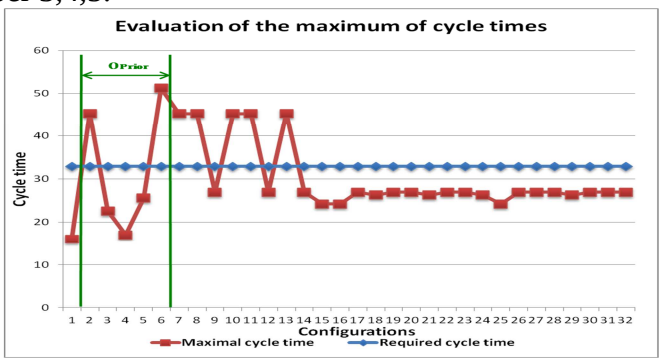


**Fig. 4.** Evaluation of the overall cycle times of manufacturing configurations

The most important role in the evaluation of manufacturing configurations plays an execution rate of demand and work in progress. From the Fig. 5 is clear that these conditions meet only configuration number 4. It should be noted that the work in progress of production is lowest in configurations 6.

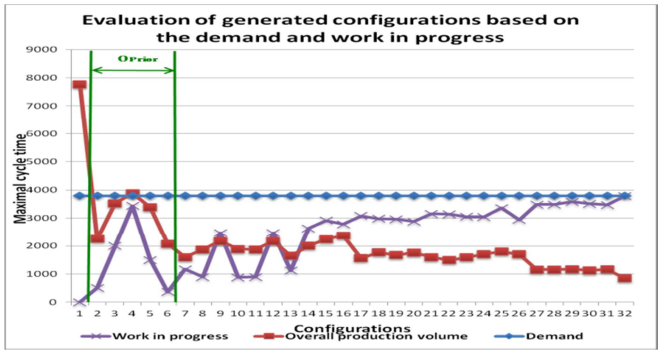


**Fig. 5.** Fulfilment of demand and work in progress

## 4. Conclusion

By the using of designed generator, we can automatically calculate all possible configurations and we can also evaluate their cycle times. This proposal can be used for the design and optimization of manufacturing configurations. His task could be the reduction of work in progress and shortage of overall cycle times within the proposed configuration. Optimization could be achieved by actual capacity scaling of the manufacturing configurations and by addition or removal of other elements. We can also assign multiple tasks to the machine but it is possible only if the machines offer this option.

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# Utilization of Genetic Algorithms in the Concept of Lean Manufacturing

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**Abstract.** The paper is aimed on the presentation of genetic algorithms in the concept of lean manufacturing, focusing mainly on practical examples of their utilization. Cases of milk-run routes design and workplace design optimization are presented as an successful applications, with relevant and useful results. Also, facility layout design with the utilization of genetic algorithms developed at the Department of Industrial Engineering is presented.

**Keywords:** genetic algorithm, lean manufacturing, applications

## 1. Introduction

Genetic algorithms are based on the Darwinian principle of natural evolution that he described in his book "On the Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life"(1859). The idea of life, which is evolving in time – new forms of life replacing the old existed even before Darwin, but it was this publication that brought a revolution of the perception of life on Earth. Together with other disciples they gradually formulated the laws of classical genetics and the basic principles of reproduction.

In the seventies of the twentieth century, genetic algorithm was proposed by J.H.Holland as an abstraction of appropriate genetic processes. A decade later, genetic algorithms became one of major rapidly developing fields of informatics and artificial intelligence. Genetic algorithm works with a population of individuals – encoded solutions, which provides decrease of chance of getting stuck in local optima, compared with traditional methods. The basic procedure of genetic algorithm, divided according to function of individual steps can be seen in Fig. 1.

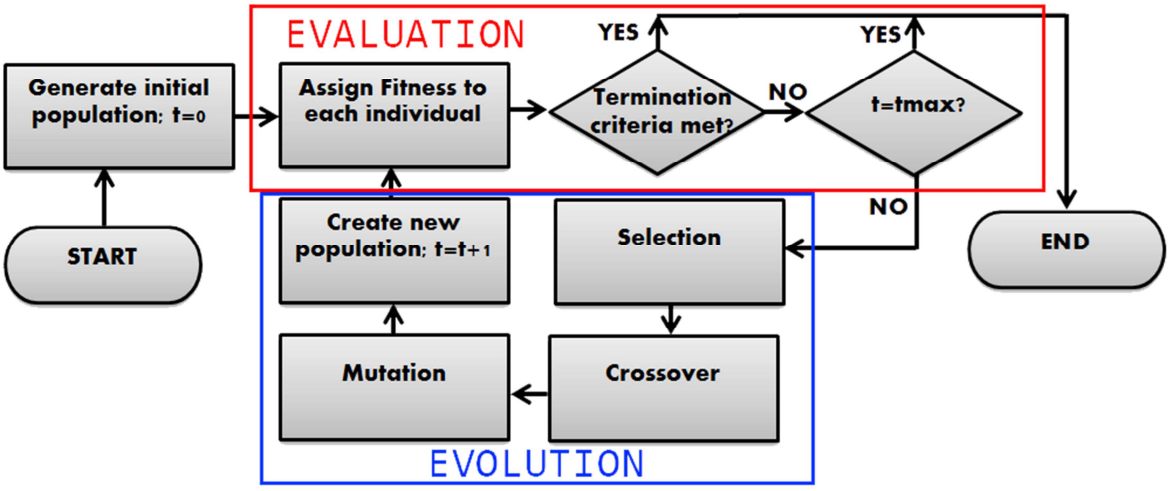



**Fig. 1.** The figure caption is of the style Description; the figure itself is of the style Figure.

Among the many areas where genetic algorithms can be used, we can find the area of industrial engineering. In the following chapters we will present applications within the concept of lean manufacturing that helped companies to improve their required parameters, and also the concept of utilization of a genetic algorithm for designing plant layout.

## 2. Optimization of Material Flow in Production

Planning the material flow organizes and optimizes production systems in order to reduce costs and increase productivity. In the publication "Lean manufacturing in the developing world" [1] an application in the company focused on production in the telecommunications sector, in their plant in Juarez, Mexico is presented. The company expanded and it was necessary to change the plant layout, which was associated with the need for planning routes for transporting material throughout production. A common problem that the company faced was unproductive time spent by staff returning to the warehouse to make further distribution. Consequently, standard time was determined for each operator supplying material for a number of production lines.

The company decided to use a genetic algorithm is in this case. One operator (M = 1) was set for ten production lines (N = 10). The requirements of lines are shown in Table 1. In this case the material is homogeneous for each of the lines, and the capacity of the operator is fifteen units (Q = 15).

| Line | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Demand | 7 | 5 | 4 | 6 | 7 | 6 | 5 | 4 | 3 | 3 |

**Tab. 1.** Material requirements of individual production lines

The distances between the store and line entry points are known. Fig. 2 shows a graphical representation of the layout, the warehouse being at position 0.

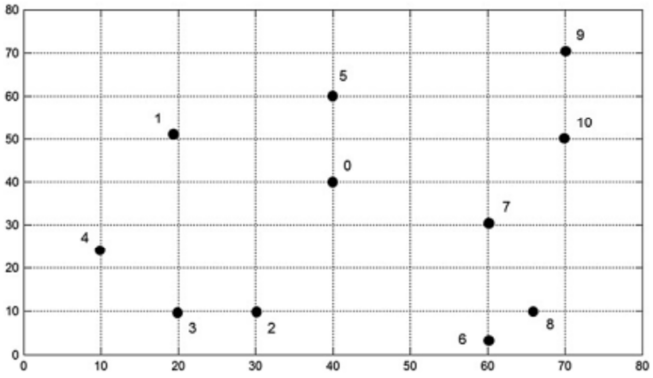



**Fig. 2.** Graphical representation of the layout

It is open to question, what the optimal material delivery route is, to satisfy the requirements of each line and also meet the restrictive conditions. Genetic algorithm with permutation encoding was programmed in Java language and used to solve the issue. The problem was defined as a variation of the traveling salesman problem, and after completing algorithm run, the path “0-5-0-6-2-3-0-8-10-9-7-0-4-1-0” appears as the most appropriate, where the operator travels 478 meters in approximately six minutes. . races in which the operator will pass 478 m, for approximately six minutes. This time was subsequently increased by the value obtained from time studies - loading and unloading of material times and tolerance set to 10%. Fig. 3 shows the obtained route.

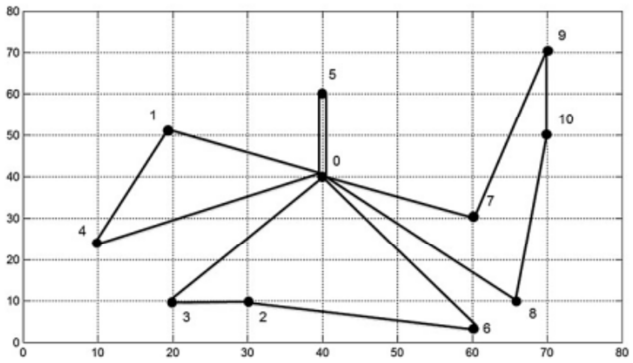



**Fig. 3.** Best route found by the algorithm

## 3. Optimization of Workstation Layout

It is said that one of the key factors in the factories, which are in a constant process of improving is the process optimization. Almost all improvements are reflected directly in the flows of the factory, and impact on the company's expenses. Therefore, workstations play an important role in the production, and directly impact on the flow of the final product. To optimize the workstation, a genetic algorithm was programmed, which aims to improve workstation design, where the evaluation function is prepared on the basis of the predetermined motion time system for basic movements - reach, grasp, move, drop, which represent nearly fifty percent of the work on the workstation. Also, outreach zones and the frequency of individual operations are taken into account. The objective is the reduction of process time and elimination of excessive movement, thus increasing the labor productivity. Permutation encoding was used to represent possible solutions, where individual parts and components were assigned to predetermined places (slots) of workplace. After ten iterations, the initial solution has been improved, and in further iterations the improvement was even more significant [1].

## 4. Plant Layout Design

Currently, system for plant layout design is being developed at the Department of Industrial Engineering at the University of Zilina, utilizing genetic algorithms. At this stage, input and results are transferred between Matlab and Excel spreadsheet, where simple user interface was created. In the spreadsheet, we input parameters such as number of machines, dimensions, types and probabilities of genetic operators or intensities between workstations/machines (Fig. 4).

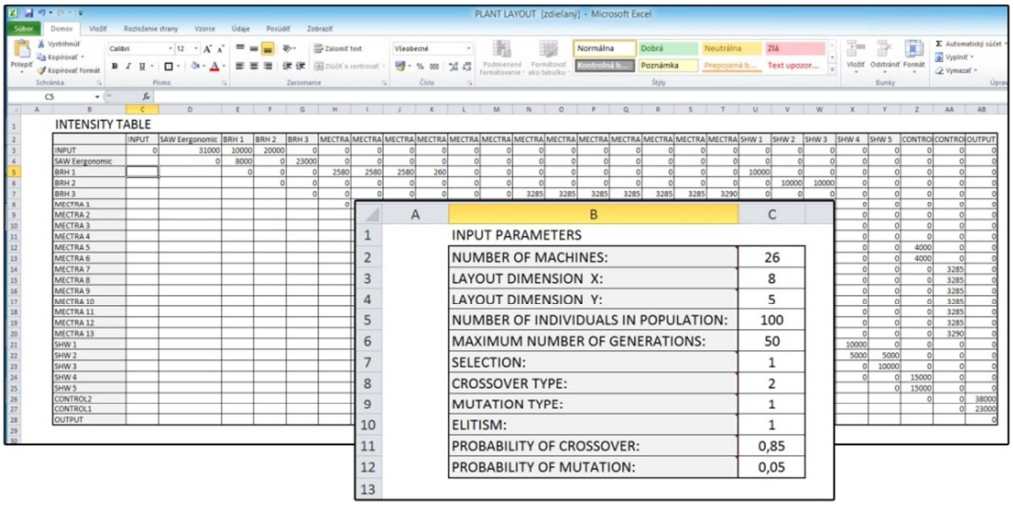
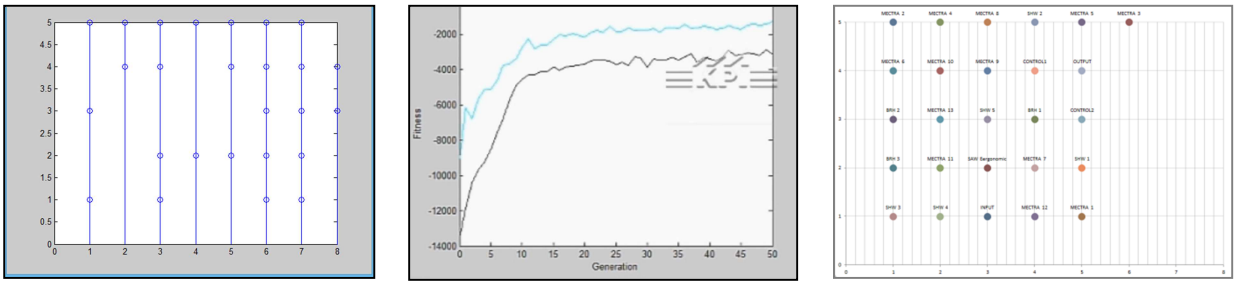



**Fig. 4:** Input sections of spreadsheet

After setting the input parameters we run the layout generator, coded in Matlab/ GNU Octave language. The algorithm creates initial solutions in specified quantity and performs evolution. The chromosome structure was determined as 2*n, where n is the number of machines. Therefore, we store information about X and Y coordinates of each machine inserted into layout. Mechanisms for machine overlap correction and desired layout dimension maintenance were also incorporated. After the run, following data are transferred back to Excel:

- X-Y coordinates of each machine,
- fitness value of proposed solution,
- graphic interpretation.

Fig. 5 shows the best initial solution from first generation (a), average and best fitness values during the run (b), and final solution visualization in Excel (c).




*a)* *b)* *c)*

**Fig.5:** Best initial solution, best and average fitness of the run, and the final solution

If we consider machines in layout as dimensionless (dimensions are not given in input section), the obtained result can be interpreted as “slots” for the machines (the layout dimensions are equal to the number of available slots in each direction), and the graphic interpretation in Excel is sufficient. However, for more accurate layout design it is necessary to take real dimensions into account, therefore there was a need for advanced drawing software. After consideration we decided to implement the interconnection with AutoCAD software, where not only the obtained plant layout can be constructed, but also thanks to installed FactoryCAD/ FactoryFLOW extensions, we can insert 3D models of machines in *.JT format, thus creating 3D model of machine layout and evaluate various aspects of the solution, such as material flow, aisle congestion, area structure or the possibility of milk run implementation with included tools. Also, thanks to SDX (Simulation Data eXchange) format, it is possible to evaluate obtained layout dynamically in another software solution by Siemens - Plant Simulation. Thanks to these functionalities, we can not only get possible layout solution in 3D, but also evaluate it both statically, and dynamically, which provides us with advantage over solutions where only simple uninteractive block layout is created.

## 5. Conclusion

In this paper, we presented successful examples of utilization of genetic algorithms in the concept of lean manufacturing. The first example was from the area of lean logistics, where milk-run route was planned, to eliminate unnecessary returns to warehouse. The second example utilized genetic algorithm in workplace optimization, where individual parts and components were placed in predetermined slots according to evaluation function, which consisted of evaluating necessary motions, their number and duration and also outreach zones. The aim was the reduction of unnecessary movements within the operation on the workplace, thus increasing productivity. Based on these examples, and further investigation of the problematique we can claim, that genetic algorithms can be used to solve various optimization problems. Also, a developing plant layout

design solution is presented as a concept of obtaining layout from genetic algorithm according to set parameters and subsequently constructing it in 3D and verifying both statically, and dynamically.

## Acknowledgement

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# Industry 4.0 as a factor of productivity increase

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**Abstract.** This article provides basic information on how to increase productivity based on the principles of concept of Industry 4.0. Article defines the basic factors and mechanisms of increasing productivity based on this concept. Application of this concept brings hgh-added value for company and for customers too. Companies are able to produce products accepting customers request in one hand and satisfy customers' needs in another hand.

**Keywords:** industry 4.0, productivity grown, cooperation, automation, simulation, IT globalization

## 1. Introduction

The core of every industrial revolution is an increase in productivity. Previous industrial revolutions had a strong impact on the "shop-floor"-level and production processes itself. Companies gained a higher productivity through the utilization of the steam engine, electricity as well as the shift from analogue to digital technology for example. The impact of the fourth industrial revolution, however, is more extensive and it affects apart from production also the indirect departments, especially engineering processes. That means that the potential of productivity growth particularly lies in the improvement of brainwork and decision making processes. Collaboration at all levels can help to accelerate this process.

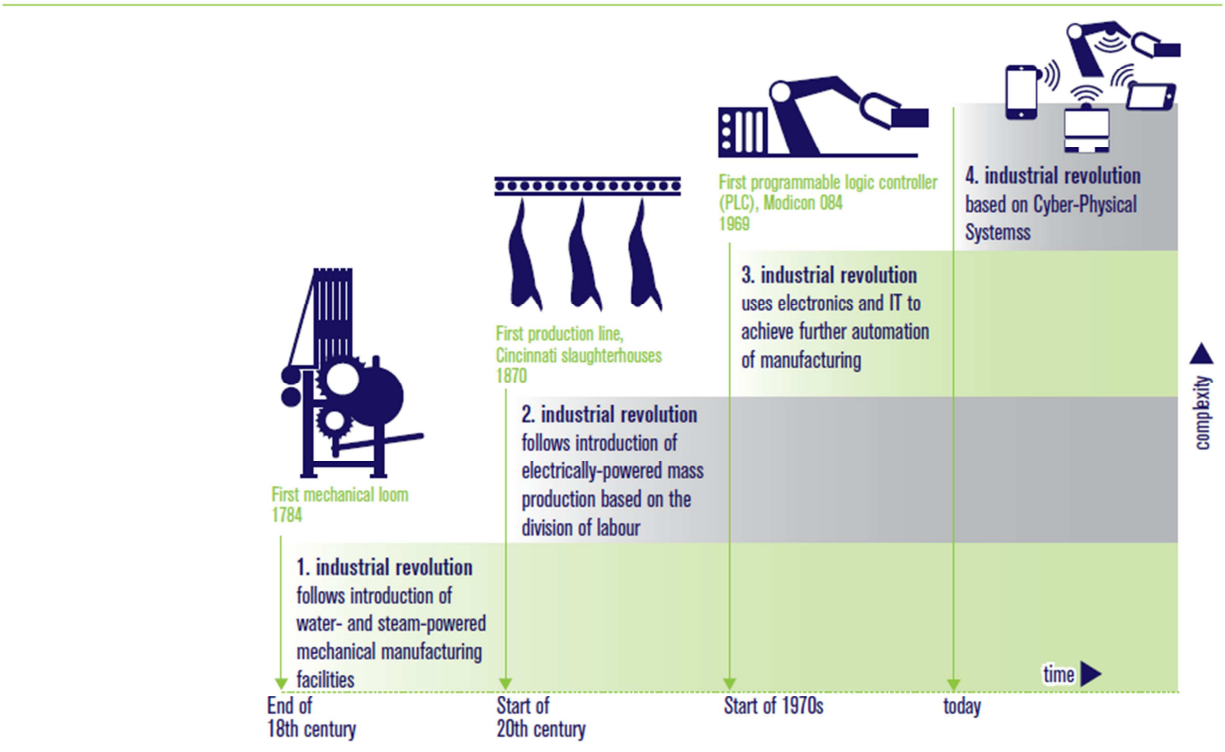


**Fig. 1.** History of Industrial revolutions [1]

## 2. Four enablers of productivity grown

Professor Günter Schuh from Aachen University [2] [3] identified four enablers of productivity grown under Industry 4.0:

- IT-Globalization
- Single source of truth
- Automation
- Cooperation

The required preconditions in a production system can be classified on two levels: The first level is the allocation to the cyber or the physical world and the second is the distinction between hard or soft component. This categorization leads to four main preconditions, which are portrayed in Fig. 2 as enablers: IT-Globalization, single source of truth, automation and cooperation.

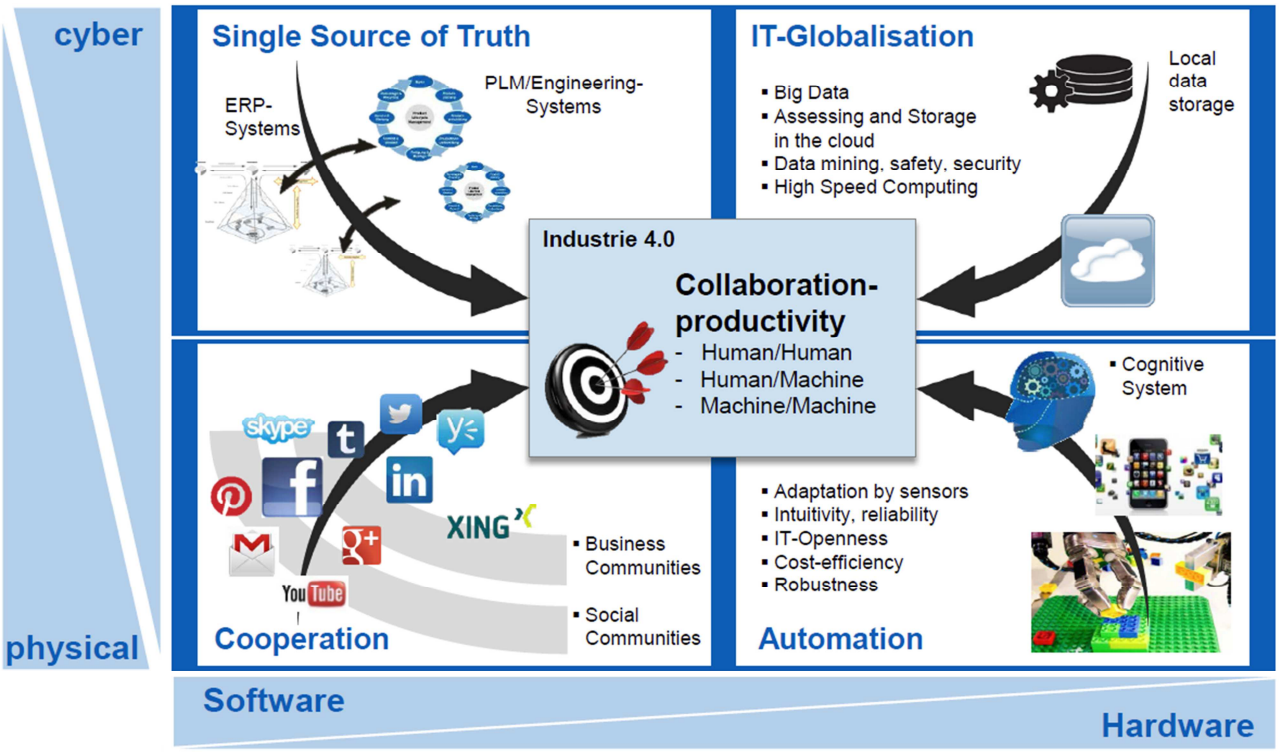


**Fig. 2.** Four main preconditions of productivity grown [2]

The realization of these enablers is the technological and organizational foundation to eventually realize collaboration productivity as the major source of productivity growth in Industry 4.0.

The four enablers are analyzed in detail in the following in order to create a better understanding for the preconditions of collaboration productivity in the context of Industry 4.0.

### 2.1. IT globalization

One key enabler relates to the potential and advantages of computers whose impact on economic growth in the past was very large in comparison to their share of capital stock or investment and is likely to increase further in the following years. Therefore computing power and global information technology (IT) need to be considered and promoted by producing companies. The advancement of both storage capacity and high speed computing is immense and is continuously raising. In future it will be possible to store data in such a global cloud system where it can be recalled fast and independently from any local place.

### 2.2. Single source of truth

In order to be able to use simulations as decision tool, they need to be embedded in the right software environment [4]. That is why the simultaneous development of software systems plays a significant role for preparing Industry 4.0. On the basis of the improving hardware, the chance to ensure a complete product lifecycle management (PLM) software emerges, in which all product information along the value chain is available. Thereby, "single source of truth" needs to be realized across the complete lifecycle which avoids ambiguity and assures that any change of product and production relevant information is visible. It is needed to allow a reporting and decision support that is valid and consistent across the organization. [5]

### 2.3. Automation

Another enabler for Industry 4.0 is the advancement of the performance of decentralized and autonomous processes collaborating in networks. This becomes possible by linking the virtual world with the physical environment by cyber-physical systems (CPS) which embed computers, sensors and actuators into an application platform. The integration of information and communication technology into the industrial environment is also referred to as Internet of Things. On the one hand, automation of production systems requires intelligent and self-optimizing components by adapting the systems behavior to dynamic objectives in technological and organizational area as already appearing in smart factories. On the other hand, it is important to properly integrate the employee into such an autonomous system where especially highly qualified and skilled workers best fit into. If necessary the gap between technological and organizational progress needs to be closed by investing in advanced training and knowledge which usually is a time consuming approach.

### 2.4. Cooperation

The fourth main enabler in the physical world is the soft component of cooperation across all borders, technologies and activities. A stronger cooperation can be established firstly by cultivating a network in order to communicate the overall target and secondly by empowerment of decision-makers in a decentralized system. The four enablers influence and depend on each other. For example the use of simulations based on big data is not possible without ensuring big storage capacities. And automation is not working properly if the cooperation between machines, workers and between human and machines is not assured. That is why in preparation of Industry 4.0 the simultaneous development of all four fields is necessary.

The superior target of a raise in collaboration productivity in the context of Industry 4.0 is lower costs per piece. In order to measure this target and understand the correlations it is necessary to measure the effects in both core areas of a producing company – the production and the engineering. The two superior ratios are:

- Return on production and
- Return on engineering.

## 3. Mechanisms of Increasing Productivity

There exist four major mechanisms in the context of Industry 4.0 which contribute to a raise of productivity.

1. Radically Short Product Development Processes
2. Virtual Engineering of Complete Value Chains
3. Revolutionary Short Value Chains
4. Better Performing Than Engineered

### 3.1. Radically Short Product Development Processes

Today, disruptive innovations increasingly occur in the business environment. Thus, the lifecycle of many products is often shortened abruptly because they are suddenly forced from the market place. In order to keep up with the competitor's speed of innovations it is essential for a company to radically compress its product development process. With Industry 4.0 new technologies, for example new tool machining concepts, merge which can help to minimize the length of time to develop products. Industry 4.0 includes a higher priority on individualized products which means higher customized products, more variants and smaller quantities of the same product. The potential lies firstly in prototypes. By focusing more on prototypes when producing tools, products can be manufactured at an earlier stage of the value chain. Secondly, it is important to generate inventions and potential innovations faster. Building small, interdisciplinary teams like in the Scrum Theory helps to systematically realize new innovations [6].

### 3.2. Virtual Engineering of Complete Value Chains

A complete virtual value chain offers several advantages of which one is transparency. Problems and bottlenecks in the workflow can directly be detected [7]. Furthermore, the whole process chain with its output and performance is presented in detail. This allows drawing conclusions about the key elements which influence the overall target. The virtual reproduction of the complete value chain offers advantages especially for the development department. In addition, virtual engineering has an important justification for the development of products, where, for example, already during the product development is possible by simulation to detect potential problems, and immediately prevented from arising [8]. The basis for the use of virtual engineering in the company's confidence in the decision-making power simulation, where you can simulate several situations and accordingly choose the best solution [9].

### 3.3. Revolutionary Short Value Chains

Current trends and requirements of customers create new and new product versions. In the automotive industry are made from one of the vehicles to several thousand different variants of the requirements of the market. This makes the operation of production and assembly lines is becoming increasingly difficult. The machines are usually able to perform only one task type and cannot integrate more functions. Production of different variations on the same production line significantly increases the complexity of the production system. That is why in the near future will be done integrating different processes and production methods. For example, the combination of production machines with a robot, which will bring faster production and at the same time can save unproductive time. While in the second industrial revolution proceeds of production was created by the assembly line, the industrial revolution reduces the amount of deployed production and assembly lines and creating manufacturing cells. In addition, it is necessary that all contributors to a single process cells cooperate with each other and thus filled up activator increasing productivity cooperation.

### 3.4. Better Performing Than Engineered

Attempts to complex automated systems existed at present, the only fully operational in bankruptcy for unfulfilled aforementioned activators. Fully automated production systems, their activity reduces the burden and work efficiently. Due to the high flexibility and reactivity that can adapt to sudden changes or result in the production process. Existing self-learning machines can theoretically achieve the maximum expected. The advantage of automated systems for the future is the effort to even higher scores. Can be used to improve the system by adapting the structure and policies. For example, the assembly line with native planned output of 20,000 units and 25,000 units improve performance after one year of using the same resources.

## 4. Conclusion

Productivity is a significant tool for enhancing business competitiveness in the market. Presently it is just one indicator of the competitiveness of the sustainability of the market. That is why concept allows not only keep the company in the market, but also the further development and growth through the use of new approaches to the use of IT infrastructure, data and their integration. Industry 4.0 holds huge potential. Smart factories allow individual customer requirements to be met and mean that even one-off items can be manufactured profitably. In Industry 4.0, dynamic business and engineering processes enable last-minute changes to production and deliver the ability to respond flexibly to disruptions and failures on behalf of suppliers, for example. End-toned transparency is provided over the manufacturing process, facilitating optimized decision-making. Industry 4.0 will also result in new ways of creating value and novel business models. In particular, it will provide start-ups and small businesses with the opportunity to develop and provide downstream services. In addition, Industry 4.0 will address and solve some of the challenges facing the world today such as resource and energy efficiency, urban production and demographic change. Industry 4.0 enables continuous resource productivity and efficiency gains to be delivered across the entire value network.

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# Line Balancing in the Environment of Tecnomatix Software

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**Abstract.** This article deals with possibility of using Tecnomatix Process Designer software for solution of assembly line balancing problem. Tecnomatix is a portfolio of digital manufacturing software solutions for manufacturing process planning, layout, optimization, simulation and execution. This comprehensive software solution also contains application for line balancing. Article is focusing on workflow with this application.

**Keywords:** Digital factory, line balancing, Tecnomatix.

## 1. Introduction

Line balancing represents one of the main problems in the process of production line design. Nowadays, in the time of mass production realized mostly by production lines, it is necessary to deal with line balancing problem.

Automotive industry as typical representative of mass production is usually represented by hundreds, even thousands of assembly operations. To solve line balancing problem of these dimensions it is necessity to rely on powerful software. There are many software tools usable in the balancing process and one of them is Tecnomatix Process Designer. This comprehensive software solution for digital factory contains application Line Balancing.

### 1.1. Line Balancing Problem

In flow line production there are many separate and distinct processing and assembly tasks to be performed on the product. Invariably the sequence of processing or assembly steps is restricted to some extent in terms of order in which the operations can be carried out.

The line balancing problem is to arrange the individual processing and assembly task at the work station so that the total time required at each workstation is approximately the same. If the work elements can be grooved so that all the station times are exactly equal we have a perfect balance of the line and the product of flow will be smooth [1].

If the sequence of operations and operation times are given, only number of workstations and tact time can be influenced. Goal of the solving line balancing problem can be:

1. minimize number of workstations n if tact time is given (cycle time is constant),
2. minimize length of tact time for given number of workstations, or generally,
3. minimize number of idle time units of whole line (maximize efficiency and minimize unbalance), when it is possible to select number of workstations and tact time [2].

### 1.2. Tecnomatix – Tool of Digital Factory

Tecnomatix product portfolio, can be used to represent a “digital factory” on the computer. This is not just about controlling individual machine tools. The interaction of all manufacturing resources in production is what is important – for instance, whether robots work together smoothly and can easily access all tools. Long before the manufacturing begins, Tecnomatix users are able to simulate the material flow and figure out the optimal assembly line speed.

***Tecnomatix Process Designer and Process Simulate*** is a digital manufacturing solution for manufacturing process planning and validation in a 3D environment. Process Designer is a major enabler of speed-to-market by allowing manufacturing organizations to bridge product and process design with integrated authoring capabilities that leverage digital product development. Process Simulate allows organizations to virtually validate manufacturing concepts upfront – throughout the lifecycle of new product introductions. The ability to leverage 3D data of products and resources facilitates virtual validation, optimization and commissioning of complex manufacturing processes, resulting in faster launch and higher production quality.

Its main features are: process modeling and verification (pert and Gantt charts, schematic and table views, time estimation, cost estimation and tracking, line design, alternative planning, process variants management, documentation authoring, application customizations), integrations with time standards systems, automatic generation of assembly structure or assembly process, line balancing, tasks management and collaboration, 2D\3D system integrations, natively supported JT visualization standard, quotation, manufacturing features management, 3D simulation, static and dynamic collision detection, 2D and 3D sections, 3D measurements, sequencing of operations, assembly and robotic path planning.

## 2. Tecnomatix – Line Balancing Application

The purpose of Line Balancing application (LB) is to assign operations to resources to achieve proper balance across the line. This proper balance eliminates bottlenecks in the line and minimizes idle time at the stations. LB takes into account constraints such as operation precedence and cycle times, as well as additional balancing aspects such as the required logistic space for placing containers at the stations [3].

LB must operate in compliance with the following set of rules:

- Availability of resources – certain operations that cannot be performed by all resources, due to criteria, work content or numeric content mismatch due to criteria, or work content or numeric content mismatch.
- Precedence of operations – sequences of operations that must be obeyed (for example, before closing a lid, the lid has to be installed) [4].
- Inter-operation constraints:
  - certain operations that must be performed as a group at the same station,
  - a pair of dual operations that must be performed in parallel at the same station,
  - one or more operations that are separated from another set of operations and thus cannot be performed at the same station (with the separated set),
  - an operation that must be exclusive to a particular station.

### 2.1. Line Balancing Workflow in Tecnomatix

In this chapter we describe workflow of line balancing in Tecnomatix. For this purpose we have defined simple example. Our goal is to assign operations to work stations on production line. As the main inputs of our example are list of operations (*27 operations*), times and precedence constraints of these operations and required tact time (*t=30sec*).

We can simplify workflow into 5 basic steps:

1. Definition of operations and resources.
2. Creating the line balancing scope and defining line balancing settings.
3. Definition of constraints – including precedence constraints of processes (precedence graph).
4. Additional setup and running of optimization process.
5. Evaluation of the results.

1. Definition of operations and resources.

Three main objects have to be created in the Navigation Tree of the project:

- Node *"OperationList"* – this list contains all operations (name and time).
- Creating a Process/Resource Tree that represents the lines to be balanced – nodes *"PrLineProcess"* and *"ProductionLine_KPIND01"*. Here we use twin objects (it means that node for process is created automatically with creation of resource node).

2. Creating the line balancing scope and defining line balancing settings.

In this step a new object in the Project Tree is created, known as the LineBalancingScope, under which the operations list and the relevant part of the line are placed (drag and drop nodes *"OperationList" and "ProductionLine_KPIND01"*). In this step we can also define various line balancing criteria, such as orientation position; the available criterion values, such as up or down; and the compound groups types that should be predefined as group constraints.

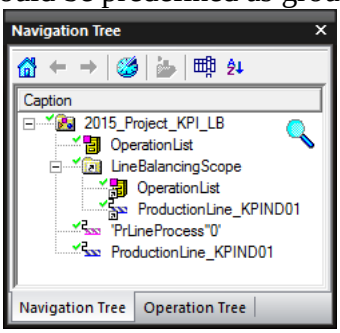


**Fig. 1.** Structure of the project in Navigation Tree after firs two steps.

3. Definition of constraints – including precedence constraints of processes (precedence graph).

In this step we can define different types of constraints, which place restrictions on our ability to assign operations to stations when performing LB. Several different types of constraints can be defined, including precedence constraints, group constraints, and miscellaneous constraints. Also cycle time has been defined in this step.

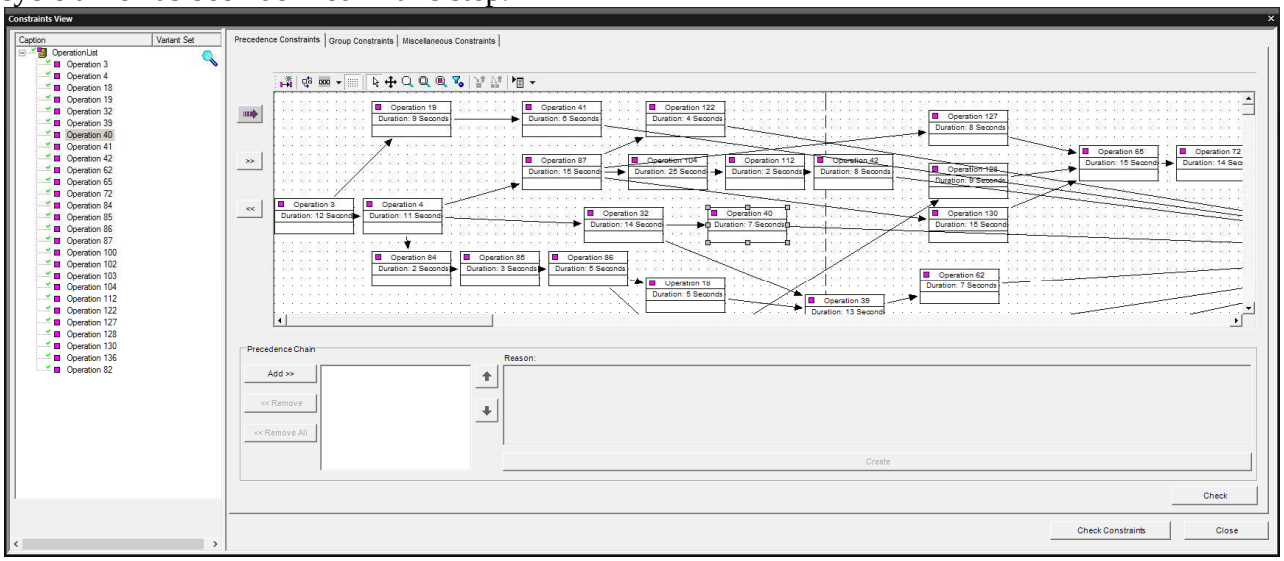


**Fig. 2.** List of operations and their precedence constraints.

4. Additional setup and running of optimization process.

In this step we use the Line Balancing viewer to assign operations to stations. This is an interactive process that immediately alerts us of constraint violations and that enables us to see the results of our allocations in terms of work content and remaining time available at each station. This information can be viewed graphically as well.

Another option is to use the Automatic Line Balancing (ALB) to provide an optimized solution. Afterward we are able to adjust this solution manually in the manual line balancing window.

The ALB application supports two main modes of work:

- **Minimizing the number of stations.** Stations are not defined yet, and the user would like the ALB application to propose a line. This mode of work is usually suitable for early phases of the process planning.
- **Optimizing the station utilization.** The user will activate the module, where the number and type of stations are already determined. This mode of work is suitable for advanced phases of the process planning, where the basic structure of the line has already been determined.

Now we can run automatic line balancing process. Proposed solution is shown on figure below. From the graph we can see, that we will need 10 work stations.

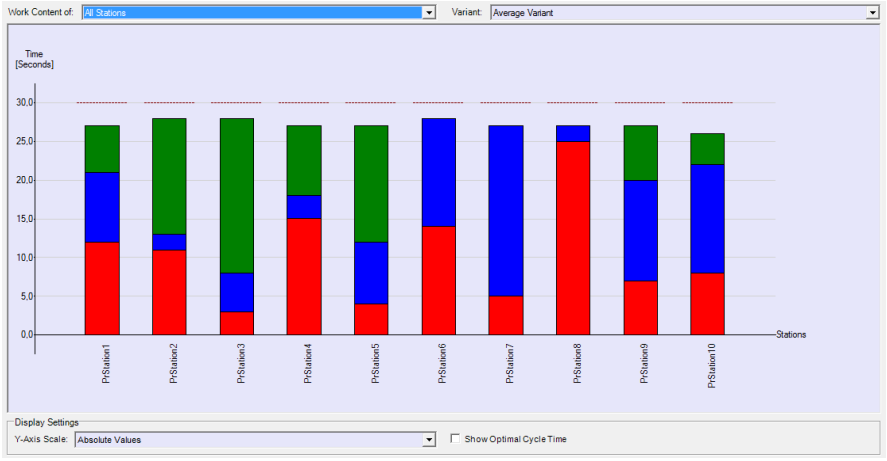


**Fig. 3.** Graph of balanced production line.

5. Evaluation of the results.

The results of the line balancing can be shown in various reports and graphs. Subsequently these results can be stored to the original data structure. In this step the balanced operations will be synchronized from the line balancing scope to the original operation structure.

## 3. Conclusion

Several approaches and software tools solving line balancing problem exist. It is described here how Tecnomatix Process Designer (Line Balancing application) solves this problem and simple example shows the logic used by software. This workflow can be very similar with workflow in other software, but what makes these systems different is algorithm they use.

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# Dispatching rules discovery in KNIME

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**Abstract.** This article deals with discovering possible hidden knowledge in production data by using decision tree learning in KNIME. Possible disruptions that can cause diversion from original schedule and induce creative decision making process are described and evaluated based on their influence on knowledge discovery. New approach to boost hidden knowledge discovery is also presented.

**Keywords:** data mining, dispatching rules, KNIME, decision tree learning

## 1. Introduction

Job shop scheduling problem received a lot of attention by scientific community, and many approaches to this problem has been formulated. In manufacturing world, scheduling problems are extensively implementing dispatching rules.[1] Their advantage and popularity comes mostly from a heuristic approach, which provides simple way to get feasible results with small computation time. In theory, the underlying goal of scheduling by applying these rules is to optimize various system performance parameters, such as makespan, flow time, or lateness. This solution is based on static and deterministic assumptions. In practice, however, the production takes place in dynamic and stochastic environment with many disruptions, which influence final order of jobs that are actually processed. This often creates a need to integrate a decision process, which in its formalized state has the same structure like dispatching rules used to create a schedule. If we consider this process to be a beneficial approach in schedule realization, we can use this decision process in future schedule creation. If on the other hand we do not want system to behave in observed way, it is possible to detect this behavior and take due actions to prevent it in future. Way to discover this knowledge from real-time production data can be found in application of decision tree learning process.

### 1.1. Decision tree learning

Decision tree learning is a very popular data mining method for creating a model based on observed relationships between recorded data and prediction attribute. This model can be then used either to classify new incoming instances of data, or to provide an overview of actual behavior of system that is being analyzed. Resulting model is called a decision tree, or more precisely, a classifier expressed as a recursive partition of the instance space.[2] This partitioning is made by series of splits decided upon by splitting criteria. In practice, there are various implementations of decision tree algorithm, which can be divided into two main types based on predicted outcome. If the aim of the analysis is to predict a class to which given data belongs, classification trees are created, if it is a real number, regression trees are considered instead. Performance of decision tree algorithm can be boosted by creating multiple trees and afterwards letting them vote for predicted class. These approaches are commonly called ensemble methods. Downside to their superior performance is usually a difficulty in visual interpretation of final model. Most notable examples of decision tree algorithms are: Hunt's algorithm, ID3, C4.5, C5.0, CART, CHAID, SPRINT. [3][4]

## 2. Problem formulation

In order to evaluate the probability of knowledge discovery, it is necessary to describe selected disruptions in light of effects they have on a current situation in production environment. If disruption causes a prolongation of time needed for processing a job on a machine, then it is likely that incoming other jobs will start to accumulate on input. This can provoke a different decision making process which can be discovered. If the time needed to process a job is shortened because of some disruption, it is less likely, that the processing will follow different order than that defined in schedule, so the probability of knowledge discovery is low. Following table shows some basic types of disruptions that could appear in production environment and their effects on possibility of knowledge discovery.

| Disruption type | Effect in schedule | Situation on machine input | Probability of knowledge discovery |
|---|---|---|---|
| Machine breakdown | Longer time needed | More material | High |
| Machine maintenance | | | |
| Absenteeism | | | |
| Tool breakdown | | | |
| Delay in transport | | | |
| Tool wear | | | |
| New order | | | |
| Rework | | | |
| Process time variability | Longer or shorter time needed | More or less material | Medium |
| Machine performance variability | | | |
| Setup times variability | | | |
| Rejection | Shorter time needed | Less material | Low |
| Order cancellation | | | |

**Tab. 1.** Disruption types from probability of knowledge discovery point of view.

### 2.1. Shop-floor data

In order to supply decision tree learning algorithm with data to get a decision tree, it is necessary to transform these data into a form suitable for data mining. In order to do so, we need to have at least 50 instances providing data for following attributes in one table:

| Data attribute | Corresponding dispatching rules | Origin |
|---|---|---|
| ScheduledFirst | - | Computed (from barcode scan times) |
| FirstJob | - | Database (id of job) |
| SecondJob | - | Database (id of job) |
| *ProcessingTime | SPT, LPT | Computed (from barcode scans) |
| *TotalProcessingTime | STPT, LTPT | Database (sum of Processing Times) |
| *ArrivalTime | FCFS, LCFS | Computed (barcode scan - logistics) |
| *DueDate | EDD | Database (order due date) |
| *SlackTime | LST | Computed (DueDate, RemainingTime, barcode scan) |
| *RemainingTime | MWKR, LWKR | Database (sum of remaining Processing Times) |

*These attributes consist of three types, relating to FirstJob, SecondJob and their difference.

**Tab. 2.** Data attributes and their corresponding rules.

A hypothesis can be made, that it is possible to create a model from these data with enough accuracy, that it can be later used as a new dispatching rule.

### 2.2. Data sufficiency

According to Machine Learning Cheat Sheet [5], there is a need to have at least 50 samples of data in order to apply data mining algorithms such as decision trees. Amount of data available for this particular problem depends on number of decisions that take place during scheduling. Each decision for choosing one job from a set of jobs can be expressed as a series of decisions between two jobs, while one of them is chosen job and another one is picked from the set. If there is $n$ decisions made, while within each decision $i$, job is being chosen from set of $k$ jobs, sum of all samples that can be gathered from schedule can be computed as follows:

$$S = \sum_{i=1}^{n} 2.(k_i - 1) \qquad (1)$$

Decision tree learners create biased trees if some class dominates. It is therefore recommended to balance the dataset prior to fitting with the decision tree. [6] In this case it was done by reversing order of compared jobs and assigning the zero value to ScheduledFirst parameter. This explains multiplication by 2 in (1). Actual number of samples $S$ is hard to compute precisely, because number of actual decisions $n$ differs based on actual need for them. However, it can be concluded that its number rises exponentially with increasing number of machines and products.

## 3. Dispatching rules mining in KNIME

Initial data used for generation of production schedule were created using simulation in Matlab. As an input, two job shop test problem instances, namely FT06 and FT10 [7] were used to create a set of 30 schedules with varying quantities of each product. These test instances consist of 6 products processed on 6 machines and 10 products processed on 10 machines respectively. Ten basic dispatching rules, namely SPT, STPT, LPT, LTPT, FCFS, LCFS, EDD, LST, MWKR, LWKR and three of their combinations, namely SPT+MWKR, FCFS+EDD and LPT+LTPT were tested. In order to test accuracy of model, incoming data were split by random sampling into two partitions, from which one with 70% volume of initial data was used to create model, and the other with remaining 30% was used to test its accuracy. Decision tree algorithm used is based on C4.5 and SPRINT techniques [8]. Core part of the workflow used to learn models in KNIME environment is shown on following figure.

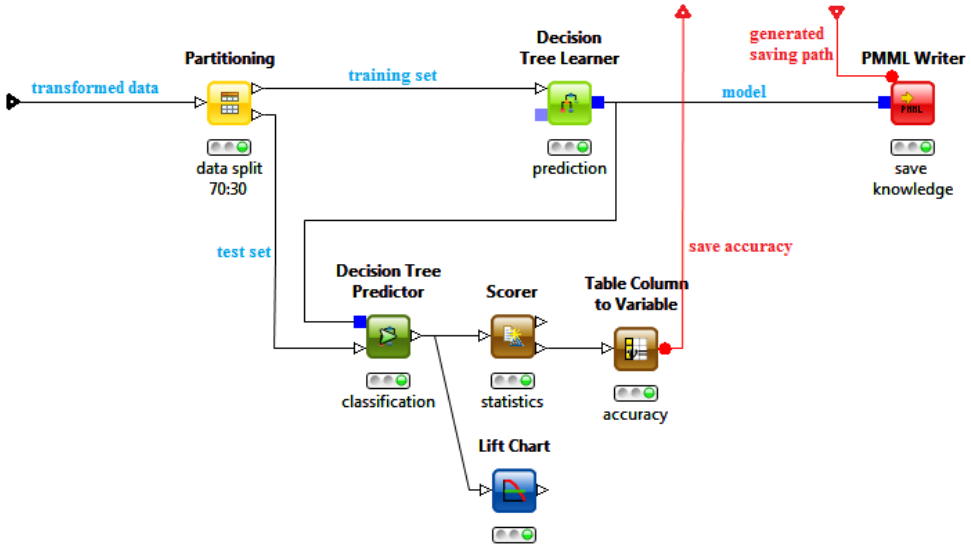


**Fig. 1.** Core part of workflow in KNIME created to derive dispatching rules from data.

Data is first split, and then sent to Decision Tree Learner and Decision Tree Predictor respectively. First node creates model, second one assigns classes based on the model. These data are sent to Scorer, which creates confusion matrix in order to calculate accuracy, which is then forwarded to other nodes along with basic schedule attributes in order to keep track of dispatching rule quality. Result accuracies of generated models can be seen on following figure.

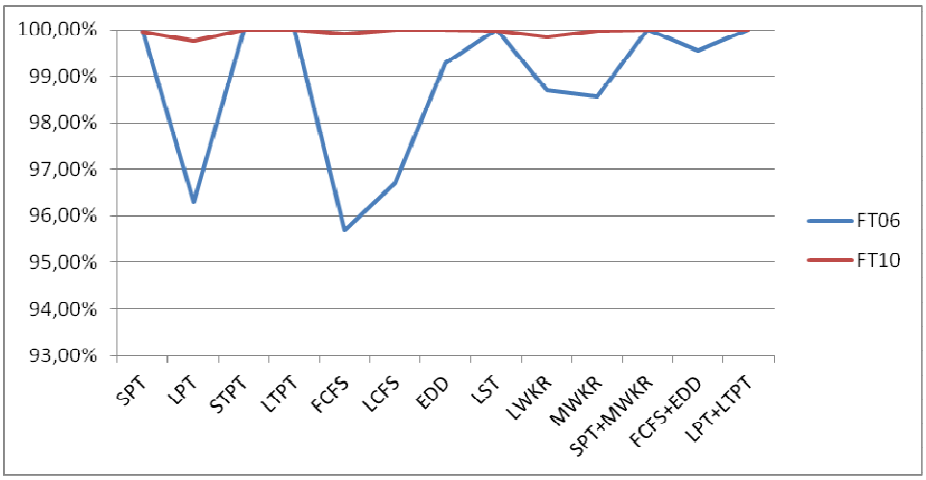


**Fig. 2.** Accuracy statistics for learned models.

FT10 test problem schedules are created in more complex environment with more decision making processes taking place. It is obvious that this situation produces better accuracy results then that of FT06, yet, the overall accuracy of all models does not fall below 95%.

### 3.1. Boosting hidden knowledge discovery

It is possible, that although hidden knowledge in production data exists, it can be overshadowed by dispatching rule initially used to create a schedule. There is a way to tackle this problem by filtering data instances, i.e., decision cases, that provide the same result as would the original dispatching rule.

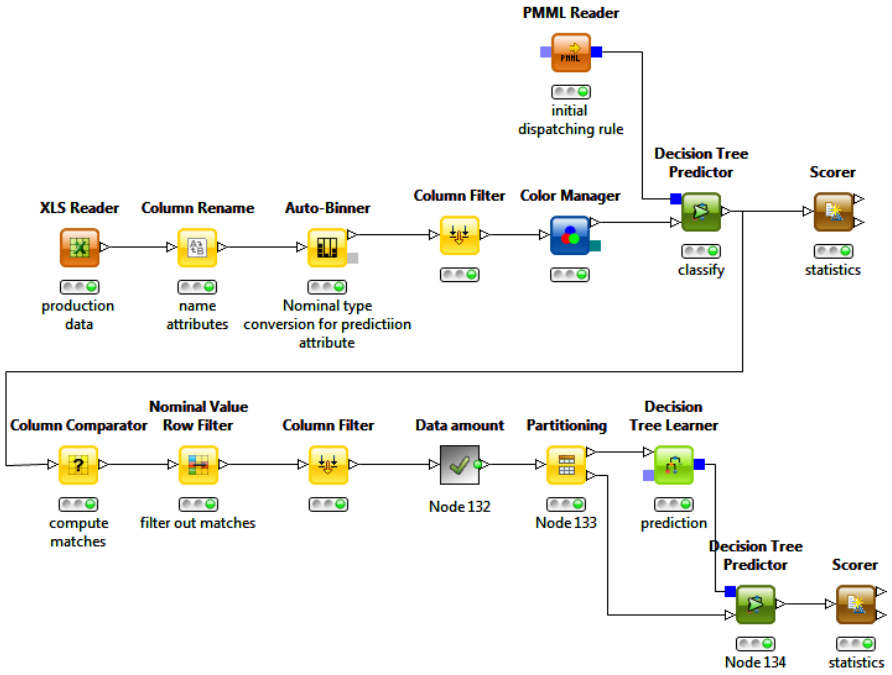


**Fig. 3.** KNIME workflow for boosted dispatching rule discovery.

However, by doing so, there is a big chance of losing significant amount of usable data, which influence the model accuracy, as well as very ability to derive any model at all. This can be addressed by evenly duplicating data until the overall amount of record set reaches minimum of 50 cases. In order to filter out the influence of initial dispatching rule, workflow that is shown in the following figure has been created. In the above example, production data scheduled with 60% of cases where EDD rule was applied and hidden knowledge in form of decisions based on 40% of cases where SPT+MWKR rule was applied has been created in Matlab. The accuracy of classification after applying EDD rule was 87,09% By filtering out correctly classified instances that are considered to be a result of original dispatching rule, SPT+MWKR rule has been discovered. Afterwards it was tested for classification accuracy with 100% result. In this case we can conclude, that hidden knowledge was successfully found and can be identified as SPT+MWKR rule.

## 4. Conclusion

In this article we showed the possibility of knowledge existence in production data created by real-time disruptions. Mechanism of formulating this knowledge has been described and 13 dispatching rules were tested for discovery by decision tree algorithm in KNIME environment with resulting prediction accuracy not falling below 95%. Furthermore, another technique for boosting knowledge discovery has been introduced for cases with small amount of disruptions.

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# Concept of data collection from Holonic system

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**Abstract.** This paper deals with the design concept of the use of different communication architectures than what is in use. The proposed communication architecture REST is part of the communication concept Holon in order to improve the functionality of principle versus the use of communication SOA.

**Keywords:** SOA, REST, Holon, PYTHON, Raspberry PI Bottle

## 1. Introduction

Presently is an automated control centralized and strictly hierarchical. In contrast to the centralized systems are multi-agent and Holonic systems dynamic, easily scalable alternative. The system is able to very efficiently respond to changes caused by the arrival of the priority of the contract, or the breakdown of the unit, and its response is proportional to severity of the cause. The problem, which tries to resolve a specific agent, and if fails, shall request the cooperation of neighboring agents.

The structure of production lines and manufacturing processes are not fixed specified in the structure of the control system. The resulting structure arises from the dynamic conditions of new order. The structure is modified with every change. Because control and the planning process is distributed to a larger number of computing units, minimizing the risk of instability caused by the loss of one agent. Range of applications requiring distributed control. It is an application example in the chemical industry, or distribution of electricity, gas or water.

These applications require autonomous units, which perform many interventions in the management of technology independently, without communication with the central unit. into the flexible manufacturing system is necessary for the operation to replace, add, or subtract devices, and because of failure or maintenance, but also in changing the production plan. It is important that when any such changes as fast as possible find new production path. For these purposes the Holonic and multi-agent systems suitable solution.

## 2. Concept of data collection from Holonic system

To ensure the cooperation of Holon is necessary for the proper selection of architecture mutual communication architecture. The most common method of communication in the literature and Internet resources is the implementation of SOA architecture. In implementing SOA are the cases where the fulfillment of the requirements for communication is unnecessarily complicated and lengthy architecture. For example, provide additional information on the status and information on other sources architecture.

The concept proposes using REST architecture as a substitute for SOA Holon communication layer, which is made up independent PC “Fig.1” (Raspberry PI), the communication interface is implemented via the API. API is a REST framework consist of which the practical implementation can be represented in Python.

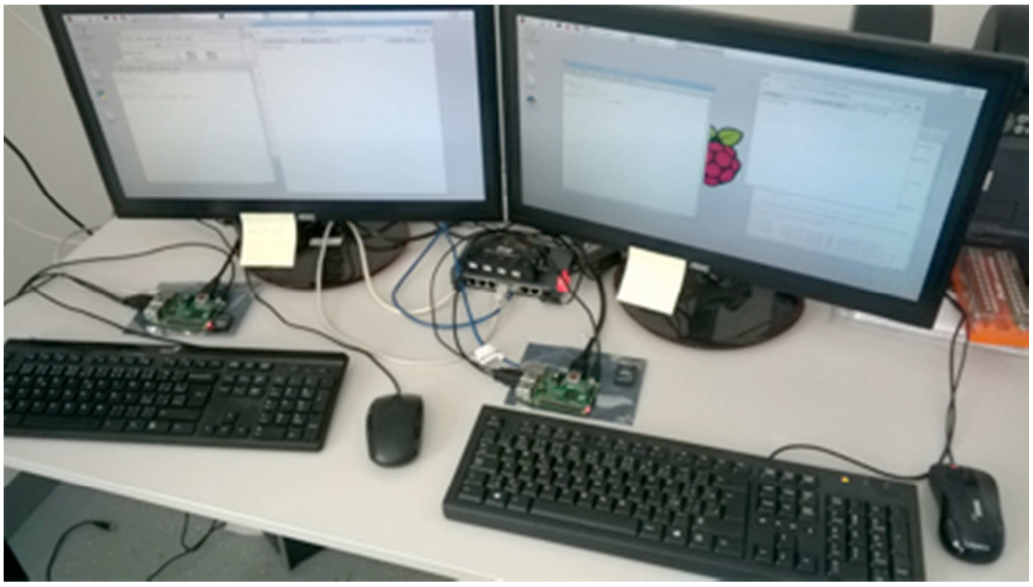

**Fig. 1. Using the REST bottle on Raspberry Pi**

### 2.1. Architecture for Holonic approach control and data acquisition

REST (Representational State Transfer) is a way to easily create, read, edit, or delete information from the server / Holon using simple HTTP calls. REST architecture is an interface that is designed for distributed environments. REST designed and described in 2000, Roy Fielding (co HTTP) under his dissertation Architectural Styles and the Design of Network - based Software Architectures. In the context of the work is the most interesting, Chapter 5, in which the principles of REST Fielding derived from known approaches to architecture.

REST interface is usable for a unified and easy access to resources (resources). The source data can be, as well as the status of the application (if it is possible to describe the specific data). REST is therefore in contrast to the better-known XML - RPC, SOAP, or oriented data, not procedural.

### 2.2. The basic principles of REST

Application status and conduct is expressed by called RESOURCE (key sources), all resource must have a unique identifier (URL).

HATEOAS (Hypermedia as the Engine of Application State in translation hypermedia application status) - represents the state of the application and is determined by the URL. Other states can be obtained by reference to the client receives the response from the server.

It is defined as a unified approach for obtaining and handling Resource with four CRUD operations (Create, Read, Update, Delete)

Resources (resource) can represent (XML, HTML, JSON, SVG, PDF), the client does not work directly with the source, but its representation.

### 2.3. Communication protocol

- Client / Server - is used to define responsibility.
- Stateless - Any request must contain all information necessary for its implementation.
- CACHE - Any request may be explicitly marked as cache-grammable or nocache allowing transparently increase the performance by adding a cache between the client and the server.
- Code - On - Demand - client functionality can be extended code that sends the server (such as JavaScript).
- Layered System - allows the composing layers providing services to increase the variability (cache, transform, load balancing etc.).

There are other ways to addressing the distributed architecture as RPC (Remote Procedure Call). Generally speaking, the difference between REST and RPC is on two levels:

• The semantics of the operations and what is distributed.

• The semantics of the operations in REST is final and consists only CRUD (create, read, update, delete) on that resource.

In contrast, the semantic structure corresponding RPC methods that are called. The REST distributes state (represented by the resource data), compared to a report to be distributed in the RPC.

REST architecture is a service, which are of a smaller number of standards and their more efficient use. Basic standards are: HTTP, URI and XML (or JSON or XHTML etc.).Knowledge abovementioned the basic requirement and necessary condition for the use and communicate with REST services. The basic idea is that the URI defines the data you want to work and HTTP operation, the data we want to perform. At the present used two operations GET and POST HTTP standard they have several. Mention: PUT, DELETE, HEAD and OPTIONS. All these operations allows us to proposal Holonic structures for other Holon. GET and POST operations obtain its popularity principally because is still used for standard web (GET to retrieve data from a page and send POST data from the form). In the design concept, we decided to Python for its multiplatform.

### 2.4. Bottle Python REST Web Framework

Bottle is quick, easy and simple WSGI micro REST web framework for Python. It is distributed as a module consisting of a single file and does not use non-standard Python library. The proposed concept is the backbone to communicate with each Holon. The way Holon communicate and how that data is transmitted is on the implementation of the algorithm, which is also implemented in Python. Proposal communication method is based on the protocol FIPA CNIP. CNIP defines the framework for communication between the "moderator" (Holon providing communication with other Holon) and "initiator" (Holon providing its services). Example of use Bottle ”Fig.2”:

*http://localhost:8080/hello/world*

```
from bottle import route, run, template

@route('/hello/<name>')
def index(name):
    return template('<b>Hello {{name}}</b>!', name=name)

run(host='localhost', port=8080)
```

**Fig. 2. Example of use Bottle**

The final function is available from any place on the network at http.

The example represents a call remote functions and the set argument.. „<name>“. Holon (layer HTTP server on Raspberry PI), evaluate the argument and the function returns its return value. In this trivial case illustrates the ease of use. The function can be connected to the OPC server device, fieldbus, database and share the required information Into the Holon local network.

The biggest difference between SOAP and REST is therefore mainly in how communicate with the server - what standards and how to use them. However, the method to be served by this request to the server is written in a different programming language, and can be very similar in both cases. It is necessary REST framework that builds on the URL to call the correct method. An interesting feature of REST is that the response that comes from the server can be written references to other data - represented by the URL. This way you know at the first answer to obtain additional information. This is undoubtedly a characteristic that the SOAP service is only difficult and it is also a step back to the classic site which is tied hyperlinks normal issue.

## 3. Conclusion

REST services are no ideal solution for all cases. Although the benefiting from the simplicity and the fact that are more similar the classic site, there are areas where their use is not as simple as for SOAP services. These are for example the different process steps in the communication between client and server. An example would be the realization of a single transaction across multiple services, asynchronous operations, or complex security and communication requirements, which can serve WS -* standards. Nevertheless appears more efficient REST architecture than SOA architecture. Main benefit is its simplicity. It is in the software world where complexity can be one of the biggest problems, a very interesting feature.

## Acknowledgement

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# Economic Efficiency of Automobile Shredder Residue Treatment Technologies Under the EU Directive 2000/53/EC

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**Abstract.** This paper deals with economic efficiency and sustainability of existing ASR (automobile shredder residue) treatment technologies in the framework of the EU Directive 2000/53/EC. Cost-to-sales-revenue ratio is calculated for the following post-shredder technologies: VW-Sicon, Citron, TwinRec and Reshment. Calculations are made using secondary data contained in two studies [4] and [5]. Cost-to-sales-revenue ratio is subsequently studied in details, we focus on the main cost components: capital, labour and maintenance costs, energy consumption and gate fee. We can see that the ASR treatment is not an activity generating profit. The question is whether recycling and recovery, bringing positive effect to the society as a whole, should be self-sustainable in the long run or it should be subsidised and if yes then to what extent. We have come to the conclusion that the lack of profitability can endanger the viability of recycling activities in the long run.

**Keywords:** ELV recycling, post-shredder technologies (PST), dismantling, shredding, ASR, economic efficiency, automobile shredder residue, economic sustainability, cost-to-sales-revenue ratio

## 1. Introduction

This Recycling flow of ELVs is almost identical everywhere regardless of existing legislation. In general, the EVL recycling process starts with dismantling. At this stage, big components like tyres, bumpers, engines and dashboards are removed to be used as materials for secondary use or to be recycled. Hazardous materials like lead-acid batteries and other mechanical fluids such as engine oil or coolant have to be removed as well. Dismantling is therefore a costly process in terms of manpower. In the next stage, dismantled car hulks are put to shredder. Shredding is a process in which car hulk is cut into pieces of similar dimensions. Then, shredded materials are separated by air classifier and the light fraction of ASR is taken out. Afterwards, magnetic separator and non-ferrous metal collectors are used to separate ferrous and non-ferrous metals. Remnants of this separation are called the heavy ASR [1].

At present, shredder residue is mostly stored in landfill sites; however, further processing is increasingly applied to reduce the amount of waste being dumped. Landfill costs differ greatly from country to country and often fluctuate. In order to fulfil the targets of the Directive 2000/53/EC, some innovative technologies have been set up to process ASR instead of keeping it in landfill sites. An average car in Europe generates 220 kg of ASR, comprising approximately 143 kg of light ASR fraction (e.g. textile, foam and other organic light material) and 77 kg of heavy ASR fraction. Each year, approximately 10 million of ELVs are dismantled and shredded in Europe [2].

The fulfilment of the targets set by the Directive 53/200/EC is conditioned no only by the existing flow of material among companies that deal with dismantling, shredding and treatment of ASR but mostly by real demand for the materials gained by such processing. It is obvious that metals are of a high interests, the issue is what to use the materials already recycled such as foams, plastics, glass, composite materials, etc. for. Kubasáková and Šulgan suggest that car designers

should think about the vehicle´s recyclability [3]. Therefore the precondition for demand for the recycled materials should be set at the stage of vehicle design. If there is non-existent or insufficient demand, operating costs of all the businesses involved are to be covered from other sources than only from the revenues generated mostly by sold energy, sold spare parts and sold recycled materials.

Even if the Directive no. 53/2000/EC states that the costs of ELV recycling and recovery should be covered by auto car manufacturers, it is necessary to state what those recycled materials shall be used for, e.g. as inputs for manufacturing other products such as plastic bottles, etc. We suggest that EVL dismantling, shredding and the treatment of ASR should be economically sustainable in the long run. In other words, we suggest it is profitable and requires less and less subsidies and aids. In this perspective, we studied economic sustainability of ASR treatment technologies as one partial stage of the ELV recycling and recovery flow (post-shredder technologies). Some of available ASR treatment technologies are run commercially, e.g. Gallo, Sult, R-Plus and Twin Rec, others are being tested. Post-shredder technologies can be operated under licence agreement given by an authorised operator, e.g. VW-Sicon, Twin Rec and Reshment or by a company that owns the technology itself (patent proprietor), e.g. Citron, Gallo, Sult and R-Plus.

## 2. Research Methods

We analysed data contained in two studies [4] and [5] and calculated different cost-to-sales-revenue ratios. These ratios show the level of resources necessary to generate sales revenue of one euro (costs/sales revenues) and they tell us more about the efficiency and productivity of a company´s operations. The main goal is to keep costs under control; we will therefore focus on different types of costs: capital costs, labour costs, energy costs, maintenance costs and gate fee. We start by calculating overall ratio (operating cost-to-sales revenue ratio) and then we deal with other specific types of costs mentioned above.

## 3. Findings and Results

Annex no. 3 of the first study [4] and the study [5] show operating costs and material sales of post-shredder technologies. The analyses show operating loss within all these technologies, being compensated only by a gate fee. If PST operators did not charge shredder operators with the gate fees, post-shredder technologies would not be economically viable.

As all PST technologies show loss, there is no use to calculate profitability ratios therefore we use cost-to-sales-revenue ratios instead. Calculations were carried out for different ASR volumes and results are displayed in charts. As data was not available for all post-shredder technologies, only VW-Sicon, Citron, TwinRec and Reshment technologies were analysed. Fig. 1 shows the relationship between the ASR volume and cost-to-sales-revenue ratio.

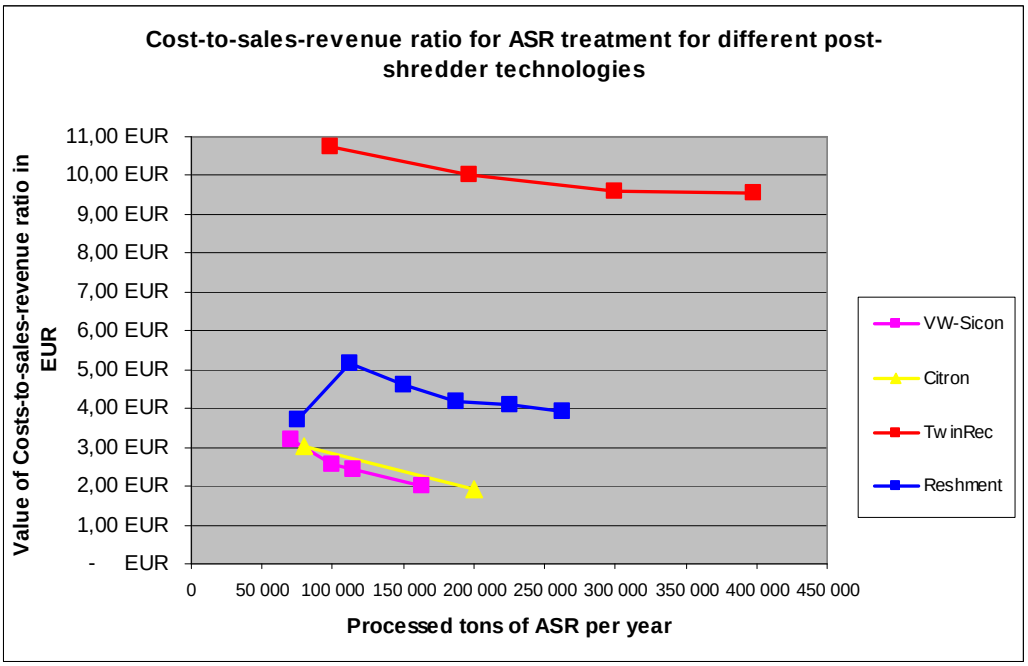


**Fig. 1.** Cost-to-sales-revenue ratio for ASR treatment for different post-shredder technologies. Source: own calculations based on [4] and [5].

The cost-to-sales-revenue ratio measures how many euros of cost are needed to generate revenue of one euro from the sales of processed ASR. The ratio is calculated for different volume (tons) of processed ASR per year. The highest level of economic efficiency is reached by the VW-Sicon technology (lowest level of the ratio). On the other hand, the lowest level of economic efficiency is reached by the TwinRec technology (highest level of the ratio)[1].

The treatment of ASR generates not only materials (plastics and metals) that have a positive value but also remains which must be stored in landfill sites. Sustainability of ASR treatment can be achieved by charging a gate fee to shredder operators for the treatment of shredder residue. The question is what amount of gate fee is reasonable. The gate fee is used to finance the loss (costs minus sales revenue) of ASR treatment. Gate fee improves the economy of PST operators but on the other hand it worsens the economy of shredder operators [6].

From Fig. 1 we can see a wide span between the highest ratio level (10.74 EUR of costs per one euro of sales revenue for the TwinRec technology[2]) and the lowest level one (1.92 EUR of costs per one euro of sales revenue for the Citron process[3]). The aim of further development of ASR technologies should rest on developing technological innovations which would finally bring better economic results, i.e. the cost-to-sales-revenue ratio. Costs for storing remains in landfill sites, e.g. shredder sand, are one of the key cost components influencing economic results of PST operators.

For further analysis we calculate several analytical ratios which show economic efficiency of the selected PST from the viewpoint of capital costs, labour costs, energy consumption and maintenance: capital-cost-to-sales-revenue ratio (CCSR), labour-cost-to-sales-revenue ratio (LCSR), energy consumption-to-sales-revenue ratio, maintenance-cost-to-sales-revenue ratio and the gate-fee-to-sales-revenue ratio (GFSR)

The first analytical ratio, CCSR ratio, is really relevant because all post-shredder technologies are capital cost demanding. Fig. 2 shows the results of this analytical ratio for all selected post-shredder processes depending upon the volume of treated ASR in tons (x axis). The least capital

[1] In order to have a complete idea about the economic efficiency of the entire ELV recycling stream, this ratio should be calculated for other operators in the stream, such as dismantlers and shredders. This is beyond the scope of this article.
[2] It corresponds to 98,438 tons of processed ASR per year.
[3] It corresponds to 200,000 tons of processed ASR per year.

cost demanding post-shredder technology in terms of annual capital costs is the VW-Sicon technology. On the other hand, the most demanding one is the TwinRec technology.

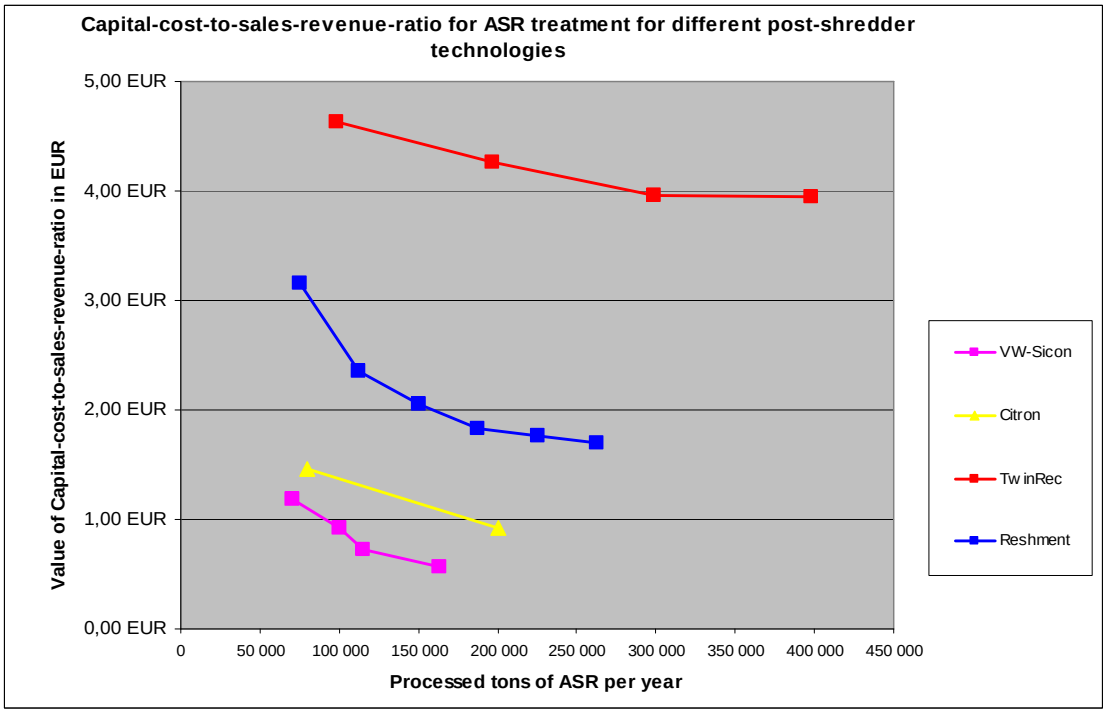


**Fig. 2.** Capital-cost-to-sales-revenue ratio for ASR treatment for different post-shredder technologies . Source: own calculations based on [4] and [5].

The second analytical ratio expresses how demanding are sales revenues in terms of manpower (labour cost); it measures how many euros of labour costs are necessary to generate sales revenue of one euro. nalysis of all post-shredder technologies in terms of LCSR ratio can be seen in Fig.3. The least demanding post-shredder technology in terms of labour costs is VW-Silicon technology. On the other hand, the most demanding one is TwinRee technology.

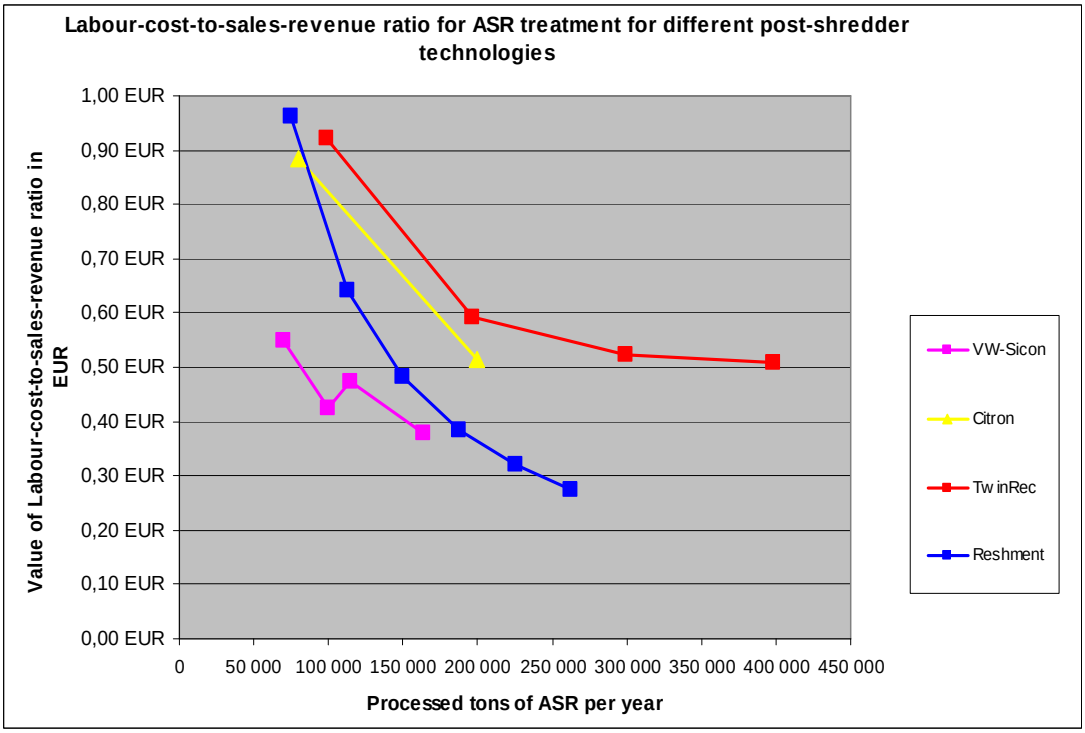

**Fig. 3.** Labour-cost-to-sales-revenue ratio for ASR treatment for different post-shredder technologies. Source: own calculations based on [4] and [5].

The third analytical ratio deals with energy consumption related to sales revenue. It measures how many euros of energy consumption are necessary to generate sales revenue of one euro (Fig. 4). The technology with the highest efficiency in terms of energy consumption is the Citron technology. On the other hand, the worst result was achieved by the Reshment technology.

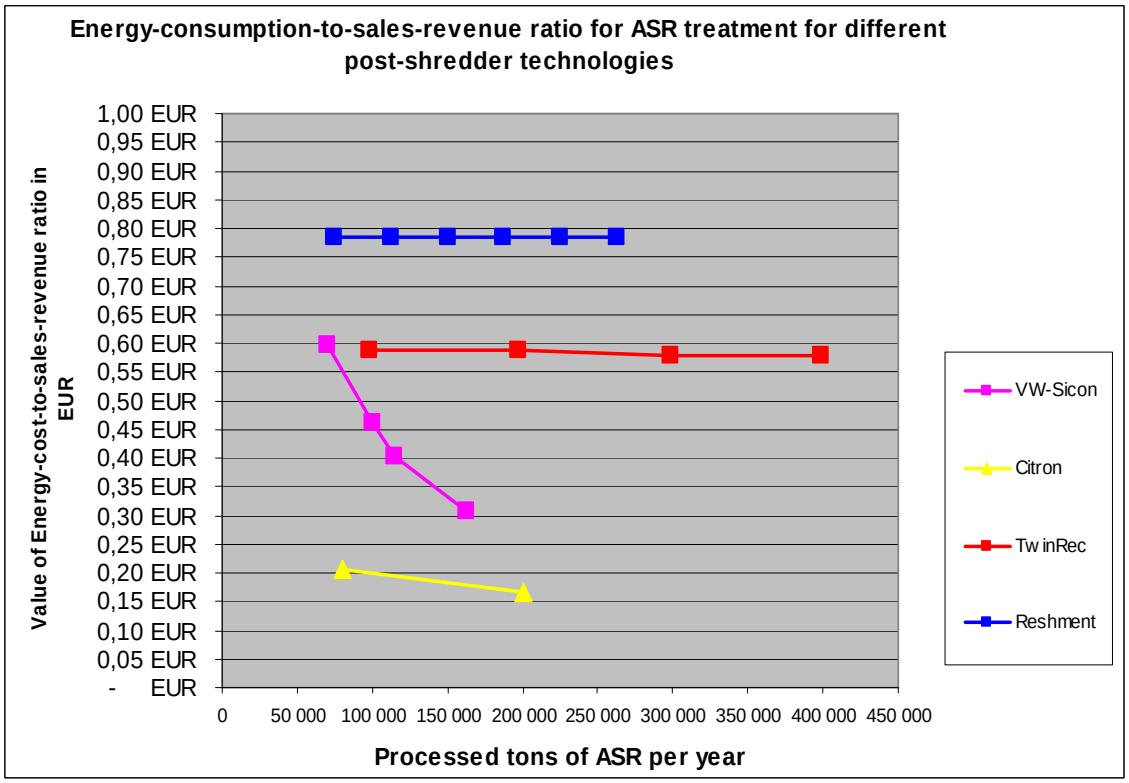


**Fig. 4.** Energy-consumption-to-sales-revenue ratio for ASR treatment for different post-shredder technologies. Source: own calculations based on [4] and [5].

The fourth analytical ratio express the operating efficiency in terms of maintenance costs. It measures how many euros of maintenance costs per year are necessary to generate sales revenue of one euro (Fig.5). The best operation efficiency in terms of maintenance costs was achieved by the Citron technology. On the other hand, the worst one was achieved by the TwinRec technology.

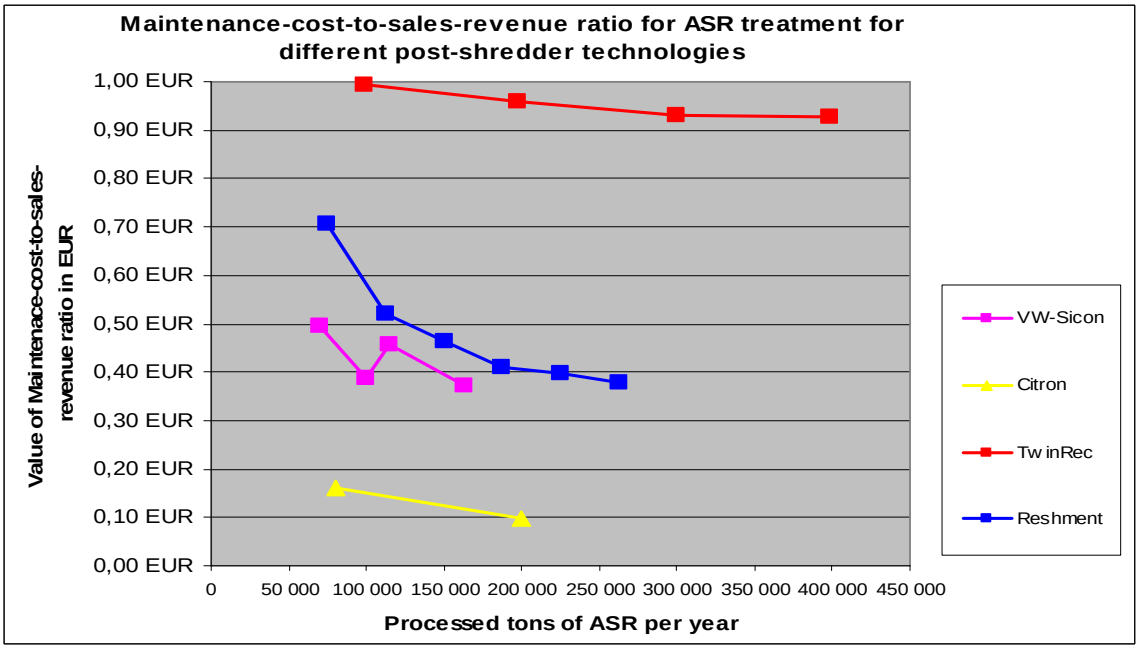


**Fig. 5.** Maintenance cost-to-sales-revenue ratio for ASR treatment for different post-shredder technologies. Source: own calculations based on [4] and [5].

The last analytical ratio (Fig.6) measures operation efficiency in terms of gate fee. The best results of GFSR ratio were achieved by the VW-Sicon technology. On the other hand, the worst operation efficiency in terms of gate fee was achieved by the TwinRec technology. The amount of gate fee is calculated as the difference between the revenue from the sale of recycled materials and/or produced energy and the costs related to recycling and/or energy production. As this difference is negative for all analysed post-shredder technologies, gate fee serves as an amount to bring balance in the post-shredding operations.

Costs for storing post-shredding remains play an important role in determining economic balance of post-shredder operators, therefore they form a variable of a high importance.

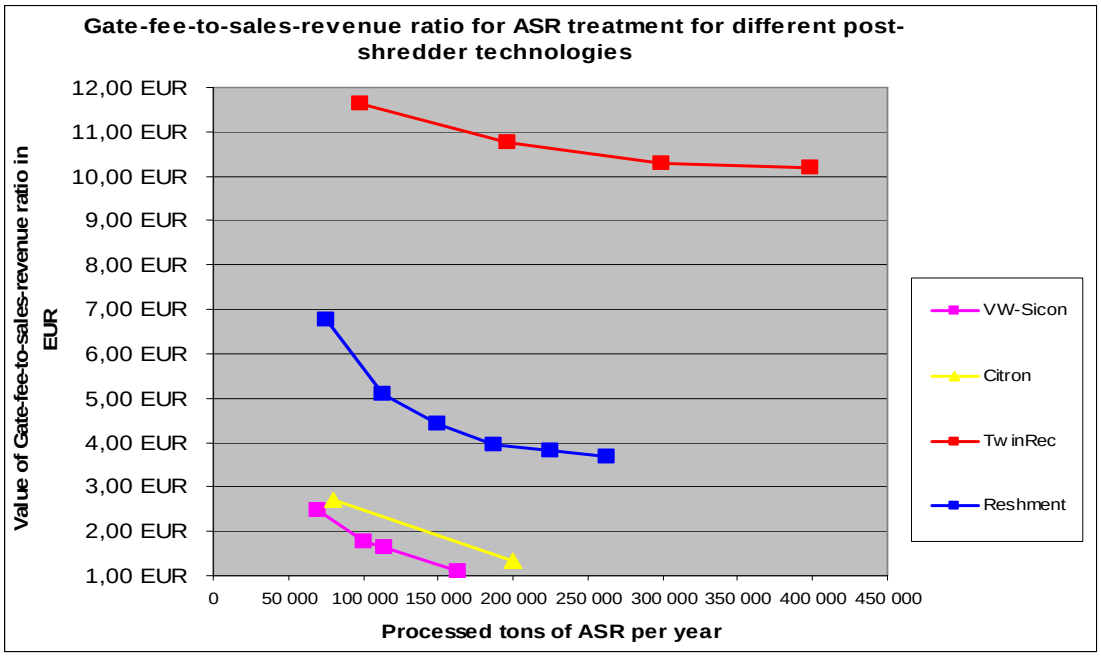


**Fig. 6.** Gate-fee-to-sales-revenue ratio for ASR treatment for different post-shredder technologies. Source: own calculations based on [4] and [5].

In Fig. 6 we can see that the drop in gate-fee-to-sales-revenue ratio is proportional to the growth in the amount of processed tons of ASR per year. This fact can lead us to the conclusion that the higher the amount of ASR a post-shredder treats, the more economical the process is, therefore we suggest that they make use of their equipment to maximum.

Apart from the equipment capacity utilization, there is a purely economic issue: the level of landfill costs compared to the level of gate-fee. If the gate-fee costs of ASR treatment are higher than the landfill costs of the ASR, there is no economic motivation for shredder operators to send such ASR for further treatment regardless of recycling and recovery targets set by the Directive 53/2000/CE.

## 4. Conclusion

The calculations of cost-to-sales-revenue ratio which were carried out for the treatment of ASR for different post-shredder technologies should be extended to other technologies situated in the ELV recycling and recovery chain (dismantling, shredding, ASR treatment). Obtained results would show to what extent those technologies are economically self-sustainable and what policy measures could be taken to increase it. In the long run, the ELV recycling and recovery chain can function only if all operators (dismantlers, shredders and post-shredder operators) achieve some level of profit. Sufficient level of sales revenue of different operators can be fulfilled if there would be sufficient demand for recycled materials, spare parts and energy recovery would function well. Last but not least, sufficient amount of ELV is necessary to use the full capacity of recycling and recovery equipment.

A follow-up study should be carried out in order to discover ways to optimize different kinds of costs. We do not suggest to set a certain value for partial cost-to-sales-revenue ratio as a policy target because the easiest way to satisfy it would be to lower ecological standards of different ASR treatment technologies.

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# The Comparison of Transport Options for Business Passenger on the Route London-Paris

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**Abstract.** The aim of this paper is to analyse the transport possibilities of business passengers on the route London-Paris. Four scheduled airlines (British Airways, Air France, CityJet, easyJet), railway company Eurostar and business aviation operator Premier Aviation are analysed in terms of prices, frequency and product features with the aim to evaluate their competitiveness on selected route. The findings from this research provide evidence that although scheduled airlines and Eurostar are the cheapest transport options, business aviation has the significant advantages, which add value to the business trip.

**Keywords:** business passenger, product feature, price, frequency, route London-Paris.

## 1. Introduction

We can observe globalization of the world economy recent decades. Economies of countries are opening in a rapid speed and the transport is a necessary tool for supporting this process. Distance is a common hurdle that plagues companies of all sizes [1]. Different modes of the transport can solve the distance problem, but no one is as efficient as air transport. Business air travel is a significant feature of an international trade [2].

Business passengers can be defined as passengers whose journey is undertaken for business purposes, as distinguished from a journey for the purpose of visiting friends and relatives or for other leisure activities [2]. Business air travel has a share in all world regions, with the significant share in Europe. We can observe significant passenger flow between the United Kingdom and France. The top five destinations from and to the United Kingdom in 2007 were Germany, United States, Ireland, Netherlands and France. The third top short-haul destination of business passengers from the United Kingdom in 2007 was Paris [2].

Business passengers travelling from London to Paris have several possibilities when deciding the mode of transport. They can use scheduled airlines (full service network carriers or low cost carriers), railway transport or business aviation[1]. Scheduled airlines can serve the needs of business travellers, but has impeding drawbacks [1]. Business aviation removes many of the inefficiencies of other business travel alternatives, although it is more cost-demanding [1].

Scheduled airlines on the route London-Paris have to face the competition from cross-channel rail services. Proportion of business passengers travelling in business classes has declined in the short-haul market. Partly, we can expect that this declining is due to transferring to business aviation [2].

Current research is focused mostly on competition between scheduled airlines. Therefore, we see potential for analysis competition between scheduled and business aviation airlines in the business passengers segment. Theoretical explanation of competition between scheduled and business aviation airlines in the business passengers segment is missing, as well as empirical analyses. In the near future, we can expect competitive struggle for the business passengers between scheduled and business aviation airlines. The comparison of transport options for business

[1] Use of any general aviation aircraft for a business purpose.

passenger on the route London-Paris and considering advantages of business aviation airlines is only the first step in our future research focused on trends in business aviation in world regions.

## 2. Methodology

For our research and evaluation of airlines (along with railway) competition in the segment of business passenger on the London-Paris route, first of all, we identified which airlines serve the London-Paris route. Subsequently, for relevant airlines (British Airways, Air France, CityJet[2], easyJet[3]) and railway company Eurostar, we determined one representative week (23th -29th March) for which we observed the product of carriers and collected data about[4].

We focused on several product features of different offered classes by carriers. The most important one was the frequency, considering time elasticity of business passengers. But for companies with small budget or business passenger not willing to spend a lot of money for travelling, important product feature is the ticket price. We collected data about price of return ticket and one-way ticket. But in both cases, in this article the prices are stated as a separate price from London (LDN) to Paris (PAR) and vice versa. In the case of price differentiation based on different date or day time, we selected the lowest possible price.

Other product features of different classes of carriers, we were considering, were:

- ticket refund (if the ticket is refundable without or with the fee or not at all)
- ticket modification (if the ticket is modifiable without or with the fee or not at all)
- baggage allowance (if the ticket price include hand baggage or checked baggage or both)
- fast track paths (if it is possible to have a fast track check-in or security or dedicated check-in)
- access to lounges for business passengers
- free seat selection
- onboard products (catering, separate cabin)

Finally, we compared product of four airlines and one railway carrier according to the mentioned product features and evaluated their competitiveness against business aviation operators. Unfortunately, data availability of business aviation operators are highly limited. Therefore we could work only with a small amount of business aviation carriers' data.

## 3. Results

Tab.1. on the next page contains type of classes, frequencies and ticket prices of analysed carriers. Almost each carrier offers a business class. Because of low cost business model, easyJet is the only exception, but offers class Flexi with some increase in product quality. Business classes are in Tab.1. highlighted. But due to the trend of divergence of business passenger from business classes to economy classes [2], we didn't want to focus only on business classes.

The most frequencies are offered by Eurostar, from the airlines by British Airways. Frequencies are spread equally throughout the day. We can observe changes in the ticket prices among particular carriers and also among classes of one carrier. Also the airline ticket price of particular airline and type of class is very variable in time. This is because airlines use revenue management and price differentiation. The exceptions are the ticket prices of business classes. The price level of business class is quite constant. The difference in price is also between return ticket and one-way ticket. Often, buying two separate tickets to and from destination is more expensive than buying one return ticket.

[2] CityJet is Irish regional carrier operating mainly routes from London City Airport to major European and UK business centres.

[3] easyJet is the only one representative of low cost business model in our analysis; other airlines are full cost network carriers.

[4] The sources of data were official websites of carriers.

The lowest ticket price offers easyJet, but without the business class, quality of product is also the lowest. Taking into account only business classes, the lowest ticket price offers Eurostar, almost the same level of ticket price is offered by British Airways and Air France and the highest ticket price offers CityJet. Price is a very important product feature, but business passengers consider in their decision-making also other factors, that can add value to their business trip.

| Company | Type of class | FRQ[5] | Price[6] (return) | | Price (one way) | |
|---|---|---|---|---|---|---|
| | | | LDN-PAR | PAR-LDN | LDN-PAR | PAR-LDN |
| **British Airways** | Business class – BC | 10 times a day | 287 | 287 | 349 | 415 |
| | Economy (hand baggage only) - EHB | | 254 | 254 | 126 | 149 |
| | Economy (checked baggage) - ECHB | | 269 | 269 | 167 | 169 |
| **Air France** | Business class – BC | 8 times a day | 278 | 278 | 352 | 302 |
| | Premium economy – PE | | 241 | 241 | 311 | 213 |
| | Economy – E | | 83 | 251 | 234 | 172 |
| **CityJet** | City premium – CP | 4 times a day | 342,71 | 301,9 | 393,71 | 451,43 |
| | City flex – CF | | 247,71 | 219,9 | 248,71 | 280,43 |
| | City value – CV | | 62,71 | 54,9 | 63,71 | 83,43 |
| **easyjet** | Flexi – F | 5/4 times a day[7] | 79,99 (65,99) | 79,98 (58,98) | 82,99 (65,99) | 115,33 (77,23) |
| | Standard – S | | 38,99 (31,99)[8] | 32,98 (31,98) | 46,99 (41,99) | 53,23 (53,23) |
| **Eurostar** | Business premier – BP | 13-20 times a day | 245 | 279,5 | 276 | 279,5 |
| | Standard premier – SP | | 162 | 210 | 162 | 210 |
| | Standard – S | | 106,5 | 106,5 | 106,5 | 106,5 |

**Tab. 1.** Frequencies and ticket prices of different classes offered by carriers [Source: Author, 3, 4, 5, 6, 7]

A significant product feature is flight duration (or duration of travel by train). The travel duration on the route London-Paris is for analysed airlines and train 1h 15 minutes and 2 h 20 minutes-2h 52 minutes, respectively.

Tab.2. on the next page contains the product features of different classes offered by carriers. Only business products of British Airways and Air France have all features that we set up for comparison, so their product has the highest quality among the analysed carriers. The higher product quality of business classes is obvious from Tab.2. Each carrier (except easyJet) provides free seat selection and onboard catering, however the level of catering can vary. Modifiable ticket and hand baggage included in the ticket price are common for all analysed carriers. EasyJet offers classes with the lowest product quality, but as we mentioned before, this carrier has low cost business model and doesn't offer business class.

Aircraft type is in relation with some product characteristics. British Airways, Air France and easyJet operate the route London-Paris with the Airbus A319, A320 and A321 [3, 4, 6]. CityJet has a different approach and operate the route London-Paris with the Fokker 50, which has much smaller capacity (50 seats) than above mentioned aircraft. Therefore, passengers have more convenience than in overcrowded large- capacity aircraft [5].

[5] For example 10 frequencies per day express 10 frequencies per day from London to Paris and 10 frequencies per day from Paris to London.
[6] All prices stated in this article are in British pounds.
[7] 2-times a day from and to London Gatwick and 3-times a day from and to London Luton (during a weekend only 2 times a day from and to London Luton).
[8] The price without parenthesis is for flight from London Gatwick, the price in parenthesis is for flight from London Luton.

| Product feature | British Airways | | | Air France | | | CityJet | | | easyjet | | Eurostar | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC | EHB | ECHB | BC | PE | E | CP | CF | CV | F | S | BP | SP | S |
| refundable ticket | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ | ✓ | ✓ | ✗ | ✓ | ✗ | ✓ | ✗ | ✗ |
| modifiable ticket | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| handbaggage + laptop | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| checked baggage | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ |
| dedicated or fast track check-in | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ |
| fast track security | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ |
| acces to lounges | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |
| free seat selection | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ |
| onboard catering | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ |
| separate cabin | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ |

**Tab. 2.** Product features of different classes offered by carriers [Source: Author, 3, 4, 5, 6, 7]

Data availability of business aviation operators are highly limited. Therefore it was not possible to make detailed comparison of product of scheduled airlines, railway company and business operators. Business operators provide non-scheduled, on demand product. Price for the flight depends on the specific demand, so prices are not published. The company Premier Aviation provides the information about flight prices from London to Paris on their official website (Tab.3.). Prices depend on aircraft type and are only indication prices. They can vary 10-20 % from those stated below.

| Aircraft type | Price |
|---|---|
| LIGHT JETS (non stand up height) | from 3 800 |
| MID SIZE JETS (stand up height) | from 7 000 |
| SUPER MID SIZE JETS (stand up height/more spacious) | from 8 800 |
| LARGE CABIN JET (stand up height/wide bodied ) | from 9 800 |

**Tab. 3.** Price of flight from London to Paris according to aircraft type [Source: 8]

Flying by business jets is significantly more expensive than flying by scheduled airlines, but using business jets has many other advantages. Verifying these advantages is the first step in our research focused on trends in business aviation in world regions. Business aviation fills the gap in the scheduled network, uses airports that airlines don't serve and customers can fly where and when they want. They don't have to fly according to schedule. Customers have more privacy and can work en route [9]. Also flight duration from London to Paris by business jets is the shortest (50 minutes against 75 minutes and 140-172 minutes by scheduled airlines and Eurostar, respectively).

## 4. Conclusion

The business passengers have different transport possibilities on the route London-Paris. They can choose between scheduled airlines (British Airways, Air France, CityJet, easyJet), railway

company Eurostar and business aviation operators. Scheduled airlines and also railway carrier Eurostar have different type of classes (usually ranging from the business classes through „semi" class to economy classes), which offer the product of corresponding quality. The ticket prices of these carriers on the route London-Paris are affordable (from 32 pounds in EasyJet economy class to 343 pounds in CityJet business class). Number of frequencies is also sufficient (from 4 frequencies a day by CityJet to 20 frequencies a day by Eurostar).

In contrast to scheduled airlines and railway carrier, using business aviation operators is cost-demanding. However business aviation has the significant advantages, which can add value to the business trip. Business aviation fills the gap in the scheduled network, uses airports that airlines don't serve and customers can fly where and when they want. They don't have to fly only according to schedule, so potential number of frequencies per day would be far away higher as frequencies of scheduled airlines. Customers have more privacy and can work en route. The important advantage is saving of time. Overall time of business trip is not only time of flight, but also time of access to the airport, time spent at the airport and time of egress to the final destination. Therefore our next research will be focused on evaluation of competitiveness of scheduled airlines and business aviation, with taking into account also the time parameter. We would like to emphasize that research of business aviation has potential because there is lack of literature and research (both theoretical and empirical) about it and expanding of business aviation in all world regions is expected.

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# Reform Strategies of Czech Rail Passenger Transport

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**Abstract.** This paper analyses liberalization of Czech rail passenger transport and defines the major problems that arose in Czech Republic during this complicated process. Among the most crucial questions that still need to be solved before public tendering is the state financial support and cooperation of contract owners. Aim of this article is to give recommendation to Czech government based on possible approaches that were accepted abroad and meet with great success. For this purpose will be examined two models which are currently functioning in Germany (namely in Bavaria) and in Switzerland.

**Keywords:** Transportation, rail liberalization, tendering, Bavarian and Swiss railway model

## 1. Introduction

It finally happened. Czech Ministry of Transport (MT) made a first step in liberalization of Czech passenger railway transportation and instead of placing an order for transport service directly to state owned company České dráhy (Czech Railways - ČD), they began with tenders designated also to private companies.

According to time schedule for long-distance rail operators' competition published by MT, the next tender for rail line R16 from Plzeň to Most should have been initiated during the autumn 2014 [1]. MT announced the preliminary requirements for quality and equipment of the vehicles in time but the tender itself was not launched until the beginning of February 2015. The reason for a considerable delay is a remaining question of tariff unification that still needs to be solved. Although the solution of this problem does not seem to be so difficult to stop the whole liberalization project, it is true that the competition for Czech railways is on the edge of breakdown. Tariff integration is one of the necessary factor contributing to good and smooth functioning of transportation service which then results in increasing ridership [2][3]. However, a root of this trouble is much deeper than the settlement on tariff unification agreement which just highlighted the lack of liberalization concept and brought to light other issues like unification of technical and quality standards, income distribution and many others. One of the most serious problem is then an inability of the separate regions and other entities to cooperate within transportation planning and tendering.

Aim of this article is therefore an analysis of problems that arose in Czech Republic during the liberalization process and give a recommendation to Czech government based on possible approaches that were accepted abroad. I will describe subsequently two different models which are currently functioning in Germany (in Bavaria) and Switzerland and both meet with great success.

## 2. Current State of Liberalization

Public transportation is currently ordered by the three authority levels – state, region and local municipality. The state level is represented by Ministry of Transport (MT) which orders international and cross-regional transportation. Regions and municipality order then regional and local public transportation. Even though this system sets quite precisely which subject is responsible for the transportation ordering, the financial aspect is very inexact. In year 2019 will end most of

the existing contracts which assigned MT directly to ČD and with them will also end the government resolution to financially participate in ensuring passenger transportation service. But the negotiated financial compensation changed many times because of its insufficiency and is rather unstable and unpredictable [4]. The separate regions are inquiring more financial subsidy, very often without being able to cooperate with each other and making a clear transportation planning.

Concerning the liberalization process, the 'height' of liberalization in Czech Republic so far was a creation of an 'open access market' on the line from Prague to Ostrava where the service is provided by three independent companies – public company České Dráhy, and two private companies RegioJet and Leo express who all operate on their own commercial risk. This model may seem like a quick and neat solution of the liberalization concept, which brought lower prices to customers and higher quality of trains. However taking into account the inefficiencies connected to this model the liberalization of the given market does not work very well. RegioJet and Leo express lost together in year 2013 in sum 251 million Czech crowns [5]. The competitiveness of the railway industry as a whole suffers. Trains cover just the peak hours but during the day is the transport service significantly imbalanced [6][7]. Moreover, every company has its own ticket issuing system and pricing policy which means that there is no tariff unification and customer must differentiate from individual ticket systems. As one of the inefficiencies can be also mentioned the restricted capacity of the rail road and its impact on freight trains. Passenger trains have in fact right of way prior to the freight trains which have to stop and let the passenger trains go first [8]. This of course brings additional energy and financial costs which are paid by state.

Because the open access method does not seem to be the right solution for Czech railways, MT started with initiating the public tenders. First tender for passenger service on cross-regional rail line R27 from Ostrava to Olomouc via Opava was announced in 2012. Even though this action was meant to be a pilot project for 15 years long period of tenders for all long-distance lines ordered by state, MT was forced to cancel it in February 2013. This tender had only two participants (RegioJet and Arriva companies) where one of which did not meet the basic requirements and therefore had to be excluded from competition. Nevertheless, MT showed its interest in opening the market and directly assigned the whole tender to private company RegioJet, the remaining participant in competition [9]. The second tender which has been initiated so far was for line R16 from Plzeň to Most which was mentioned in introduction part and which highlighted the current problems linked to liberalization.

At this point it also needs to be clarified what is the difference between the direct ordering and tendering. While CR Company gets financial sources compensating the amount of loss from state, the alternative transportation provider will get fix amount of money which was competed in tender. Therefore without a clear liberalization project and set financial sources necessary to cover mentioned expenses would be hard to open the markets for private companies which would operate on they own commercial risk.

## 3. Questions to Solve before Liberalization

Unfortunately, tariff unification mentioned in introduction part is not the only problem which postponed the tenders' announcements. It just showed that liberalization is a complex problem and firstly it needs to be decided what concept of liberalization method will be accepted. For this purpose MT published the so called Green book which summarize the public transportation conceptions for years 2014 till 2020. This document was a predecessor of so called White book which then should accept one of the suggested method and determine the further direction of public transport financing. Until now the White book was not finished which indicates that government is still deciding what transportation project to support. It is worth to mention that in last 15 years Czech Republic had 10 ministers of transport [10]. In such a kind of environment is then very hard to make a clear liberalization decision. But the suggested options for financing the tenders are as follows [4]:

1) Three level ordering – state, region, municipality which means in effect the current state described in previous text. While the order is fully within region's authority, state compensation covers approximately 1/3 of total costs without being able to influence the order. This violates the principle of parity between the payer and the contract owner and therefore state should also gain certain rights in decision process. This model also brings problems regarding the maintenance and development of railways in particular region where state is forced to subsidize routes that for example do not provide sufficient transportation flow.

2) State ordering. This option would solve the problem of bad communication among the separate regions and improve the cohesion and cooperation within transportation areas. Even though the separate region seems to be on high level of collaboration, MT claims that the collaboration is not very sophisticated and needs certain supervision. The concept of superior agency (in our case state or any authorized company) would contribute to solve other complications like tariff and timetable integration, revenues distribution, unification of technical and quality standards and so on.

3) State would order approximately 1/3 of all orders which exactly corresponds to state financial contribution within transportation service. This option would thus solve the principle of parity mentioned above. On the other hand it would be quite difficult to decide which lines will be under state supervision and which of them will be ordered by region (or even more complicated by individual municipality).

4) Region ordering where all responsibilities in ordering the transportation service would devolve on individual regions. In this case state would be financing just international transportation service. This option is in compliance with principle of subsidiarity which is fundamental for better functioning of regional transport but on the other hand it can deepen the differences which occur at the borders of districts and aggravate the intercity transport. Furthermore this concept also rise a question of financing track maintenance, for those would be now responsible all separate regions. Therefore the maintenance would be very ineffective because it does not bring any economies of scale.

To summarize the issues connected to tendering and it's financing the most difficult one is tariff integration and income distribution (clearing) among alternative transportation providers which would also require unification of technical standards for ticket issuing and checking devices, cash desks and so on [11]. Other issue is an appropriate connection of trains, timetables and cooperation in transportation planning, for this are responsible the individual regions and local municipalities that are very often unable to reach any compromise. The last issue area is problem of financing the renovation and modernization of the vehicles, maintaining the rail roads and solving the ownership of station's buildings and depots.

## 4. Bavarian Railway Model

Concerning the problem description it implies that the best possible approach for assigning the public orders would be an option 2 – transfer the responsibility to state or any state owned superior agency. Government in fact does not have any kind of leverage which would force regional authorities to cooperate. Therefore option 2 seems to be a good way out for Czech rail transport.

One of the exemplary adoption of this solution is the Bavarian model. This model is based on establishment of superior agency, called BEG (Bayerische Eisenbahngesellschaft), responsible for planning, financing and control of transportation service [12]. It was founded in 1995 right after the reform of German railway industry which transferred the responsibility for transportation to all individual federal states. At the federal level the tariff cohesion is set by TBNE (Tarifverband der Bundeseigenen und Nichtbundeseigenen Eisenbahnen in Deutschland), the cooperation platform for all rail transportation providers [13]. TBNE take over the tariff from state owned company DB (Deutsche Bahn) which is the largest provider of transportation service in Germany. DB also carries out the so called income clearing – financial settlement – where revenues are divided among all

transportation companies according to the previous passenger counting. At the regional level also exist a unified tariff (mostly in form of special discounts) that is valid just within the area of federal state. This model also solves the second area of problems – good transportation planning together with connectivity of train lines and timetables because of the single controlling object – BEG agency.

With regard to the question of ownership and maintenance of tracks, stations and depots German model brings solution as well. Within the railway reform they decided to implement the so called holding model – integration of railway owner (and also manager and service engineer) and rail operator in one holding agency with separate accounting and ensuring independent open access to all operators [14]. This model enables better infrastructure planning, high-quality maintenance and superior investment coordination and layout. One disadvantage of holding model could be the incentive to discriminate other potential operators and prioritize the own integrated provider. This holding agency is in Germany called EIC (Eisenbahninfrastrukturunternehmen) and unify all private or public companies taking care of railways [15] – beside DB Netz which administer almost 88% of German network it is also a BBB (BayernBahn Betriebsgesellschaft).

## 5. Swiss Railway Model

Swiss railway model serve as an example of the perfect match of liberalization and effectivity. A lots of Czech railway experts consider the high competitiveness among all private and public companies to be the biggest advantage of the Swiss model and believe that competition will bring less costs [16]. Influenced by this idea, in Czech Republic was liberalized one of the most popular line Prague – Ostrava which was mentioned in second chapter also with all the problems that appeared in this market after an open access. The mentioned inefficiencies were not caused by following the exact Swiss model but more likely by its incomprehension. The high quality trains in Switzerland are not the outcome of mere rising competition among firms. On the contrary the Swiss model is based in fact on no competition pressures. Trains and buses complement each other, they don't compete over the same routes.

Essentially, SBB (Schweizerische Bundesbahnen) has a similar structure to German railway model, with separate organizations for track and train services. Like in Germany, local services are tendered out to a concessionaire, who can be either SBB or another private railway organization. In addition, even though Switzerland is a non EU country, it decided to adopt an accounting separation between operations and infrastructure according to EU legislation [17].

Switzerland is known for its high level integration of public transportation system. Public rail and bus routes are very well designed to ensure perfect transport continuity and timetable interconnection. All transportation means thus create one integrated system with unified tariff (Swiss Pass) including special discounts, season tickets and also unified technical standards for vehicles, ticket issuing and checking devices which facilitate the income distribution among individual firms.

## 6. Conclusion

Under the pressure of liberalization of Czech railways the government take certain measures to confront criticism. Unfortunately, judging by the delay in tendering assignments and inefficiencies caused by open access on route Prague – Ostrava these steps turned out to be contra productive. Starting with tenders and market openings without clear liberalization concept has its disadvantages. During the tender negotiations come into existence couple issues like tariff and timetable unification, maintenance financing or a question of ownership of stations and depots. The reason for postponing the decision process is obvious – there still does not exist any clear plan for

issuing and financing the tenders, if it falls into the hands of state or will be distributed among separate regions.

With regard to the specified problems, the best strategy according to this article would be some kind of state control which would have the power to integrate whole transportation system. One possible approach was shown on the German example where federal state Bavaria created a superior agency called BEG which is responsible for planning, financing, control and cooperation of transportation. In Switzerland is functioning very similar model in that does not exist any competition pressure among transportation providers though.

Czech Republic is constantly competing with disunity among individual regions which are in some cases unable to cooperate. In this situation there is a need for any kind of supervision coming from a superior entity which has the potential to unify all tenders including technical standards for vehicles, checking devices, tariffs and train connectivity.

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# Implementation of ERP System as a Tool of Improving Managerial Efficiency

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**Abstract.** During the past few years and even today, corporate environment has changed significantly with the development of IT tools and data processing. The appearance of the ERP (enterprise resource planning) systems had objective to align all the data relative to the different functions of the company (production, sales, accounting, communication, human resources, marketing...). This allows to increase the performance of the company, especially by avoiding certain malfunctions. Decision making process was also highly affected by the appearance of the ERP.

**Keywords:** ERP, information system, IT, management, decision making.

## 1. Introduction

Management roles and activities have evolved a lot over the years. In addition to the financial control, (especially budgets, costs, profits ...), a successful manager should now control and influence the development of the company. His objectives and roles are therefore much more broader than in the past. In this situation, ERP could be a source of significant help in everyday work or in taking strategic decisions.

If the ERP should be really helpful, as well as any other corporate information system (IS) it should meet some qualitative expectations that should allow the manager to get his work done in more efficient way:

- Be adaptable,
- Include specific modules meeting the needs of the company,
- Provide the performance indicators,
- Present a multiple information in an organized manner, prioritized and adapted to the user.

Generally, we can distinguish the impact of ERP on different levels in the company: operational, decisional and organizational.

## 2. Operational Contributions

### 2.1. Enhance Rigor

ERP software packages have led, at all levels, to more rigorous and new ways of working. Introduction of ERP systems has modernized more quickly and efficiently the corporate management systems, most of which were made up of different specific programs more or less linked between one and other. These softwares were usually dedicated to a single function and were not able to communicate with others. Often it was quite difficult to keep them up to date in order to ensure the technological and functional level. Therefore, there is no doubt that the use of ERP helps significantly managers to provide the operational excellence.

### 2.2. Provide Consistent and Reliable Financial Information

While trying to understand the overall situation of the company, a chief financial officer (CFO) or a CEO will be faced with several versions of reality. Finance department has its own vision of the figures, sales department have another one and each different business unit or department have their own view. ERP creates a single version that can legitimately be questioned because everyone contributes to the feeding of the system and thus to the results. ERP allows the company to leave this vertical view and ensures the consistency of information. Even a consistency does not necessarily mean reliability, but in case that the data error occurs, ERP allows data traceability and guarantees that the correction could be done easily. In this sense, ERP helps to improve the data reliability.

### 2.3. Consistent Procedures

ERP requires all entities of the same company to work in the same way, which facilitates comparisons between various units and data consolidation that is also important to obtain the correct results.

### 2.4. Reduction of Delays

Members of different departments all have access to the same data and can instantly update it. The data is only entered once, avoiding duplication generating errors and resource consumption. In addition, the real-time data processing reduces the closing time, which is a huge advantage in comparison with older systems. With these shorter deadlines, management as internal customer can expect faster delivery and less frequent errors.

### 2.5. Cost Reduction

General cost reduction is balancing around three themes: cutting waste, optimizing the organization and the establishing the procedures and follow up. ERP then helps the management by proposing complex processes of cost monitoring. Moreover, thanks to the ERP, the input information is introduced only once that allows to remove low-value tasks.

### 2.6. Source of Savings

The return on investments in implementation of ERP is supposed to be generated from the following qualitative and quantitative elements:

- Reduced IT maintenance costs (because of the reduction of multiple IT systems).
- More accurate forecasting due to data sharing and real time processing.
- ERP enables to introduce visibility and traceability to the stock management. This can lead to improving the efficiency of stock management (reduction of storage costs ...) and planning of deliveries that helps to reduce the stock and therefore save money.

A reorganization of work with consequences on the number of positions as the data input is not redundant.

## 3. Decisional Contributions

We have seen the various benefits brought by ERP in terms of operational management. However ERP brings also another advantages to management of the company. As the access to the information becomes strategic to guide managers within the decision making process in the right direction, it is crucial for them to have the accurate performance indicators to be able to react on time and pilot their activity efficiently.

### 3.1. Better Information

In order to take appropriate decisions, it is necessary to be able to get the required information as fast as possible in the correct form. Reporting and production of dashboards become therefore a strategic issue for the company. Being taken into a difficult situation by discovering that the information you need is missing may not be forgiven and could easily let you pay expensive. With ERP, information is directly available on the server in a single database. All this data can be sorted and classified as needed.

### 3.2. Resource Optimization

ERP integrates management and control modules (dashboards, simulations, budgets). These new tools change the organization of the management functions. Some tasks are real-time performed automatically, the workload of management is therefore reduced and managers can concentrate on other activities, such as understanding of the figures, interpretation of results and reflection about actions to be taken. It allows managers to be more reactive and optimize decision making through better information.

## 4. Organizational Contributions

The integration of all business functions and data sharing between different actors and entities multiply software performance. This synergy helps to bring similar services together and to implement a more efficient management structure.

### 4.1. Change of Information Systems

The arrival of ERP has completely transformed the conditions of design, implementation and operation of the management information system in a company. In fact, the basic principle of these tools is to associate, within the same product, different complementary functionalities depending each other (e.g. purchase, accounting, financial control ...). First versions of corporate information systems were closed and they forced to re-enter the same data in different applications. The next generation of IS started to create links and interfaces between these different applications and modules in order to avoid duplication. The actual generation of corporate information systems changes the corporate structure: ERP allows to pass from a vertical organization of corporate functions (production, sales, accounting, human resources, ...) to the transversal structure organized by processes corresponding to a set of cross-functional activities. This new organization is often required because companies tend to have a focused strategic customer orientation. It requires them to have a more reliable, fast and consistent information to better meet the needs of their clients (in terms of quality, time, price, technology ...).

### 4.2. Centralization of Services and Cooperation

Along with the modernization of their IT tools, companies that implement ERP also upgrade their methods of work and their organization by changing the relationship between financial services and the rest of the company. This means that the integration of accounting and budgetary modules in most of these systems gives an opportunity for centralization of financial functions and cooperation with management by giving them possibility to control, analyze, present and report results.

### 4.3. Support for Using ABC/ ABM Method

Recently, more and more companies are wondering about the relevance of the traditional methods of tracking costs and the information necessary for the preparation and making of strategic

decisions. This question can be answered by implementing the ABC / ABM approach that meets two objectives:

- Cost control through efficient activity management,
- Cost calculation through efficient allocation of indirect costs.

The ABC method (Activity Based Costing) provides business analysis of corporate activities based on the cost criterion and provides decision makers with information tailored to a new form of management called ABM (Activity Based Management). The basic idea is to better identify activities creating value and knowledge on which activities the efforts should be focused on the improvement and cost reduction. The use of ERP then provides an efficient support for the implementation of these methods.

## 5. Conclusion

It is clear that in a world of today, significantly based on the information technology, the key to success lies in the ability to find the right information at the right time and transfer it fast to the right person in order to facilitate decision making. This capacity for decision-making is therefore a comparative advantage that will allow the company to differentiate itself from its competitors.

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# The benefits from IT investments in business practice

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**Abstract.** This article is focused on defining the benefits of the investment in information technology (IT) in the company. The investments in information technology represent big costs for the company but they are useful in almost all areas of business, both in terms of the internal environment but also the ambience of the place. For the needs of defining the benefits are described in the article information technologies, the need for their use and their connection with the process of investing in the company. Common benefits were defined generally on benefits for businesses of investment in information technology. They are divided according to the identified characteristics into groups that define the essence of their introduction into the business.

**Keywords:** information technology, investment, benefits

## 1. Introduction

Information technology (IT) is currently constantly changing due to intensive technological development in all areas and segments of life. The orientation of businesses on the key factors of their performance with the development of information technology has changed. IT of the companies is now becoming an integral part of the decision-making venture. This trend was based on the large amount of data that businesses must process to reach a decision to allow companies to gain competitive advantage, to reach many customers, streamline processes in the company. Information technology businesses are currently considered to be important for their success, by which they can increase their competitiveness in the market.

## 2. Information technology and their importance in the company

The area of information technology has in the company and its management, extensive possibilities of using. Include IT processes, computer software, hardware, information systems, programming languages, various data etc. In a narrow sense, information technology represents something that provides data, information, knowledge, where appropriate, in any form of media. [1]

In a broader sense, it is possible to understand information technology in the company as a set of hardware and software for the company security needs and support the implementation of corporate activity. This technological equipment provides businesses with a variety of methods and tools through which users can process their business data in order to obtain such information they need the workers to exercise activity or to control activities in the company. The term information technology is also possible to understand the nature of various electronic devices that can work with data through a predefined algorithm. This includes also a device that receives the data, processed, through predefined software and subsequently giving to the adjusted data to the recipient or other processing system. [2] [3] [4] [8]

Information technologies are complex technological equipment, which is applicable in all activities of human work and the whole industry [5] [6]. According to Keen [7] information

technology are applied in business management in particular in the following areas: "managing of data of the company, application solutions of business issues, management communication, computer support processes in the company, integrating problem-oriented systems, computer support research and development, computer integrated manufacturing , management information systems, reservation systems, integrated business systems, decision support, industrial automation, office automation, supply and administrative applications. "[7] [5]

Information technology represents a diverse set of activities, methods, procedures and software, to support the collection, storage, processing, verification and distribution of information in the required quality, quantity and form, for the purposes of meeting the information needs of users. Information technology may be used as a support tool in solving complex problems of users and help them to design the optimal solution to the problem in the company. [2] [4] [9].

## 3. Investment in Information Technology

The gradual development of IT-s and continuous improvement in their businesses now have to maintain their competitiveness begin to spend their funds on their purchase and implementation. Prerequisite for the introduction of IT in the company is their contribution to the company not only at the time of their introduction but during the following years. Companies have therefore started to spend their money to invest in IT. Investment is by Valach generally defined as cash expenditure, which are expected to assess whether the financial terms or other value over a longer period of time [13]. Ďurišová defines investment from a business perspective as "capital placement decision respecting the return and recovery" [14].

It is possible to say on the basis of common definitions of investment and information technology, that IT investments represent expenditure by the company to software, hardware, information systems, which are the company's future benefit, increase its competitiveness in the market and thus satisfy its owners and other stakeholders. Investments in information technology in enterprises can be classified into internal and external investment. Additional external investments include those technologies that contribute to the acquisition of new customers and the use of market opportunities. From an internal perspective may IT investments be defined as investments supporting cost reduction to improve internal processes (communication, production). On the basis of their relationship to the development of the company is mainly on development investments that contribute to the company's ability to produce and sell products and services.

It is difficult to define the benefits derived from their implementation as with all types of investment and investment in IT. In relation to other type of investment, however, be noted that even after the economic life of these investments is very difficult to quantify obtained cash income, because the use of IT technology has a significant impact on a number of business processes (information gathering), which can be not expressed in monetary indicators. Kraemer and Dedrick defined characteristics to ensure the success of the investment in IT: [15]

- The investments in IT must be in line with the business strategy and should contribute to the achievement of business objectives,
- Companies should be decentralized, which will bring them the flexibility to respond to changing market conditions,
- Companies should have strong IT managers, who are able to offer individual parts enterprises have applications that are necessary for their operation,
- Business processes should be enriched with IT components, and should be visible benefits for business owners,
- Companies should be paid to evaluating implemented and initial investment requirements have been defined before their implementation.

Gartner also defined the points that must be achieved to reach the effectiveness of the established investment in relation to the management. He says that IT investments can be effective only when their management linked to the expected and achieved improvement undertaking, which

also appears in the financial indicators. Managers of companies also have to monitor changes in IT with a focus on improving business processes, i.e. IT is not the primary object pursued, but should contribute to the better functioning, whether in manufacturing, sales, etc. [16]

The need to evaluate the effectiveness of IT investments in the company, according Hittmár et all [2] appropriate to evaluate these investments quantitative (economic) and also qualitative. Quantitative evaluation is a means of economic evaluation methods that are well quantified, such as the comparison of costs and benefits and the like. Qualitative evaluation is an evaluation of the benefits that are difficult to quantify but are important for the overall evaluation of investments such as customer value, improving the quality of management and other processes of the company. [17] [18]

## 4. The benefits of IT investment in the company

As it was defined in the previous chapter, it is very difficult to identify and quantify the benefits of introducing IT into businesses. Some authors are dedicated to defining the methods by which it is possible to discover the benefits of these investments, but the introduction of IT in companies and companies themselves and their decisions are very subjective. Based on the research of several authors, it is possible to divide the benefits of investment in information technology for the company in the following categories (fig.1): benefits affecting the performance of the company as a whole, the benefits for employees of the company, the benefits to customers, benefits affecting an external environment (State of Environment, trends etc.)

The benefits of introducing IT investments customer-oriented businesses have to ensure their satisfaction, loyalty and repurchase. They should be also used to gain new customers, either by extending their shopping opportunities such via the Internet, also use IT for communication with them, improve product quality, saving customers' time and efficiently meet their needs. An example is Walgreens pharmacies that have invested in network technology and Internet business by specific database vendors. They could improve processes for customers so that doctors could fill a prescription online and patients it could pick up in the so-called drive-through pharmacies in a very short time. [17] [14]

Invested in information technology focused on employee benefits is another category defined by the authors. IT applications in companies can increase productivity of the work of the employees. The increase in labour productivity can be achieved by accelerating the production of the use of new technologies in the company, which may also contribute to increasing the satisfaction of employees who will carry out their work quality. Survey of the University of Malaga for tracking productivity in the US between 1980-2004 confirmed that up to 35% in labour productivity was the subjugation of changes in IT [19]. Also, the company may increase the investment in IT skills of its employees. [15] [17] [21] [22]

In addition to employees as an internal factor that influence IT investment can also specify other group internal benefits of technology in business. It's very business performance. A company may be the introduction of information technology to streamline their processes. In the case of the production process is beneficial eliminate downtime, reduce wasters, use of new technology to ensure the required quality. IT investment and improve their warehouse management processes with a clear and registered reserves electronically. This supports a more efficient process of purchasing materials and maintaining the right amount of inventory.

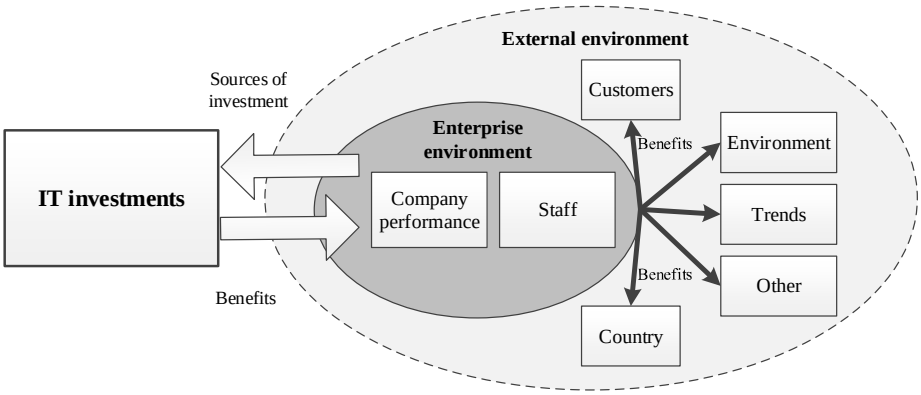


**Fig. 1.** The benefits of IT investments**.**

Routine and administrative processes that take up a lot of time employees can also be automated. The introduction of IT is of benefit to all processes and also in the decision-making and management, since managers have available relevant information that can help your IT process and subsequent decisions [15]. Using IT is also possible to control achieving the goals of the company [20] [23] [25]. All of the benefits of investments also reduce company costs, which mean that the company is able to deliver to its owners more profit as well and its value [17] [20] [24]. In terms of performance is yet to assess the status of the undertaking. Using information technology, businesses can monitor its customers' requirements, market developments and on the basis of demonstrated specify their opportunities in new markets occupation, prove to strengthen its market position and also flexibly respond to changes. [17] [21] Collins specified the companies that have achieved a dominant market position in its business through investments in IT. These include: Abbott, ciruit City, Fannie Mae, Gillette, Kinberly - Clark, Kroger, Nucor, Phillip Morris, Pitney Bowes Walgreens, Wells Fargo [17].

The introduction of information technology can influence over business and to its external environment, based on the defined benefit investments in IT companies. The benefits for the companies can contribute to economic growth in the country and also in helping to restructure States [18] [24]. Introducing IT can conduce to the protection of the environment, given that the storage of information longer need to perform physically, but the information can be stored in data centres etc. The company has constant access to new technologies that are trend through investment in IT, for example on the effective management of operational processes, for example in the production (Toyota Production System, or support the analytical process information processing (eg. Big Data, Business Intelligence, etc.) and the like. At the same time, the company may solicit clients directly through technology, which is a trend of (tablets, smartphones, internet sales, social networks, etc.) and in this way to acquire customers possibly influence their purchasing behaviour in terms of its business.

## 5. Conclusion

It is necessary to consider carefully the actual investment in IT. Purchasing new technology does not automatically mean achievement for the company mentioned benefits. It is necessary for the company to realize that they are in the information technology really needs and uses real extent of their opportunities within your business. Information technology should work in the business accelerators to support the achievement of the desired goals of the enterprise. The introduction of information technology, therefore, does not immediately fulfil its objectives, return on investment and increase profits. Achieving the benefits of investment in information technology can therefore be described as a long-term process of effective management of these IT investments and themselves.

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# EFFECTIVENESS OF ACTIVE LABOUR MARKET POLICY

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**Abstract.** The article deals with an essential part of active labour market policy and the effectiveness as well as evaluation methods of active labour market policies. The active policy plays an important role in the employment policy as a whole. The economic policy of the country intends to achieve effective and efficient usage of funds. With respect to the comparison on international level, the Slovak Republic spends a relatively small amount of funds for the implementation of measures of active labour market policy. However, during the recent years, the strategy for activating the active labour market policy has strengthened and therefore the evaluation of programmes with emphasis on efficiency has become important.

**Keywords:** unemployment, active policy, efficiency active labour market policy,

## 1. Introduction

The unemployment rate has become a major problem with respect to the Slovak economy. High unemployment rate in Slovakia is a great challenge for us and for the economic policy of the country. Measures introduced by means of the active labour market policies can not entirely remove the problem of unemployment. However, active labour market policy represents a key factor of the labour market. The active objective of labour market policy plays a major role, however the particular tools must be set up correctly so as to perform the role effectively and efficiently. If these tools are not set up correctly, they become non-transparent and inefficient and shall not be a part of the active labour market policy tools. Therefore, there is a need for effectiveness analysis and the effects analysis so that the active policy could become even more effective in the struggle with unemployment. Currently, it is difficult to measure the effectiveness and efficiency of the tools of the active labour market policy. No precisely defined uniform methodology for such evaluation has been determined yet.

### 1.1. Active labour market policy and its effects

Specialized literature suggests that the active labour market policy has no positive effect on reducing unemployment.
Active labour market policy brings many effects on unemployment. Some of the effects are intended in advance and have become the reason for the creation of the tools of active labour market policies, but there are as well some effects, which were not foreseen in advance**.**
The positive effects have been identified by [1].

- The effect on the process of job seeking – the aim of the consulting activity provided by the state and addressed to the unemployed is to streamline this process. It means, to increase the number of successful candidates applying for one vacancy. This effect is usually referred to as the primary objective of active labour market policy.
- The effect on competition among working positions - any candidate who has completed a retraining program, can become significantly more attractive for employers.
- The effect on the allocation of labour among the particular sectors in the economy - via ALMP, the possibility of promoting the labour force transfer from a stagnating sector into a prospering sector with better productivity.

A different view on the effect decreasing the efficiency of labour market active policy was presented by [2].

- **Deadweight effect** - this effect means that a part of the candidates would be hired despite of their non-participation in the program of active labour market policy.
- **Substitution effect** – this effect means that the subsidized employees receive an occupation at the expense of those benefiting neither from a subsidized work place nor incorporation in the program of ALMP.
- **Expelling effect**- companies receiving a wage subsidy thus gain an advantage over the other companies as they can increase their market share on the market.

### 1.2. Expenses for active labour market policy in the conditions of the Slovak Republic

Active labour market policy represents a younger form of labour market policy, which arose as a reason of unsuitable passive policy, since the passive policy gradually became a disincentive to job seekers. [5]

The primary role of active labour market policy consists in facilitating and acceleration of the transition to paid work as well as in using special programs in order to maintain people's ability to work with the aim of finding a permanent place on the labour market. The active policy (by means of the so called active measures on the labour market) is solved by the Act on Employment Services No. 5/2004 as amended. This legislation came into force in February 2004 and was abolished by the Act No. 387/1996 Coll. on Employment. The Act underwent several changes in 2004, the changes have affected several areas including labour market policy and employment enhancement.

The Ministry of Labour, Social Affairs and Family (MPSVR) is the main actor in the implementation of the active labour market policy, Other activities concerning the active labour market policy are performed by 46 Offices of Labour, Social Affairs and Family (ÚPSVR).

Within the context of the international comparison, the Slovak Republic ranks among the countries with relatively low investment of funds in the active labour market policy if considered in relation to GDP. In contrast, countries such as Denmark, Sweden, Belgium fall into the group with the highest amount of funds invested in the active labour market policy. Slovakia therefore achieves only a third of the EU 27 average as compared by [3].

The following table shows the list of all expenditure spent on all measures of the active labour market policies in proportion to GDP in the Slovak Republic in the period from 2008 to 2012. The lowest amount of funds in Slovak Republic is invested into the training program while the highest amount is invested into start up incentives programs.

| **Programes** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|
| PES and ADM | 0,11 | 0,1 | 0,1 | 0,07 | 0,07 |
| Training | 0,01 | 0,01 | 0,01 | 0 | 0 |
| Employment incentives | 0,02 | 0,03 | 0,1 | 0,1 | 0,08 |
| Sheltered and supported employment and rehabilitation | 0,02 | 0,03 | 0,03 | 0,04 | 0,05 |
| Direct job creation | 0,05 | 0,01 | 0,01 | 0,01 | 0,01 |
| Start up incentives | 0,06 | 0,07 | 0,08 | 0,07 | 0,05 |
| Out of vork income maintenance and support | 0,11 | 0,29 | 0,24 | 0,25 | 0,26 |
| Early retirement | 0,33 | 0,38 | 0,36 | 0,25 | 0,18 |
| Total | 0,69 | 0,93 | 0,94 | 0,79 | 0,69 |
| Tolal active (10-70) | 0,26 | 0,25 | 0,33 | 0,3 | 0,25 |
| Total pasive (80-90) | 0,43 | 0,67 | 0,61 | 0,5 | 0,44 |

**Tab. 1.** Public expenditure as a percentage (% of GDP) SLOVAKIA, own processing

## 2. Active labour market policy efficiency

Labour market in Slovakia has undergone a certain development process. The transformation of the Slovak economy had a significant impact on the labour market resulting in the increase of unemployment in the past. However, the Slovak Republic still remains among the countries with a high rate of unemployment. In the contemporary world typical of incessant and dynamic changes, the effective employment policy plays a decisive role. It is therefore important to recognize the effective tools of the active policy and to distinguish such tools from the less efficient ones. The effective tools can thus be aimed at groups of candidates who need them.

Efficiency and effectiveness are the two categories interconnected very closely. According to [6], efficiency shall be understood as a relationship where inputs incurred are compared with the outputs and value effects (revenue, profit). If the strategy is efficient, there is no waste of resources. The effectiveness of the active labour market policy programs shall be understood as the extent to which the intended objectives of the programs are met. As for the active labour market policy, its effectiveness is expressed by the ratio of job seekers successfully placed in the labour market.

However, specialized literature as well as the majority of programs indicates a low level of effectiveness of the active labour market policy tools. As stated by [9], the active labour market policy acts through direct and indirect effects.

Direct impacts are defined as the impacts directly serving to reduce unemployment via particular programs. The direct impacts are considered to be the most important. In addition to the direct impacts, there are also the indirect impacts which are also of great significance and involve e.g. flexibility of working skills. The indirect impacts tend to have more long-term impact on the labour force employment.

Except for the direct and indirect impacts, the active labour market policy brings many other effects listed at the beginning of the article. As stated by [7], several criteria can be used to evaluate the programs of active labour market policy:

- relevance – compares the way the outputs correspond to the original aims and objectives, an occurrence of any duplicate or overlap of a part of the program is looked for,
- efficiency and economy - examines and compares the inputs to the outputs,
- effectiveness - comparison of actual and planned objectives of the program, effects brought to the target group,
- impact/effect - evaluation of the program related to a larger group of people, assessment of positive and negative results,
- sustainability - the effect of the expected positive changes in terms of viability.

## 2.1. Study of the efficiency of the active labour market policy tools in the Slovak and Czech Republic

The information systems of ÚPSVaR are nowadays unable to evaluate the efficiency and effectiveness of the active labour market policy tools. This evaluation is worked out within the frame of specific programs funded by the European Social Fund. However, this depends only on the specific program as it is not uniform and systematic.

There are several evaluation methods of active labour market policies programs. **Microeconomic methods** evaluate the actions of the effects. These methods can be divided into quantitative, qualitative and economic.

- Quantitative methods – non - experimental methods - these methods are the simplest, as they measure only gross output. This method is used to evaluate the participants after the completion of the program during the period of three months in order to determine whether the participants successfully entered the labour market. In contrast to the non –experimental methods, there are the experimental methods. The experimental methods are based on the creation of two groups of participants. One group involves experimental candidates who participate in the program and the other group is used as a control group. The problem is that the creation of an identical control and experimental group is not possible.

- Qualitative methods - the essence of these methods rests in collecting the opinions of the program participants through interviews and surveys. These methods represent the most effective form of obtaining individual results.
- Economic methods – the economic methods involve the analysis of cost minimization (CMA), cost-benefit analysis (CBA), cost-effectiveness analysis (CEA) and cost-utility analysis (CUA). All of these analyses are based on the notion of costs. Rosi, Freman and Lipsey (1999) emphasize the cost- benefit analysis (CBA) and cost analysis -effectiveness (CEA) as a basis for further comparison of the costs in relation to the results of the active labour market policy programs.

**Macroeconomic methods** are applied to check whether the measures of active labour market policies really reduce unemployment. In practice, however, microeconomic methods are used more frequently as they are more indicative of the active labour market policy impacts on the participants.

Another view of the evaluation methods has been mentioned by [3] who divided the methods into the scientific and unscientific ones. **Scientific studies** are more demanding as they use the samples from the control group which is compared to the experimental group. The information on individual level is required in the process of scientific studies usage.

**Unscientific studies** use econometric methods in order to assess the impact of the programs on unemployment.

Econometric studies can be divided into three types:

- the first is used to measure the net impact of regression, which is modified by the observable characteristics of individuals,
- the second regulates the regression by unobservable characteristics,
- the third called matched pairs creates a new control group (the most similar to the group participants).

## 2.2. Slovak Republic

One of the first studies on the evaluation of the effects of active labour market policy in Slovakia was elaborated by Burda and Lubyová 1995. The authors evaluated the impact of the active labour market policy tools used to decrease unemployment during the period from 1991 to 1994. This study represented the first comparison of such kind between the Czech and Slovak Republic. In both countries, a positive relationship between active labour market policy costs and the number of vacancies was proved. [8]

Another study realized by Lubyová 1997 brought the conclusions mostly based on the analysis of monthly data statistics published by the Ministry of Labour, Social Affairs and Family. [8] This study is based on unscientific research and it evaluates the programs efficiency on the ground of the econometric regression. The conclusion of the study consisted in the fact that the impact of total expenditure on active labour market policies and unemployment reduction is ambiguous and weak. The impact of the amounts of expenditure on the active policy has thus not been confirmed. The study also involved several recommendations on the short-term programs where the compensation plan for the participants should be higher than unemployment benefits.

The Ministry of Finance has performed a study on the (Efficiency Rating), [3] which assesses the net efficiency. This measurement deals with the graduate practice programs and activation allowance programs in the period from 2006 to 2009. The results pointed out at the negative efficiency in some regions. The conclusion thus leads to the idea that the differentiation of using and financing the tools in particular regions is necessary.

To investigate the effects of the active labour market policy it is necessary to evaluate the effects of the active labour market policy tools. These effects were examined by the study performed by the organizations Infostat and Trexima [4]. It is currently a standard method of measuring the effects abroad. According to this study, the net efficiency expresses the percentage of the enhanced possibility to successfully enter the labour market due to participation in the program. However, this study emphasizes the creation of a high-quality information database and the

continuous monitoring of the participants in the active labour market policy programs for the period not shorter than twelve months.

### 2.3. The Czech Republic

As stated by [7] only partial studies on the evaluation of the active labour market policy effects were carried out in the Czech Republic until 2010. Within the context of a research project of the Ministry of social affairs and family, a project with the objective of creating conditions for the development and spreading of evaluation methods of the active labour market policy was created. The key aspects of the evaluation of the project consist in:

- the comparison of the effects with respect to the different groups of unemployed,
- the evaluation of net effects influencing employment and the estimate deadweight,
- the evaluation of short and medium-term effects.

The project resulted in the recommendations of periodic qualitative analyses. Last but not least, the study highlights the importance of the social impacts of the active labour market policy.

Other studies called Active labour market policy programs in 2005 and the evaluation of effects on unemployment in 2006 were performed by the authors [9] within the context of Social and Family Affairs Research Project. The innovation of this project compared to the previous programs consists in the application of a new matching model, where the candidates with the same degree of risk are sought after on the ground of well known properties. The analysis uncovered the fact that a significant reduction of the risk of unemployment has been achieved in the programs aiming at the creation and support of work places. In contrast, retraining programs achieved mixed results, whereas the analysis of success factors show no clear conclusions.

## 3. Conclusion

The persistent high rate of unemployment creates major political, social and economic problems for the country. Jobseekers are highly heterogeneous, therefore, a number of different methods considering the heterogeneity has to be used to evaluate the efficiency of the active labour market policy.

According to the Employment Institute in Slovakia, active labour market policy is a significant element in reducing the impact of the economic crisis on unemployment. In the periods of economic crisis, financing must be increased rather than decreased. The economic policy aims at the most efficient usage of the resources of the state budget for the active labour market policy. A single evaluation methodology to evaluate the active labour market policy ought to be adopted. The main prerequisite for obtaining high quality evaluation consists in the access to high quality statistic data in databases, otherwise there is a risk of a gradual reduction of the effectiveness of the active labour market policy tools.

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# The Offshore Outsourcing

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**Abstract.** This paper deals with the problematic of outsourcing, especially the offshore outsourcing. The paper starts with the various definitions oh what outsourcing is. Then, outsourcing is divided into categories based on the position between the client and vendor. One of these categories is offshore outsourcing. In the article there are mentioned some characteristics of offshore outsourcing and also definitions of what offshore outsourcing is, its top risks and most common reasons for its realization. In the next part, there are some statistics data about offshore outsourcing, for example the most outsourced sectors or the top countries for realization outsourcing processes. In the last part are mentioned possibilities of this outsourcing type to future.

**Keywords:** outsourcing, offshore outsourcing, cost reduction, India, company

## 1. Introduction

Outsourcing is one of many management tools. It consists of two words – "out/outside" and "sourcing". To define outsourcing at first the meaning of "sourcing" has to be clear. Sourcing refers to the act of transferring work, responsibilities and decision rights to someone else. The whole outsourcing process is an act of transferring the work to an external party. It is a tool of strategic business management and optimization of enterprise resources consumption oriented to basic strategic goals [1].

Dvořáček defines outsourcing (Outside Resource Using) as a using of external sources and it represented decision making between two strategies Make or Buy [2].

Rydvalová defines outsourcing as a long term contract with "somebody" from external environment to provide services in one or more areas of corporate activities. In the process of outsourcing there are eliminated the organizational inter stages what leads to flattening the structure of the company [3].

## 2. The Types of Outsourcing

There are many types of outsourcing categories and models. Each of them has both its advantages as well as disadvantages. If outsourcing is categorized based on the position where the work is performed, it is an on-site or off-site outsourcing. On-site outsourcing involves the employees of the service provider in the client's premises. The off-site outsourcing is the situation where the outsourcing services are carried out in the provider´s conditions. Within the off-site outsourcing, providers of outsourcing services may be different on where is their current geographic position regard to position of the client. Power, J. M. et al. defines three types of this outsourcing [1]:

- Onshore vendors. They are located in the same area as client, it is an outsourcing within a country in a relatively distance suppliers from consumers. One of the advantages of this type of outsourcing is that the partners do not have big cultural differences, language barriers and threats of the performance of services due to different time zone are minimized. Using of onshore vendors is especially helpful if outsourced services have a sensitive character as e.g.

in field of medicine or finance with regulations that prevent leaving work to offshore vendors in order to protect property and privacy.

- Near-shore vendors. They are located in "neighborhood". It is the term determining cooperation between offshoring and onshoring. It is an export of work to nearby countries. That means it is a combination of low labor costs and geographical distance. Except the advantages of low costs resulting from the performance of services near-shore vendors, there are other benefits such as minimal cultural differences, cheaper travel and communications costs and minimum problems in different time zones.
- Offshore vendors. They are located far from the client (US and India). Originally the term was associated with tax heavens, until 2002 when it was given a new context by Wall Street Journal defined as a transfer of some or all activities to low-cost countries. This is a transfer of operations to countries which are at considerable distance from the client. An example of this type of provider is India, which has become the dominant country for the software work outsourcing. The companies from the USA, Canada or the UK the often outsourced there their projects.

## 3. The Offshore Outsourcing

This paper is focused on the offshore outsourcing. In literature review there are many various definitions of offshore outsourcing (offshoring). Dvořáček described some characteristics of offshoring (offshore outsourcing):

- partial or total removal of goods production or services in the inland (domestic country) associated with reduction of staff,
- the activities which have been partially or completely deleted in domestic country are contracted on a regular base with other companies which are not their affiliates
- the company that orders subcontracts abroad, imports the products and services it produced itself before to meet domestic demand in domestic country
- in the case of foreign contract it is possible that foreign companies are able to outsource some of their activities in other foreign companies outside the domestic country and then import the product and services to the enterprise which first gave the order command [2].

Offshore outsourcing is the practise of hiring an external organization to perform some business functions in a country other than the one where the products or services are actually developed or manufactured. It can be contrasted with offshoring, in which the functions are performed in a foreign country by a foreign subsidiary. Opponents point out that the practise of sending work overseas by countries with higher wages reduces their own domestic employment and domestic investment. Many customer service jobs as well as jobs in the information technology sectors (data processing, computer programming and technical support) in countries such as the United States and the United Kingdom – have been or are potentially affected [4].

Offshore outsourcing is the process by which a concrete company transfers part of its work process to abroad. This economic activity is a common practise all around the word. It is expanded mainly thanks to efforts to reduce costs in the period of global recession. Outsourcing is realized as not only for reduce labour costs, but also because of the increasing the fuel price or to gain the experts who are not in domestic country [5].

Companies entering the international business environment through offshoring allow for the fact that they will be able to use the resources of competitive advantages. They arise precisely from international business in compare to domestic firms. It can be said the greater the corporate international engagement is, the greater are potential growth opportunities. The most common reasons for offshore outsourcing are:

- Basic economic goals. It is mainly the company growth, market expansion, productivity growth, growth of the value of shares, the value added growth or profit maximization.

- Entering foreign markets. It is one of the basic motives for offshore outsourcing. The company anticipates that the existence on the foreign market will bring higher sales thanks to better knowledge and speed of knowledge.
- Demand, preferences and income level differentiation. Multinational company is able to move its sales from the region with small purchase power to those with bigger and generate higher profits. When the potential of a product is exhausted on the one market the company relocates the product to other market, even for the lower sales prices. This is the way how it extends the product life cycle.
- Cost savings. In the recent years the trend is relocation of production to areas with significantly lower prices of production factors, especially human labor. The theory of international trade talks about profits of specialization.
- Access to factors of productions. The factors of productions are labor, land, capital, natural resources and also blanks.
- Differentiation of knowledge. Multinational companies can benefit from the knowledge and experience gained on the foreign markets. This information can lead to innovation of products, production processes or management practices.
- The exploitation of various government regulations. The investment process of the company can be targeted to the states with lower tax rates, higher subsidies or easily regulation.
- Diversification of the risk. The companies have the possibility to respond relatively quickly to negative development by relocation of production, realization of revenues or gain of capital.
- Diversification of the fluctuations in demand. The economic instability of a state can lead to a fall in demand in a segment. This decrease may not be global and it can be compensated by stable sales on other market.
- The great bargaining power. Multinational companies have great bargaining power in relation to government, union or local business partners thanks to their ability to transfer assets from one country to another [6,7].

Entering foreign market should have fatal outcomes if the company management is not decided on the basis of an objective assessment of not only the benefits but also the risks and costs. The top risks of offshore outsourcing are as follows.

- Cost – reduction expectations. The biggest risks do not arise from offshore outsourcing. It involves the expectations of the internal organization – usually that high savings will be reached. Unfortunately, many executives assume that labour arbitrage will yield savings comparable to person to person comparison without taking into account the hidden costs and differences in operating models. It also involves the investment costs linked with technology relocation to foreign states or training the staff.
- Data security, protection. Organizations evaluating any kind of outsourcing question whether vendors have sufficiently robust security practices and if vendors can meet the security requirements they have internally. While most organizations find offshore vendor security practices impressive (often exceeding internal practices), the risk of security breaks or intellectual property protection is inherently raised when working in international business. Privacy concerns must be completely addressed. Although these issues rarely pose major impediments to outsourcing, the requirements must be documented and the methods and integration with vendors defined.
- Loss of business knowledge. The most companies have business knowledge or some business secrets. It is necessary to evaluate that outsourcing company carefully makes sure your data is protected and the contract has a penalty clause if an incident occurs.
- Vendor failure to deliver. Some of the organizations who outsource work out a contingency plan. It tells what happens if a vendor, in spite of fact he is absolutely reliable, simply fails to deliver. Although such failures are exceptions, they do occur, even with the superb

quality methodologies of offshore vendors. Appropriate is when the organizations assess the implication of vendor failure. High risk could deter the companies from outsourcing. On the other side, it could drive the company to start with the process of outsourcing if the vendor has specific skills to reduce risks.

- Government oversight – regulation. Companies have to ensure that the vendor is sensitive to requirements of the industries. They also check up the vendor´s ability to comply with government regulations and provide sufficient "transparency".
- Culture. Culture is one of the most important factors influencing the multinational trade. It sounds easy but it is not. The most common and important differences include religions, model of dress, social activities or history. Most of leading vendors have a cultural education programs. But, managers should not assume that the cultural alignment will be insignificant or trivial.
- Turnover of key personnel. Rapid growth among outsourcing vendors has created a dynamic labor market, especially in Bangalore, India. Key personnel are usually in demand for new, high-profile projects, or even at risk of being recruited by other offshore vendors.
- Knowledge transfer. The time and effort to transfer knowledge to the vendor is a cost rarely accounted by organizations. Some of companies experience a 20% decline in productivity during the first year of an agreement, largely due to time spent transferring both technical and business knowledge to the vendor. Many offshore vendors are deploying video conferencing (avoiding travel) and classroom settings (creating one-to-many transfer) to improve the efficacy of knowledge transfer [6,8].

Despite these and many other risks following from offshore outsourcing, it is very popular. More and more companies are engaged to this process all around the world. The country which implements the process of outsourcing most often and thus creates the highest income is USA. Statistical survey focused on offshore outsourcing performed by a Sourcing Line Computer Economics showed that US outsourced abroad to 2,637,239 jobs. Companies outsourced the most activities related to the production, at least call and help centers [9].

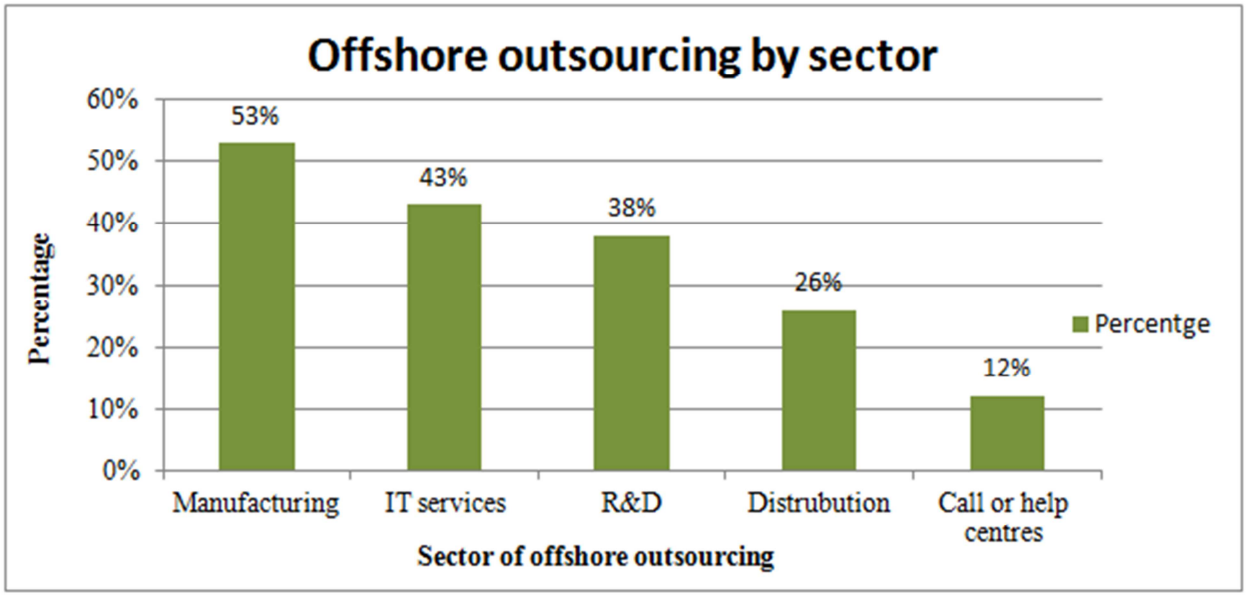


**Fig. 1.** Offshore outsourcing by sector

Source Line Computer Economics made up a scale with the most appropriate countries for outsourcing. The first place takes India followed by Indonesia and China. From nearby countries there is Czech Republic (16th place) and Poland (15th place). Hungary is located at the 14th position. Slovak Republic is not situated in this scale. The overall index takes into account cost

index (cost of labour, taxes, and estate prices), resources, education, skills of population (educational structure, technological premises or the level of English) and also workforce.

| No. | Country | Overall Rating | Cost Index | Resources/Skills | Workforce |
|---|---|---|---|---|---|
| 1 | India | 7.1 | 8.3 | 6.0 | 1 430 000 000 |
| 2 | Indonesia | 6.9 | 8.6 | 4.3 | 1 033 000 000 |
| 3 | China | 6.4 | 7.0 | 5.6 | 780 000 000 |
| 4 | Bulgaria | 6.4 | 8.8 | 2.9 | 3 000 000 |
| 5 | Philippines | 6.3 | 9.0 | 2.8 | 39 000 000 |
| 6 | Jordan | 6.2 | 7.6 | 2.7 | 2 000 000 |
| 7 | Singapore | 6.5 | 6.4 | 5.7 | 3 000 000 |
| 8 | Thailand | 6.0 | 8.2 | 2.3 | 39 000 000 |
| 9 | Lithuania | 5.9 | 7.0 | 3.9 | 2 000 000 |
| 10 | Egypt | 5.8 | 9.0 | 0.9 | 26 000 000 |
| 11 | Malaysia | 5.8 | 7.9 | 2.2 | 12 000 000 |
| 12 | Estonia | 5.8 | 7.5 | 5.2 | 1 000 000 |
| 13 | Chile | 5.7 | 7.2 | 3.0 | 8 000 000 |
| 14 | Hungary | 5.6 | 6.9 | 3.4 | 4 000 000 |
| 15 | Poland | 5.6 | 6.1 | 3.6 | 17 000 000 |
| 16 | Czech Republic | 5.6 | 6.9 | 3.2 | 5 000 000 |
| 17 | Ukraine | 5.5 | 6.3 | 3.2 | 22 000 000 |
| 18 | Romania | 5.5 | 6.8 | 2.7 | 9 000 000 |
| 19 | Latvia | 5.4 | 7.0 | 2.7 | 1 000 000 |
| 20 | Vietnam | 5.4 | 7.4 | 2.5 | 46 000 000 |
| 21 | Ghana | 4.9 | 7.5 | 0.9 | 11 000 000 |
| 22 | South Africa | 4.6 | 6.9 | 0.6 | 17 000 000 |
| 23 | Kenya | 4.5 | 6.7 | 1.3 | 18 000 000 |
| 24 | Senegal | 4.3 | 7.1 | 0.2 | 6 000 000 |

**Tab. 1.** Top rated outsourcing countries [4].

Foreign companies use staff potential of India for a long time. For decades it attracts companies looking for cheap but English - speaking workforce. English speaking countries relocate there its customer service (call centers), administrative activities and IT industry. The city with the largest supply of activities is Bangalore, called the “Silicon Valley of India”.

Except the India, China has also a great potential to become an offshore outsourcing world leader. It is expected that Chinese outsourcing market will achieve in this year (2015) 85 billions of dollars. This great potential has probably influence potential for Chinese cities and economic transformation. From 2008 to 2012 outsourcing of services grew more than 60 %. Outsourcing of services is growing fastest in the Asia - Pacific region. It becomes a major destination for global outsourcing services [10].

## 4. Conclusion

According to analysts, the popularity of offshore outsourcing is gaining power. There is an expectation of new destination rise for outsourcing in America, especially Latin America. The cities in United States are also accepted as main places for outsourcing processes. The new destinations will arise in Europe – probably Poland. China has also outsourcing assumptions but there are some fears of production costs, an aging population and the political situation. The global outsourcing can be influenced in future by USA and UK where the idea of domestic market work is more and more popular [5].

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# Study on Dynamics of Material-flow in a High-bay Warehouse

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**Abstract.** In the paper the mathematical model of logistics processes dynamics is considered in case of material-flow studies in a high-bay warehouse. It can allow a better understanding of any logistics process (to be specific: material handling and internal transport here, in this paper) both in qualitative and quantitative way. The example results are also presented and discussed both in qualitative and quantitative representation.

**Keywords:** Logistics, process dynamics, qualitative descriptors, model formulation.

## 1. Introduction

With increasing size and complexity of supply-chain in transportation systems, it is necessary to gain a better understanding of its every link chain. Herein, a warehouse is considered as one of the most important link of this supply-chain due to its operational functions such as material-handling, order-picking etc. The aim of this paper is to investigate dynamical behaviour of the material-flow in a high-bay warehouse. Thinking of material-flow in a warehouse, its behaviour is not static. It changes every day, every week, month, year, decade etc. Therefore, it is important to investigate dynamic changes of units load quantities of the material-flow in warehouse in a pre-defined period of time in case of e.g.:

- giving new proposals or changes of work-flow,
- rearranging infrastructure's elements,
- increasing/reducing number of means of transport in a warehouse,
- studying operations inside a warehouse.

To study the dynamics of load units incoming to and outgoing from a warehouse or flowing between functional areas in a warehouse, the analytic model of logistics processes dynamics, defined before, can be used. The model is recalled here – it was defined in previous papers as [1, 2] and, what is more, the model was implemented into the software to make data computing easier. Since the time of publication previous papers, the analytic model of logistics processes dynamics has been changed. Herein, it is given with slightly reconstructions of the model.

What actually is "dynamics of material-flow"? The definition is given in [1] and it sounds as: "dynamics of material-flow in a logistics facility deals with the motion of unit loads under some specific processes circumstances in terms of organizational, technological and technical aspects." This definition is briefly explained in [1].

Meanwhile, a high-bay warehouse is a logistics facility "which has a permanent building structure (usually constructed of a steel structure) and storage infrastructure is part of the supporting structure for walls (façade) and the roof of the warehouse", [4]. What is more, a high-bay warehouse is a warehouse, which the minimum height is 12 meters (or 14 meters according to [6]) and currently the maximum height is about 50 meters, as the information in practical information is given in [7].

In the paper historical data of the material-flow in high-bay warehouse are used. The reason for historical data considering is a custom of trade secret protection in different companies. And this data are given in the master thesis, [5].

## 2. Analytic Model of Logistics Processes Dynamics

To express the idea of using the model, a generalised line graph of any logistics process is presented in figure 1. It is the line graph of e.g. material-flow in a warehouse ($u_j$, [load unit]) in function of time ($t_j$, [min]).

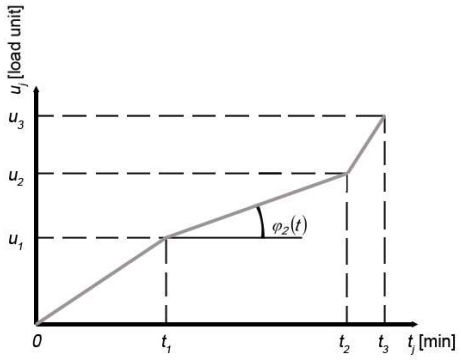


**Fig. 1.** Material-flow in warehouse in function of shifting time - example graph of any logistics process [1].

In short the model is, as follows. Some definitions of the parameters used in the formal modelling are given as, [1]:

- $j$ – a step of calculation, in general it is understood as a quantity of sections in any logistics process and each new section starts while the slope angle changes (*e.g.* in figure 1. three sections are considered: the first section for time window (0; $t_1$), the second section for time window ($t_1$; $t_2$) and the third section for time window ($t_2$; $t_3$)),
- $\boldsymbol{J}$ – a set of steps of calculation,
- $u_j$ – a quantity of load units taking part in a logistics process in $t_j$-moment of logistics process duration in $j$-step of calculation, [load unit],
- $\boldsymbol{U}$ – a set of $u_j$ values,
- $t_j$ – duration time of a logistics process; indicates a moment of time, in which $u_j$-quantity of load units is taking part in a logistics process, [time unit],
- $\boldsymbol{T}$ – a set of $t_j$ values,
- $d_j(t)$ – a parameter of proportion between $u_j$ and $t_j$, [-],
- $\varphi_j(t)$ – a slope angle in case of section between predecessor $j$-*1* and successor $j$, [rad],
- $\boldsymbol{\Phi}$ – a set of $\varphi_j(t)$ values,
- $\tau$ – units reducer**,** $\tau$ = 1[time unit/load unit],
- $\boldsymbol{Q}$ – a set of numerical $q$-values (quantitative expressions) which are defined as terms of qualitative expressions, [-].

Formulation of the problem of considering the dynamics of any logistics process is presented as formulas (1)-(7). Slightly reconstructions of the model are given since the first introduction of it in the papers [1, 2]. At first, it was the model for researching dynamic changes in the process, just "changes." Now "changes" are divided into two main possibilities: "increasing changes" or "decreasing changes."

$$\boldsymbol{J} = \left\{ j : j = \overline{1, J};\quad j \in N - \{0\} \right\}. \tag{1}$$

$$\boldsymbol{U} = \left\{ u_j : u_0 = 0;\quad u_j \in N;\quad j \in \boldsymbol{J} \right\}. \tag{2}$$

$$\boldsymbol{T} = \left\{ t_j : t_0 = 0;\quad t_j > t_{j-1};\quad t_j \in \langle 0; \infty );\quad j \in \boldsymbol{J} \right\}. \tag{3}$$

$$\forall j \in \boldsymbol{J}\quad \forall u_j \in \boldsymbol{U}\quad \forall t_j \in \boldsymbol{T}:\quad d_j(t) = \frac{u_j - u_{j-1}}{t_j - t_{j-1}} \cdot \tau;\quad u_j \in N. \tag{4}$$

$$d_j(t) = \tan\left(\varphi_j(t)\right). \tag{5}$$

$$\boldsymbol{\Phi} = \left\{ \varphi_j(t) : \varphi_j(t) = arctan\left(d_j(t)\right) = \left\{ arctan\left( \frac{u_j - u_{j-1}}{t_j - t_{j-1}} \cdot \tau \right);\ u_j \in N \right\} \right\}. \tag{6}$$

$$\begin{aligned}
&\forall j \in \boldsymbol{J}\ \ \forall q_j = q \in \boldsymbol{Q}\ \ \varphi_j(t) \to q_j : \left\{ q_j = q = -8 : -\frac{\pi}{2} > \varphi_j(t) > -\frac{7\pi}{16} \ \vee \right. \\
&q_j = q = -7 : -\frac{7\pi}{16} \geq \varphi_j(t) > -\frac{3\pi}{8} \ \vee\ q_j = q = -6 : -\frac{3\pi}{8} \geq \varphi_j(t) > -\frac{5\pi}{16} \ \vee \\
&q_j = q = -5 : -\frac{5\pi}{16} \geq \varphi_j(t) > -\frac{\pi}{4} \ \vee\ q_j = q = -4 : -\frac{\pi}{4} > \varphi_j(t) \geq -\frac{3\pi}{16} \ \vee \\
&q_j = q = -3 : -\frac{3\pi}{16} > \varphi_j(t) \geq -\frac{\pi}{8} \ \vee\ q_j = q = -2 : -\frac{\pi}{8} > \varphi_j(t) \geq -\frac{\pi}{16} \ \vee \\
&q_j = q = -1 : -\frac{\pi}{16} > \varphi_j(t) > 0 \ \vee\ q_j = q = 0 : \varphi_j(t) = \left\{ 0, \frac{\pi}{4} \right\} \ \vee \\
&q_j = q = 1 : \frac{\pi}{16} > \varphi_j(t) > 0 \ \vee\ q_j = q = 2 : \frac{\pi}{8} > \varphi_j(t) \geq \frac{\pi}{16} \ \vee \\
&q_j = q = 3 : \frac{3\pi}{16} > \varphi_j(t) \geq \frac{\pi}{8} \ \vee\ q_j = q = 4 : \frac{\pi}{4} > \varphi_j(t) \geq \frac{3\pi}{16} \ \vee \\
&q_j = q = 5 : \frac{5\pi}{16} \geq \varphi_j(t) > \frac{\pi}{4} \ \vee\ q_j = q = 6 : \frac{3\pi}{8} \geq \varphi_j(t) > \frac{5\pi}{16} \ \vee \\
&\left. q_j = q = 7 : \frac{7\pi}{16} \geq \varphi_j(t) > \frac{3\pi}{8} \ \vee\ q_j = q = 8 : \frac{\pi}{2} > \varphi_j(t) > \frac{7\pi}{16} \right\}.
\end{aligned} \tag{7}$$

Subsequently, it is important to rename the $\varphi_j(t)$ values into quantitative expressions. It is done as well as notation (7) is computed, where: $q_j = q$ = -8 is equal to the statement that there is "*exceptionally rapid decrease*" in the dynamics of *j*-section of a logistics process, $q_j = q$ = -7: "*very rapid decrease*", $q_j = q$ = -6: "*rapid decrease*", $q_j = q$ = -5: "*rather rapid decrease*", $q_j = q$ = -4: "*rather slow decrease*", $q_j = q$ = -3: "*slow decrease*", $q_j = q$ = -2: "*slow decrease*", $q_j = q$ = -1: "*exceptionally slow decrease*", $q_j = q$ = 0: "*no change*", $q_j = q$ = 1: "*exceptionally slow increase*", $q_j = q$ = 2: "*slow increase*", $q_j = q$ = 3: "*slow increase*", $q_j = q$ = 4: "*rather slow increase*", $q_j = q$ = 5: "*rather rapid increase*", $q_j = q$ = 6: "*rapid increase*", $q_j = q$ = 7: "*very rapid increase*", $q_j = q$ = 8: "*exceptionally rapid increase*".

$$n\left(q_j\right) = 0;\ \ q_j \in \boldsymbol{Q} = \{-8,\ldots,q,\ldots,8\};\ \ j \in \boldsymbol{J} = \overline{\{1,J\}}. \tag{8}$$

$$\forall j \in \boldsymbol{J}\ \ q_j = q \Rightarrow n\left(q_j\right) := n\left(q_j\right) + 1. \tag{9}$$

$$N_{q_j = q} = n\left(q_j\right) / J \cdot 100\%. \tag{10}$$

$$\forall j \in \boldsymbol{J}\ \ \forall q_j \in \boldsymbol{Q}\ \ \sum_{q=0}^{9} N_{q_j = q} = 100\% \Rightarrow end. \tag{11}$$

## 3. Evaluation of High-bay Warehouse Material-flow with Using the Analytic Model of Logistics Processes Dynamics

Historical data of the material-flow in high-bay warehouse that are used for evaluation material-flow in high-bay warehouse are given in fig. 2-4. These are quantities of material-flow between specific areas in considered warehouse: truck loading/unloading point *S* and buffer on entry *B1*; operation point *P2* and material-handling *M2*, buffer on exit *B2* and truck loading/

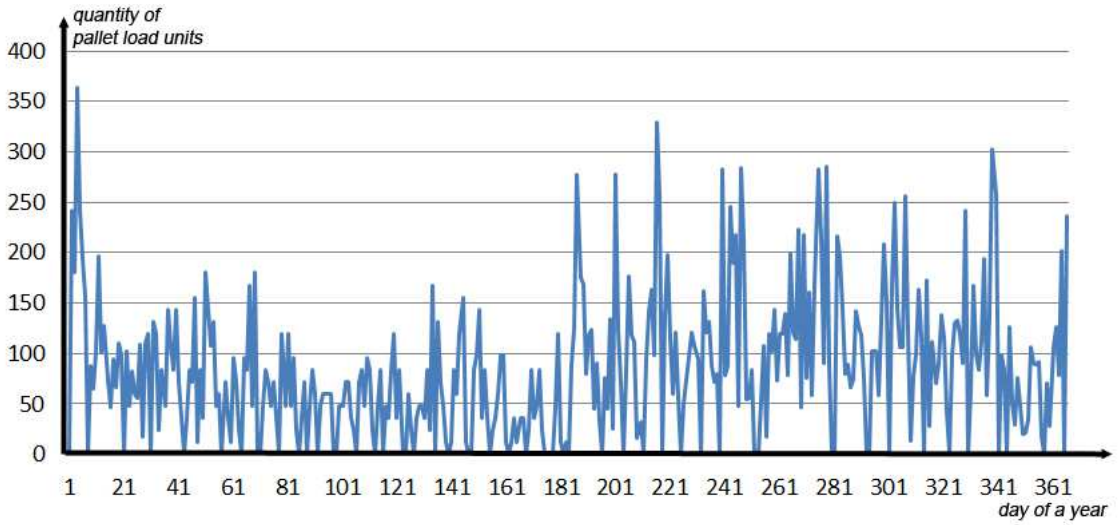


**Fig. 2.** Diagram of dynamics changes in the process of material-flow between truck loading/unloading point *S* and buffer on entry *B1*; source: [5], table 1-3, between pages: 11 and 12.

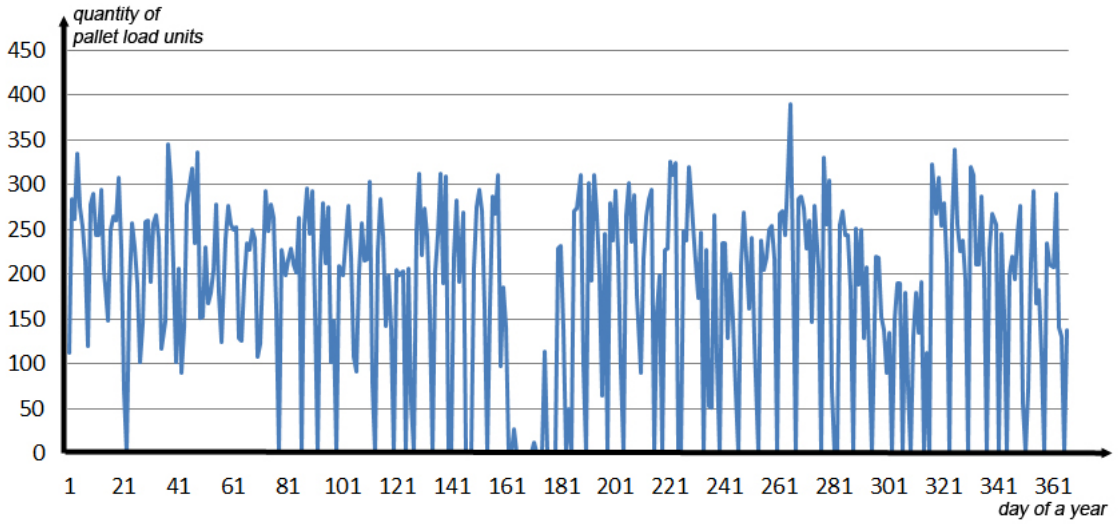


**Fig. 3.** Diagram of dynamics changes in the process of material-flow between operation point *P2* and material-handling *M2*; source: [5], table 1-4, between pages: 13 and 14.

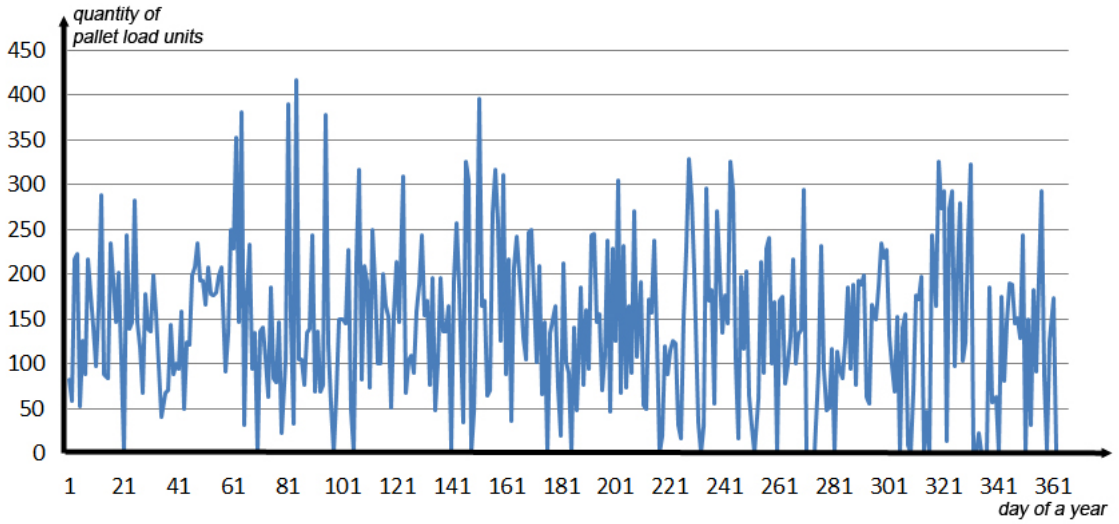


**Fig. 4.** Diagram of dynamics changes in the process of material-flow between buffer on exit *B2* and truck loading/unloading point *S*; source: [5], table 1-5, between pages: 19 and 20.

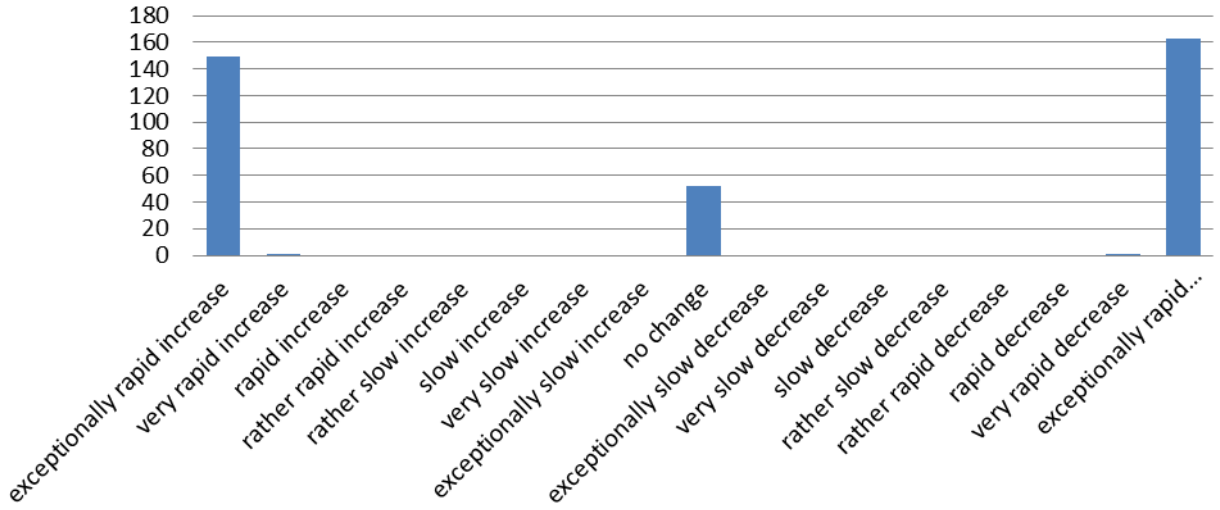


**Fig. 5.** Quantity of sections under adequate qualitative descriptors given as the diagram for data in fig. 2.

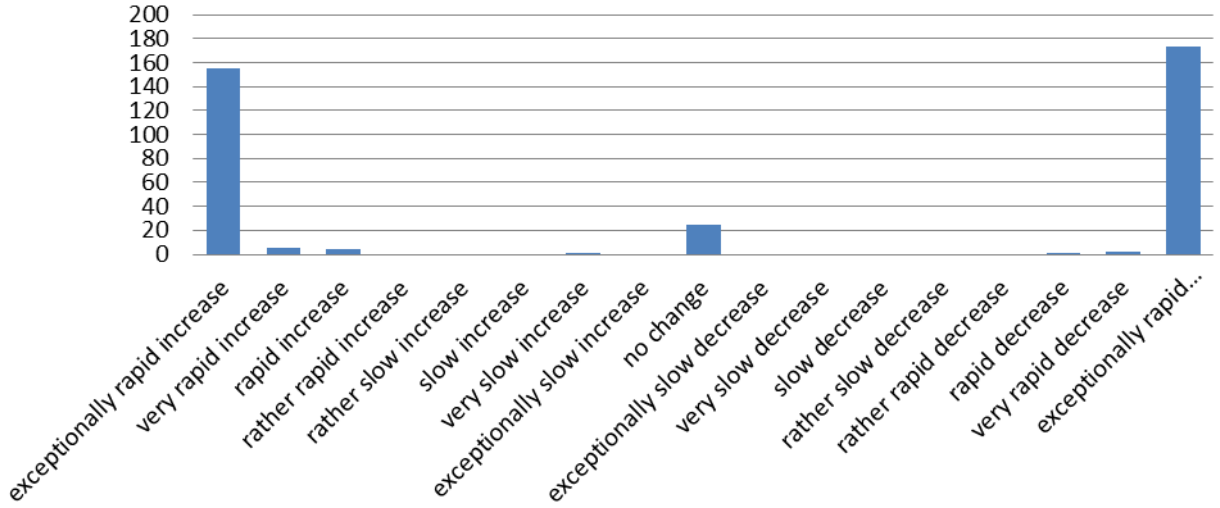


**Fig. 6.** Quantity of sections under adequate qualitative descriptors given as the diagram for data in fig. 3.

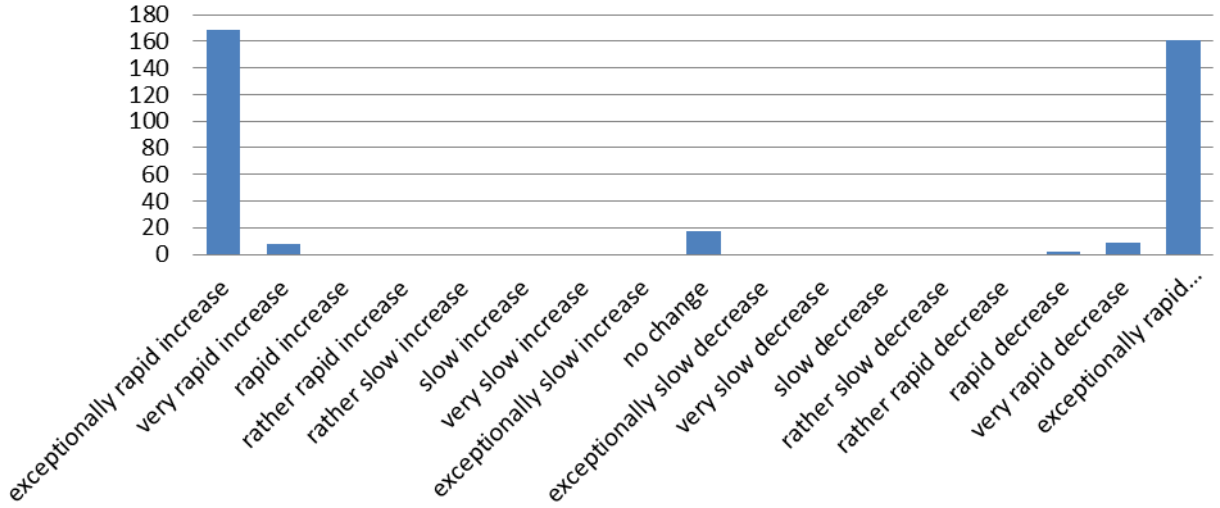


**Fig. 7.** Quantity of sections under adequate qualitative descriptors given as the diagram for data in fig. 4.

unloading point *S* (letters abbreviations correspond to scheme of considered warehouse given in [5] fig. 1.2., between pages 7 and 8). After using the analytic model of logistics processes dynamics some results were obtained. These are given as diagrams in fig. 5-7 and briefly described below.

The results changes are extreme. On the one hand, more than 47% (in the case of material-flow between truck loading/unloading point *S* and buffer on entry *B1*), more than 42 % (in the case of material-flow between operation point *P2* and material-handling *M2*), more than 46% (in the case of material-flow between buffer on exit *B2* and truck loading/ unloading point *S*) of changes in the material-flow are increasing exceptionally rapid. And on the other hand, more than 44% (in the case of material-flow between truck loading/unloading point *S* and buffer on entry *B1*), more than 47 % (in the case of material-flow between operation point *P2* and material-handling *M2*), almost 44% (in the case of material-flow between buffer on exit *B2* and truck loading/ unloading point *S*) of changes in the material-flow are decreasing exceptionally rapid. The rest of adequate qualitative descriptors can be statistically omitted. Therefore, it can be assumed that changes are 50-50, 50% for increasing and 50% for decreasing. It can be proclaimed then than the work-flow in that kind of warehouse in annual period of time is not stable, not uniform. There are considerable fluctuation in the processes. It can be obviously connected to seasonal matters however after studying material-flows given in figures 2-4, in accordance to Christmas, holidays *et cetera*, it cannot be clearly identified. High-bay warehouses should be designed in case of more or less regular material-flow.

## 4. Conclusion

The preliminary analysis showed that in the considered high-bay warehouse with an existing work-organization, some disparities in the performance of individual transport subsystems seems to occur. The technology and organizing should be re-designed then. The main reason of the paper is not to give solutions in that aspects. It is to show whether the problems occurs or not. And it does.

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# Securitisation funds in Poland

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**Abstract.** The paper presents the problem of functioning and development of securitisation funds as a special type of investment funds created by Investment Fund Companies in Poland. The paper describes the idea of creating of such funds as the vehicles combining collective investment schemes and processes of securitisation. In the paper, we provide descriptive analysis of investment fund market in Poland and we characterise the role of securitisation funds in it. Moreover we identify major issues related to the development of the securitisation funds market. In the paper we include results of own investigation of securitisation funds with research questionnaire. Upon the research we conclude that the potential development of the domestic market of securitisation funds is primarily related to legal and tax aspects of securitisation in Poland and the scope of cooperation between participants of the process of securitisation.

**Keywords:** securitisation, investment fund, securitisation fund, receivables, Investment Fund Company, non-standardised fund.

## 1. Introduction

The main objective of the paper is to present the securitisation fund as a type of investment funds created by Investment Fund Companies in Poland. A securitisation fund is a vehicle that combines collective investment schemes and process of securitisation. In the paper we provide a descriptive analysis of securitisation investment funds in Poland and identify major issues related to the development of the securitisation funds market. The potential development of the domestic market of securitisation funds is primarily related to legal and tax aspects of securitisation in Poland and determined by the efficient cooperation between entities in the securitisation process.

In the paper we used critical analysis of legal solutions in Poland, as well as statistical data analysis. The work is based on statistical data of the domestic market of investment funds from The Chamber of Fund and Asset Management. The background for the analysis is the results of the original research prepared and conducted by the authors with using research questionnaire. The aim of the survey was to obtain information on securitisation funds in Poland in Investment Fund Companies' perspective. The questionnaire was directed to boards of directors of nineteen Investment Fund Companies, which manage securitisation investment funds in Poland. The research was conducted in March 2015. The authors received responses from eight Investment Fund Companies, which manage thirty-eight of the seventy securitisation investment funds operating in the period of research.

## 2. The characteristics of the investment funds market in Poland

The Polish investment funds market exists for almost 24 years. Nowadays, it operates based on the Act of May 27th 2004 on Investment Funds. In accordance to Polish law three main types of investment funds are allowed in Poland: open-end investment funds, specialized open-end investment funds and closed-end investment funds. In Poland, only the Investment Fund Company (IFC) can create and manage an investment fund. At the end of March 2015 the Polish Financial Supervision Authority licensed fifty-eight Investment Fund Companies. Forty-one IFCs reported to The Chamber of Fund and Asset Management.

Open-end funds are harmonized investment funds at European Union level. This type of fund is called UCITS funds (undertakings for the collective investment in transferable securities). The acronym "UCITS" refers to a series of European Union directives that have established a uniform regulatory regime for the creation, management and marketing of collective investment vehicles in the countries of the EU. The first Directive was Council Directive 85/611/EEC of 20 December 1985. The legislative instrument covering UCITS funds is Directive 2014/91/EU (amending Directive 2009/65/EC). The other two types of investment funds in Poland are non-harmonized at EU level and they are called non-UCITS funds. Domestic law regulates each kind of non-UCITS fund in European countries.

Net Asset Value (NAV) of the investment funds market in Poland reached almost PLN 220 billion (nearly EUR 53 billion) which is only about 0.5% of NAV of the European investment funds market (UCITS and non-UCITS). Open-end investment funds, which are mostly UCITS funds, had a 43% share of the Polish investment fund market at the end of March 2015. Other funds with a share of 53% of NAV of investment funds market in Poland were non-UCITS funds (specialised open-end investment funds and closed-end funds).

## 3. The idea of the securitisation fund

A securitisation fund, in accordance with Polish law, is one of the types of closed-end investment funds. A closed-end investment fund may be created as a securitisation fund which issues investment certificates in order to accumulate funds for the acquisition of receivables, including receivables financed with public funds, as defined in separate regulations, and/or for the rights to income from specific receivables (Act of 27th May, 2004 on Investment Funds). It is worth to note that the regulations of banking law in Poland related to limitation of participation of capital companies in the securitisation process caused that the securitisation funds become the only effective special purpose vehicles (SPV) type in the securitisation processes.

According to Polish law a securitisation fund can be created as a standardised or non-standardised investment fund. A standardised investment fund shall be created as an umbrella fund and non-standardised investment fund may be created us a umbrella fund. A standardised fund shall be obliged to invest at least 75% of the asset value of a given sub-fund in 1 pool of receivables and/or in the rights to all income received by the originator from 1 pool of receivables (or in more than 1 pool of receivables and/or in the rights to all income received from more than 1 pool of receivables, provided that: domestic banks and/or credit institutions are the originators; the receivables comprising all the pools of receivables are of the same type). The second type, non-standardise fund shall be obliged to invest not less than 75% of total assets, and in the case of a non-standardised securitisation umbrella fund of not less than 75% of the assets of each sub-fund, in: specific receivables; securities incorporating monetary receivables; rights to income from specific receivables.

It is important to emphasise key terms of the securitisation process, which are defined by Polish law: securitised receivables, an originator and pool of receivables. Securitised receivables shall mean receivables in which a securitisation fund invests, and receivables ring-fenced by the originator or another entity that has concluded an agreement with the fund obligating it to transfer to the fund any income received in relation to such receivables. An originator shall mean a local government body, an association of local government bodies or a commercial entity which sells a pool of receivables to a securitisation fund or which undertakes to transfer all the income received by it from a specific pool of receivables to the securitisation fund. Pool of receivables shall mean a group of uniform-type receivables that generate a regular income, which is held and ring-fenced by an originator, where each of the receivables constituting in total at least 75% of the group, generates a regular income and each of the receivables meets the criteria defined in the fund’s articles of association.

Generally, securitisation fund is assessed as the best intermediary in the securitisation process in Poland [2]. In this process it fulfils the role of a special purpose vehicle [8]. Buszko presented the role of a special purpose vehicle in the securitisation process [1]. In the securitisation process the role of organiser (e.g., a bank) and the investor are also important. The investor buys investment certificates that are issued by a securitisation fund. The objective of a securitisation fund investment is to acquire receivables. The supplier of receivables, because of tax benefits, may sell them only to a securitisation fund. The securitisation process was discussed by Nastarowicz [3] who characterised it from the perspective of banks. The review of actual legal conditionings of securitisation proceedings applied in the Polish bank sector was prepared by Szaraniec [6]. It should be emphasised that entities within various sectors (not only banks) are increasingly willing to sell pools of receivables to securitisation funds. Tab. 1. presents benefits due to establishing of securitisation funds for the main participants of process securitisation.

| Beneficiary | Benefits |
|---|---|
| Investment Fund Company | – enrichment of the offer with assets not correlated to traditional capital market<br>– obtaining additional source of income<br>– getting earnings on trade of receivables<br>– possibility of setting up sub-funds and developing investment strategies<br>– getting experience in trade of debt and receivables<br>– developing relations with banks providing long-term funding<br>– developing offers of alternative investments |
| originator | – securitisation funds are the only effective structures that enable of securitisation in banking sector<br>– obtaining tax benefits due to sales of non-performing receivables<br>– liquidation of non-performing or unwanted assets<br>– possibility of refinancing main operations<br>– increasing accounting profits through reduction of provisions for non-performing loans<br>– increasing ratios of profitability (ROA, ROE)<br>– possibility of assets restructuring |
| securitisation fund's investor | – obtaining return on investment not correlated with capital market performance<br>– possibility of obtaining regular fixed income<br>– diversification of investor's portfolio through certificates of securitisation fund<br>– possibility of individual investment in receivables through securitisation fund |

**Tab. 1.** Benefits due to establishing of securitisation funds for the main participants of process securitisation. Source: Compiled by the authors.

## 4. The securitisation fund market in Poland

The securitisation fund market in Poland has existed for almost ten years. At the end of February 2015 in Poland there existed 70 securitisation funds offered by nineteen IFCs. Net asset value of all securitisation funds was PLN 3,661 million (approximately EUR 400 million). Fourteen of these IFCs which manage 46 securitisation funds are reporting to The Chamber of Fund and Asset Management. Figure 1 represents the share of securitisation funds in the investment funds market in Poland.

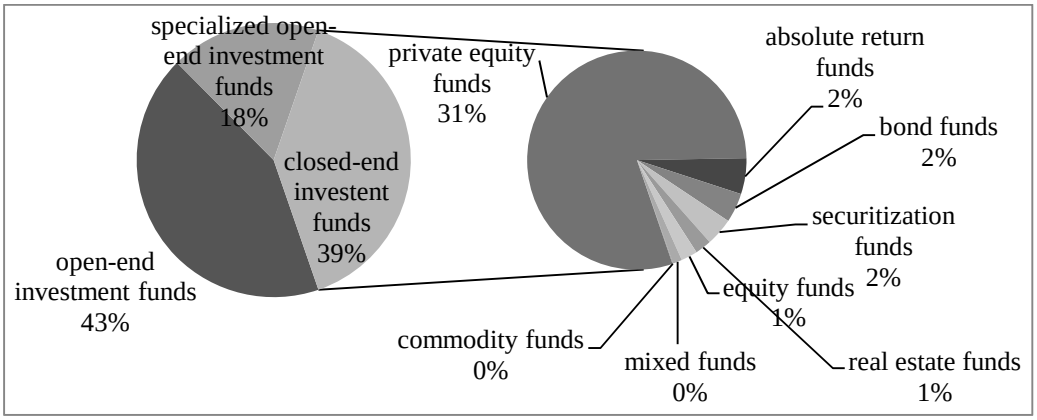


**Fig. 1.** Securitisation funds on the investment funds market in Poland, end of February 2015, % of NAV. Source: Compiled by the authors based on the data from [7].

The share of securitisation funds in the investment funds market was very low (only 2%). In the other hand we can see that the development of the securitisation fund market was rather intense (Figure 2).

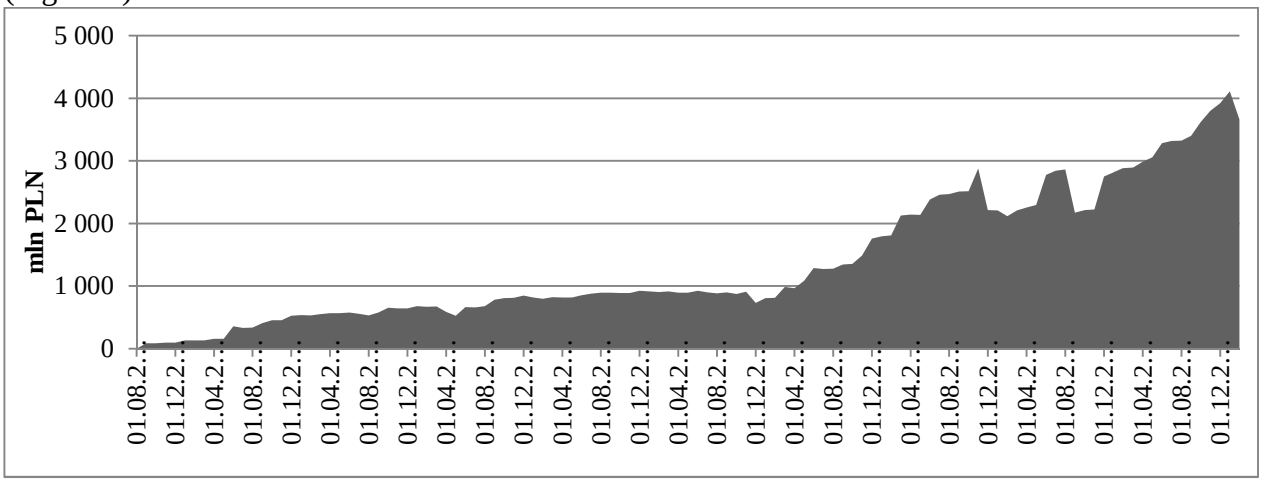


**Fig. 2.** Net Asset Value of securitisation funds in Poland (01.08.2005 – 31.03.2015). Source: Compiled by the authors based on the data from [7].

In practice, only a non-standardised fund is used to create a securitisation fund in Poland [5]. In the research conducted by the authors IFCs pointed out reasons for the use of only the non-standardised type during the creation of a securitisation fund. The reasons include:

- the early stage of securitisation market development,
- the possibility of further issues of investment certificates in non-standardised securitisation investment fund type,
- lower limitations and higher elastic investment policy in non-standardised securitisation investment funds,
- a lack of economic sense of standardised securitisation fund,
- a lack of uniform-type receivables for standardised fund.

Securitisation funds are established primarily upon overdue loans (non-performing loans). As the value of such loans is increasing, their role will be even more critical. There is no securitisation based on non-overdue loans in the banking sector.

A securitisation fund works with a debt collection company (licensed by the Polish Financial Supervision Authority). Debt collection companies are more experienced in the recovery of debts [4]. In the research conducted by the authors IFCs indicated institutions, whose initiatives were used to create a securitisation fund by IFCs (Figure 3). In six cases Investment Fund Companies indicated their own initiative, in 5 cases a debt collection company and in two cases other institutions (financial investor and dedicated investor). No IFCs chose a bank.

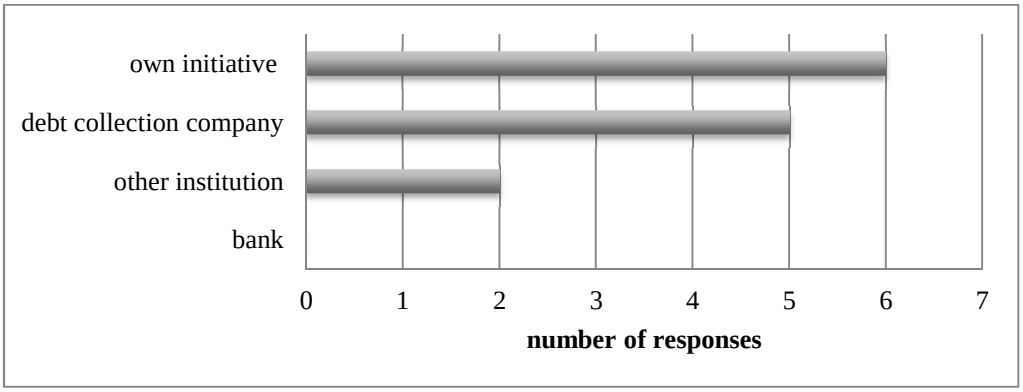


**Fig. 5.** Institutions whose initiatives were used to create a securitisation fund by IFCs. Source: Compiled by the authors based on own research, N=8, multiple choice.

IFCs were asked about particular limitations in the process of creating securitisation funds. Only one IFC responded that there were two kinds of limitations: legal restrictions and a lack of adequate investors purchasing certificates of the securitisation fund. Also, the question about particular limitations during management of investment funds was asked. Five IFCs indicated that they hadn't any limitations during management of securitisation funds. The other three IFCs indicated limitations., Legal restrictions were indicated most frequently, in second place was low securitised asset quality, in third place were low cooperation quality with participants of the securitisation process, a lack of appropriate human resources and high asset portfolio management costs.

## 5. Conclusion

In spite of a low share of securitisation funds in the investment funds market we can see that the development of the securitisation fund market is rather intense. The market of securitisation funds has high growth potential due to the increase in the outstanding debts of Polish people. The development of the receivables assets market as well as the deterioration of the quality of bank loans could impact the creation of securitisation funds. Investment Fund Companies systematically increase the offer of securitisation funds and they create securitisation funds mostly with their own initiative or with the initiative of debt collection companies.

For the market development it is important, that due to limitations of the banking law in Poland related to capital companies, the only effective solution of a special purpose vehicle (SPV) in the securitisation process are securitisation funds. The potential development of the domestic market of securitisation funds is related to the legal and tax aspects of securitisation in Poland and the efficient cooperation between entities in the securitisation process.

Concluding, both securitisation fund market and the role of the investment funds in the securitisation process in Poland shall be an interesting research area in the future.

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# Smart Monitoring Technologies and Internet of Things in Healthcare

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**Abstract.** Internet of Things combined with Radio Frequency IDentification technology enable a whole new context for smart objects that are able to combine their physical and virtual existences. Radio Frequency IDentification, putting an identification label into every object, enables a smart system to get information, either real-time or virtual-linked information, without any physical contact. Information retrieved from such an object, turns it into a potential smart object, certainly able to auto identify itself and, if security problems are suitably treated, most probably able to connect to the global Internet. This way, one can get a ubiquitous framework to access, monitor and control any of those smart objects over an Internet of connected things. RFID tags in medical context enable a rapid and precise identification of each smart entity, enabling a ubiquitous and quick access to Personal Health Records over an Internet of Things. The use of smart phones with Internet access, along with strong security concerns - such as authenticity, privacy, confidentiality, integrity, data origin authentication, entity authentication and non-repudiation - turn this whole context into a decentralized and mobile healthcare system. Using the simple IoT architecture presented, combining smart objects, the security solution and mobile communications, one may remotely take care of patients' will being, establishing an ubiquitous Ambient Assisted Living for Mobile Health applications. As an application example, a prototype m-health service, its security mechanisms and web based application, establish a use case scenario for the evaluation of the proposed architecture.

**Keywords:** Healthcare, services, management system, RFID, Internet of Things.

## 1. Introduction

Internet of Things (IoT) refers to a recent paradigm that has rapidly gaining ground in the area of modern wireless telecommunications. IoT is then a new technological trend joining new computing and communications paradigms. Within this new trend, there are intelligent devices that have a digital entity and are ubiquitously interconnected on a network and to the global Internet. Everyday objects may integrate intelligence and the ability to sense, interpret and react to their environment, combining the Internet with emerging technologies such as Radio- Frequency Identification (RFID), real-time location and embedded sensors. The IoT concept is based on the idea of a universal presence of 'things' or 'objects', such as RFID tags, sensors, actuators, mobile phones, etc, with digital identification and addressing schemes that enable them to cooperate with neighbors in order to achieve some common goals. In the business sector, the most apparent consequences of IoT may arise in industrial automation and manufacturing, in logistics, in business or process management and in intelligent schemes for transporting people and goods.

Therefore, in general, the term Internet of Things refers to any type of devices that are interconnected by means of Machine-to-Machine Communications (M2M), each of which may be identified through a unique ID and defined through a virtual representation within the Internet.

The Radio-Frequency IDentification, commonly known as RFID, is used in many applications. The use of this technology is constantly evolving, expanding at exponential rate. There are several methods of identification, although the most common is a microchip able to store a serial number that identifies the person, object or thing. Using electronic devices that emit radio frequency signals, it is possible to perform an automatic capture of data, or a tag, from a reader. Although it depends on the type of tag, passive or active, RFID is an easy-to-use and versatile acquisition information technology, where a radio signal is used to get data from transponders (e.g. tags) into the target application. Apart from the tags there is also the need for procedures to read or interrogate these tags (e.g. readers, antennas) in order to transmit the data to a host system where it is further processed. The main advantage of using RFID is the possibility of reading without physical contact, being that the production price of tags has been heavily declining over the years. One can put the tag inside a product and read it without unpacking or even implant it under the skin of a patient and read it from outside, even if it is moving.

Whenever we make use of RFID-enabled items, we may face privacy loss as users or items may be identified and linked together by means of tag identification. So, when using this type of technology special security concerns must be brought into place. In health care contexts, these security and privacy concerns are imperative, so any m- health solution must deal with this threat; if personal or private information is to be accessed, all the necessary security mechanisms must be in place, protecting direct data access and or information inference.

The Internet of Things enables to virtually establish links from the information residing in smart objects, for instance in tags, to any Internet connected system. This way, when working in intelligent spaces, we may establish interfaces to connect smart objects to this ”Internet of Things”, thus fostering mobile solutions for Ambient Assisted Living. RFID technologies are of special interest in such scenarios because it does not need any physical contact, or even awareness, of established communications in this Internet of Things; being this the case, of course there is a need and special concern on privacy and security issues.

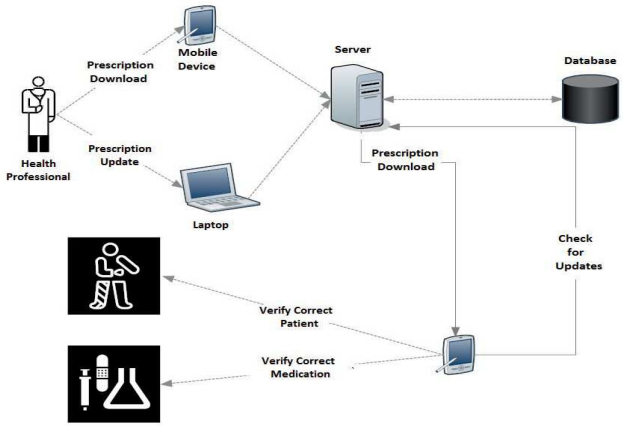


**Fig. 1.** Smart objects and Internet of Things for Healthcare.

This paper discusses these technologies and presents a new m-health service architecture, using RFID tags and structured around the Internet of Things, to establish a remote medication control system for Ambient Assisted Living, specially aimed at elderly people care in outpatient clinic. The main objective of this m-health service architecture is to allow elderly patients to self-manage their health in mobility, outside any special health care giving unit, either by monitoring their disease or by helping them to control the timely and correct intake of their medication.

After the technological context discussion and review of related work in section 2, the general IoT architecture we propose is presented in section 3. Section 4 describes the prototype m-health service we have implemented and the testing of its main components, focused on RFID identification and Object Name System resolution, but also dealing with security and indoor localization aspects. Section 5 presents some concluding remarks and future work.

## 2. Smart Patient rooms

The goal for patient rooms is to make them more patient-centered, improving the patient experience by helping patients take a more active role in their own health care.

For instance, these “smart rooms” will be equipped with a bedside console that will potentially enable the patient to do everything from controlling the room’s lighting to speaking directly with a nurse when needed. On the wall in front of their bed will be a large, flat screen monitor that will not only offer entertainment (TV, video games, internet), but also patient education sites to learn more about a health condition or a pending procedure. They will also be able to access dietary services and order their evening meal. Appointments and reminders will automatically be displayed at the beginning of the day so they know their MRI is scheduled for 10 a.m. and rehab at 1 p.m.

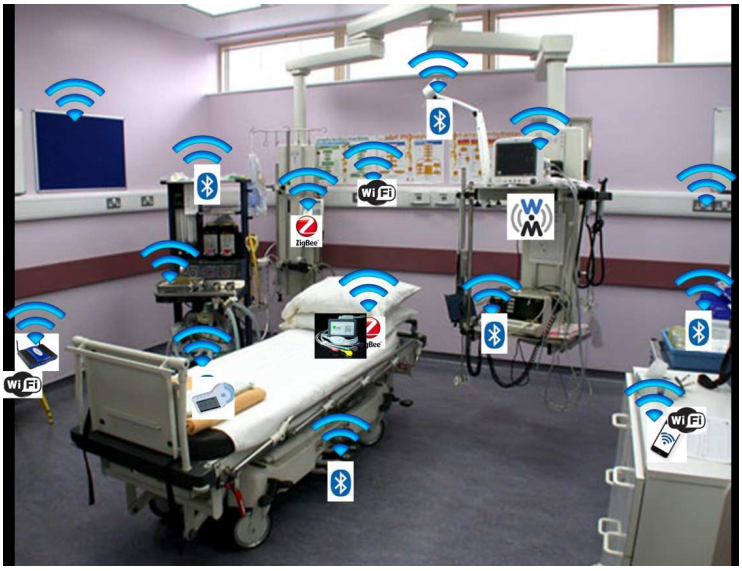


**Fig. 2.** Smart room for patient.

The rooms may also be equipped with video conferencing so a patient can visually interact with family and friends anywhere in the world. It will also allow the physician to consult with outside specialists, conduct “rounds” from a patient room, and stream video into a medical school classroom where students can ask questions. The operating rooms will have the same capabilities and offer greater opportunities for teaching residents and medical students.

### 2.1 Smart Clinicians and Nurses

The goal for clinicians is to ensure the information they need is immediately available, when and where they need it. Instead of having multiple devices – phone, pager, beeper, nurse call system – caregivers will have just one and it will do everything. It will most likely be hands-free and could be attached to clothing, worn around the neck, or carried in a pocket.

If a patient's vital signs change, an alert will be passed directly to the patient's caregiver through this device – reducing time spent watching monitors. If the primary caregiver doesn't respond, the system will reroute to the back-up providers until someone answers the alert.


**Fig. 3.** Smart hospital.

The caregivers will likely have sensors in their identification badges so when they enter a patient room, their name and title may appear on the patient's TV monitor. There will also be a small computer monitor next the patient's bedside which will be voice-activated to increase efficiency (keyboarding will be cut to a minimum). Based on the caregiver's badge, the computer will generate information pertinent to them. For instance, a nurse will be able to view the patient's vital signs and a doctor could call-up the latest lab results.

## 3. Conclusion

This paper presents a simple and secure Internet of Things architecture aimed at establishing a generic and ubiquitous Ambient Assisted Living framework to be used by hospital applications. The global solution presented is based on Radio Frequency Identification technology (RFID) and Electronic Product Code (EPC) normalization for the establishment of a unique identifier for each m-health related item (an object, a medicine, pharmaceutical drug, physician, patient, caregiver, drug, hospital, pharmacy, etc).

The paper also argues that the broad development of RFID technology has the potential to increase patient safety in medical services and to reduce costs. As most health services can be enhanced with the location, tracking and monitoring, specially in mobile and ubiquitous environments, an IoT system for monitoring and position referral of any of health-related entities - people (such as patients, nurses, doctors visits, auxiliary) and goods (such as medicines, clinical analyzes, wheelchairs, beds, medical equipment) - has been presented and discussed.

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# Taxpayers' attitudes towards state fiscal policy

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**Abstract.** The presence of taxes in most countries of the world exposes taxpayers paying them both to the temptation of not paying, as well as to situations in which the fulfilment of the duties towards the state is contrary to their conscience. Despite the existence of orders to pay taxes in most religions and moral standards imposed by the state including honest paying taxes, this practice persists. It is positively correlated with trust in the ruling elites and government agencies [1].

**Keywords:** tax evasion, cheating on tax, tax avoidance

## 1. Introduction

Taxes to the state and, more precisely their honest paying, are a regular part of socio-economic life and a duty of citizens almost all over the world. Poland is no exception in this issue. Can we avoid the fulfilment of these financial obligations to the state? What prevents us from doing so? In what situations is tax evasion at least partly justified? The aim of this article is to analyse the attitudes and needs of taxpayer towards the state and to answer the question of how the state can guarantee itself loyal taxpayers. The thesis built here contains the statement that cheating on taxes is positively correlated with a lack of confidence in the government, parliament and government bodies. Using the methods of data analysis, I'm going to answer these questions.

Taxes are divided into direct and indirect taxes. Direct taxes, such as income tax, land tax or others, are more visible and felt by the taxpayer. The second type of taxes are indirect taxes that, although they are in every sphere of citizens' life, are not so visible, such as the value added tax (VAT) and excise duties.

The overwhelming difference between tax evasion and tax avoidance should be emphasized here. It is a matter of great importance not only in semantics but also in the letter of the law.

Tax avoidance is a legal action involving the use of taxpayer's tax laws permitting the avoidance of paying all or a portion of taxes. Examples are tax incentives given to a taxpayer by the legislature. Another type of tax avoidance is the adoption of an appropriate strategy by the taxpayer, in order to reduce taxes. Its main objectives are to exploit loopholes in the law. This action is manifested in the selection of the most unusual actions, differing from common ones, in the field of taxation. The end result of such procedures should be the reduction of tax liabilities. It should be emphasized that all measures aimed at avoiding paying taxes, through the use of tax loopholes, unclear or complicated tax regulations and the understatement of the legislator, are still within the limits of the law. The strategy, however, requires adequate knowledge and experience of the taxpayer in tax law. The goal is not the complete abandonment of paying the tax, but the optimization of the amount of taxes paid.

A different range of activities defined as prohibited acts, and therefore punishable, is evasion of taxes. In this case, a taxpayer deliberately breaks the law by falsifying tax returns, inadequately maintaining revenue records, documenting fictitious transactions, intentionally concealing or misrepresentating the real state of affairs, or by submitting apocryphal documents. The most common purpose of such action is not to reduce or optimize the tax paid but to totally eliminate its payment [2]. The greatest source of losses due to the evasion of taxes is the shadow economy.

## 2. Socio-economic attitudes and the taxpayers' propensity to risk

Based on the Allinghama and Sandmo model, we can observe that the tendency to risk depends on the subjective assessment of the probability of detection of tax fraud. An important factor is the relationship between the amount of the tax and the amount of the penalty and the probability of its occurrence. If the penalty is not probable or its amount is lower than the amount saved by avoiding tax, a taxpayer has a greater propensity to risk [3]. This model, however, assumes that society is composed only of individuals calculating their own benefits. Most taxpayers have a sense of moral obligation and regardless of the circumstances and their own benefit or loss, and regardless of the minimal level of detection of fraud, they will pay taxes honestly. Equally important are the personal experiences of a taxpayer. A taxpayer who has not been punished for a tax offense is more likely to repeat this practice, assuming a negligible probability of punishment. A taxpayer who has experienced the consequences from the state due to a tax offense will evaluate such action as risky. [4]

Equally important reasons of the behaviour of the taxpayer are so called horizontal and vertical justice, that is feelings of a taxpayer with respect to the fairness of the state and equal treatment of all citizens - equal to taxpayers with similar conditions. Horizontal justice refers to similarities of the amount of tax liabilities paid by taxpayers with similar characteristics such as similar economic or social situation, belongness to a specific group or community. If taxpayers having similar conditions are treated in a similar way, a taxpayer feels justice and is more willing to pay taxes. Vertical justice determines the amount of burdens in relation to other taxpayers with different (higher or lower) income. The higher the feeling of justice is, the higher is the sense of moral responsibility.

Equally important is a sense of fairness of the government to a taxpayer, that is procedural justice. If taxpayers find activities and expenditures of the government as right and fair, there is less resistance to the payment of taxes [5]. An important issue is the evaluation of a taxpayer as to the amount of taxes with respect to the benefits achieved later. If a taxpayer feels satisfied by a state with respect to his own needs and therefore does not feel cheated or exploited by the state, he also pays taxes. If, however, he assesses the taxes paid by himself as excessive, bringing depletion of his income and not giving anything in return, he is more willing to consider the evasion of tax liability [6]. An equally important factor is the relation between tax officials and a taxpayer. The greater the mutual trust between the state, tax offices and taxpayer, the higher are the taxpayer's loyalty and sense of obligation and duty to the state [7]. The above issue is highly influenced by the state and modus operandi of officials at the administrative level. Complex, incomprehensible rules, ambiguous laws, the text of which may have been interpreted by various tax authorities depending on the needs and interests of officials, affect the sense of high-risk in carrying out legal business activity and thus affect the lack of confidence in the tax and decrease the motivation for loyalty to the state.[8]

Fear of social exclusion in case of a religious or conservative community with strict moral and ethical values can also be a phenomenon that restrains the taxpayer from the evasion of taxes. In Christianity, Judaism, and Islam, there is an issue of taxes and their payment. All of these religions agree on the point that one has to pay taxes. Jesus, asked by his students for an opinion on paying taxes to the emperor, said "Give to Caesar what belongs to Caesar and to God what belongs to God. [9]" Interestingly, every religion contains both the question of the possibility of abandoning the fulfilment of tax obligations and the situation in which such action is permitted [10]. A Christian may feel justified in not paying taxes when the tax system is unfair, the government corrupted, or tax revenues are used to finance a "dirty" war [11]. A follower of Judaism who avoids payment of taxes does not violate the Torah where the rulers are unrighteous and oppress believers [12]. A Muslim does not necessarily have to pay taxes when the state is governed by other laws than the laws of Sharia, or if the state is defined as secular [13].

Apart from religious issues, some situations might appear to justify the opposition of citizens to payment of taxes, such as an objection to the social or political situation [14]. An interesting, yet extremely clear, case may be the example of the government acting in an exceptionally unfair way which aims to persecute citizens and to rob them, e.g. in the case of the occupiers or invaders. In this situation, the taxpayer's honesty can be seen as collaboration or betrayal of the nation, neighbours and the local community [15].

Much more frequently, there are more mundane, everyday situations, which every citizen may be faced with. We can safely conclude that a man faced with the dilemma of paying taxes in a difficult financial situation of the family chooses the good of his family over the good of the country. It remains an open question whether such a situation will be treated with understanding by the tax authorities. It is a very individual matter which lies within the responsibility of the relevant tax authorities and the state [16].

Another important factor that affects the citizens and encourages them to carry out their financial obligations to the state are cultural and social factors, such as a sense of responsibility for the country and its needs. The belief that the honest paying of taxes is necessary is obvious to the citizen who cares about the welfare of society as a whole. These feelings are usually also fuelled by the state. In order to strengthen the positive image of a paying taxpayer, public advertising campaigns are established to create the image in which a person paying taxes is shown as an authority, who cares about the development of not only the country, but also the community in which he lives, and therefore is a good model to follow. Many cities in Poland conduct campaigns for paying taxes in the workplaces and residences. This applies to people who live and work in the city but pay taxes in different places. An example would be the Warsaw "It will come back to you. The accounting of PIT in Warsaw" [17] campaign, or Wroclaw, offering in exchange for the accounting of the PIT an opportunity to participate in a lottery with valuable prizes. [18]

## 3. Research analysis on the example of Poland

The report carried out by the World Values Survey sixth wave for the years 2010 to 2014 gives evidence drawn from 966 Polish citizens who answered questions related among other things to the issue of fairness and taxes.

Question No V115 studied the issue of how much confidence citizens have in the government. "Not very much" accounted for 54.2%, while "None at all" accounted for 25.5% (80% in total). The result of a question regarding trust in Parliament turned out similarly: Not very much 56.0%, None at all 26.8% (82.8% in total), and the Civil Service: "Not very much" 55.0%, "None at all" 17.5 (72.5% in total). We can see from these statistics that the government did not enjoy broad support.

Question No V201 asked … "Do you think it can always be justified, never be justified, …: Cheating on taxes if you have a chance?". The answers were "Never justifiable" 52.9 %. The rest of the respondents considered the possibility of justifying tax evasion in varying degrees.

These empirical studies confirm the theoretical considerations set out at the beginning of the article. Nearly 80% of the citizens do not place their trust in the government, 82.8% do not trust the parliament, and 72.5% the civil service . This in turn results in a straight line in attitude towards tax obligation. In total, 47.1% of citizens believe that in one way or another, you can justify tax evasion.

## 4. Conclusion

Taking everything into consideration, there is no hard, always efficient and always current concept of fairness in relation to paying taxes. Despite the framework imposed by religions and laws, life writes screenplays for which we need to adapt to the tax system. In some cases, the conflict arises between the dictates of public administrative bodies and our conscience, as well as

opportunities. There is no one, always applicable and universally correct answer to the question of whether we should always pay taxes. Research confirms a strong positive relationship between trust to the authorities and the amount of tax fraud. Whenever there is uncertainty as to the use of revenues from taxes and intentions of the ruling class, it increases the number of excuses for evasion.

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# Development of the Robotic Co-worker´s Applications Implemented to the Production Systems

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**Abstract.** This paper describes a new approach to robotics. The new trend in the field of robotics is human-robot cooperation. Manufacturers of robots as well as manufacturing plants are aware of that fact, hence it is expected to increase the robotics co-workers sale in the coming years. The article deals with the safety of humans and cooperating robots and consequently with application development using ROS (Robot Operating System).

**Keywords:** Cooperation human-robot, automation, ROS(Robot operating system)

## 1. Introduction

Nowadays, a development of new approaches used in an industrial automation and robotic applications is demanded. The potential of robotic co-worker is being used in the show-business but what is more important, usage of such robots for the applications in the industry has still not been explored.

Intelligent manufacturing systems are considered to be highly discussed theme. Industrial robotic is a part of the discussion. While the actual trend in some big corporation is to move personnel to background of manufacturing, trend in smaller or middle level company is to create a cooperation of the robots with the personnel. This kind of robotic workstation includes a robot capable of a direct cooperation with the personal or includes robot controlled by remote control via SCADA/HMI. Because of the safety, the robotic station has to be in a separate area with no human access during robot´s job execution. To assure the safety, elements such are barriers, light curtains, scanners and etc. have to be implemented by designer of the station. In the case of person´s occurrence in the defined safety area, the robot has to come to slacken speed or stop itself [1].

## 2. Direct Cooperation of Human-Robot in Production Systems

Technological breakthroughs in the field of industrial automation attract a lot of manufacturers. Nowadays manufacturing companies increasingly consider and consequently implement to their production not only the technology that is precise, safe etc, but also take into account a new technologies such are robots that are able to cooperate with human. Generally, those robots capable of job execution alongside people and simultaneously capable of the cooperation with the human are called *co-worker*. Co-worker implemented to the factory on the shop floor is called *co-bot* (cooperative robotic assistant).The conventional industrial robots are usually behind the safety fences, cameras and other safety systems. Co-bots or robotic co-workers are no longer considered to be the conventional robots and one of the most important differences is that those robots are implemented to the workplace without safety systems as mentioned above. Those collaborative robots have a certain benefits for which they are suitable not only for large production plants, but also for small and medium enterprises with small production, limited workplace, limited initial investments, a lack of engineers for programming, calibration, service etc. [2],[6],[7].

In order to achieve the simplest way of human-robot cooperation and communication to each other motivate manufacturers to implement human characteristics to the robotic co-workers. Especially, it is non-verbal communication method such is body movements etc. Moreover, many manufacturers are specialized not only to behavior of the robots in society, but also to design of the robots that are similar to people, which brings us to the new term *humanoid*. (Fig 1.)

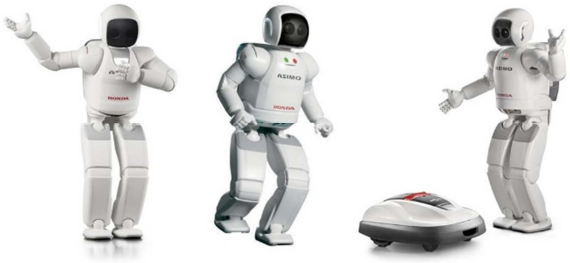

**Fig. 1.** The typical example of the humanoid robot

## 3. Application Development of the Robotic Co-worker Baxter

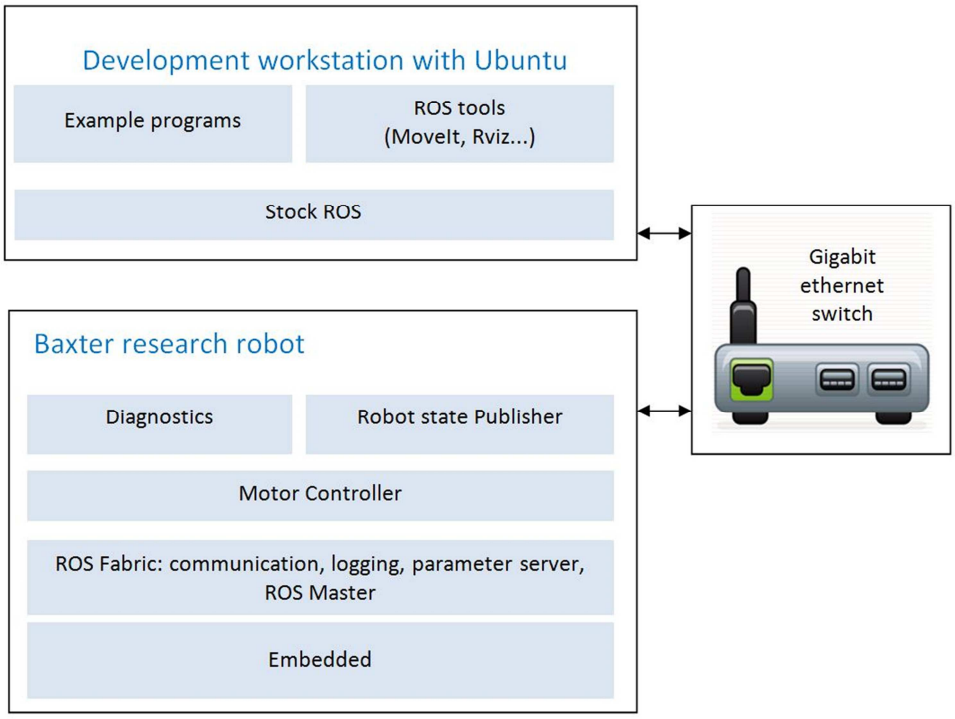


**Fig. 2.** Baxter research robot software developers kit

Many software engineers use software packages SDK (Software Developers Kit) during the development of robotic applications. The same applies with the robot Baxter. Developed programs designed to control the robot are tuned on the robot through the operating system of the robot called ROS (Robot Operating System). Development workstations are connected to the robot Baxter, represented as a master, for the purpose of debugging of custom applications. See the Fig.2.

Using of the very core of SDK is considered to be very useful to get the access to the source code developed for accessing, monitoring and management of all robot´s peripherals (motors, sensors, etc.). Application developers can thus shortly come to an essential knowledge from the area of the individual joints control to a defined position, camera control, etc. Respecting the certain principles of ROS interface, the robot can be programmed in various programming languages such as Python, C++, etc. Example of the source code of the application "pick and place" is depicted on the Fig.3 [3],[4],[6].

*pick_and_place.py

```
    def performing(self):
        #~ try:
            while not rospy.is_shutdown() and not self.mustStop_performing:
                self.pick()
                if self.mustStop_performing: break
                self.place()
        #~ except:
            #~ self.baxter.no()
            #~ self.setState("ready")

    def pick(self):
        lock=self.parent.coordinator.lock[self.side]["pick"]
        lock.acquire()
        try:
            t=self.baxter.gripper[self.side].post.open()
            self.arm.move_to_joint_positions_pid(self.pos["pickup"],1.8,0.03)
            t.join()
            self.arm.move_to_joint_positions_pid(self.pos["pickdown"],1,0.01)
            self.baxter.gripper[self.side].close()
            self.arm.move_to_joint_positions_pid(self.pos["pickup"],1,0.05)
        finally:
            lock.release()

    def place(self):
        lock=self.parent.coordinator.lock[self.side]["place"]
        lock.acquire()
        try:
            self.arm.move_to_joint_positions_pid(self.pos["placeup"],1.8,0.03)
            self.arm.move_to_joint_positions_pid(self.pos["placedown"],1,0.01)
            self.baxter.gripper[self.side].open()
            self.arm.move_to_joint_positions_pid(self.pos["placeup"],1,0.05)
        finally:
            lock.release()

class MainWindow:

    def __init__(self,master,baxter):
        self.master=master
        self.baxter=baxter
        self.post=Post(self)
```

**Fig. 3.** Preview of source code for the application "pick and place"

## 4. The Application "Pick and Place"

A The transfer of material from the conveyor to the packing line, palletizing of the various parts, etc. are considered to be the most used applications in the industry. Generally, these operations are called "pick and place".

During the execution of these operations, that are thought to be monotone for machine operators, often tend to increase of inattention and consequently to increase the risk of injury. In another case, there is an operation such is the transport of heavy parts, when the health problems might occur (Backache, neck pain. strained muscles etc.). Robotic workcells are able to perform such operations several times faster and more accurate, whereupon the economists look at the operation "pick and place" especially in terms of financial savings. The robot called Baxter and many other industrial cooperating robots are almost ideal for such operations. They are ideal especially from perspective of direct cooperation between those robots and machine operators. The laboratory ZIMS disposes of such cooperative robot - Baxter. The current research is conducted and simultaneously tested in order to debug the pick and place operation.

From the point of view of robot teaching, it is an easy process so almost every operator in the enterprise might be able to teach the robot to a new operation. Teaching is composed from three simple steps. The first step is to grab the effector of the robot, teach the robot to the position from where the part should be taken (pick). The second step is to teach the robot to the position where to put the part (place). The last one is pushing of the button to save and confirm a new job for robot. Communication between the robot and the machine operator is realized via the robot´s head. Specifically it is via the display on the top of the robot as you can see on the Fig.4. [5],[8].

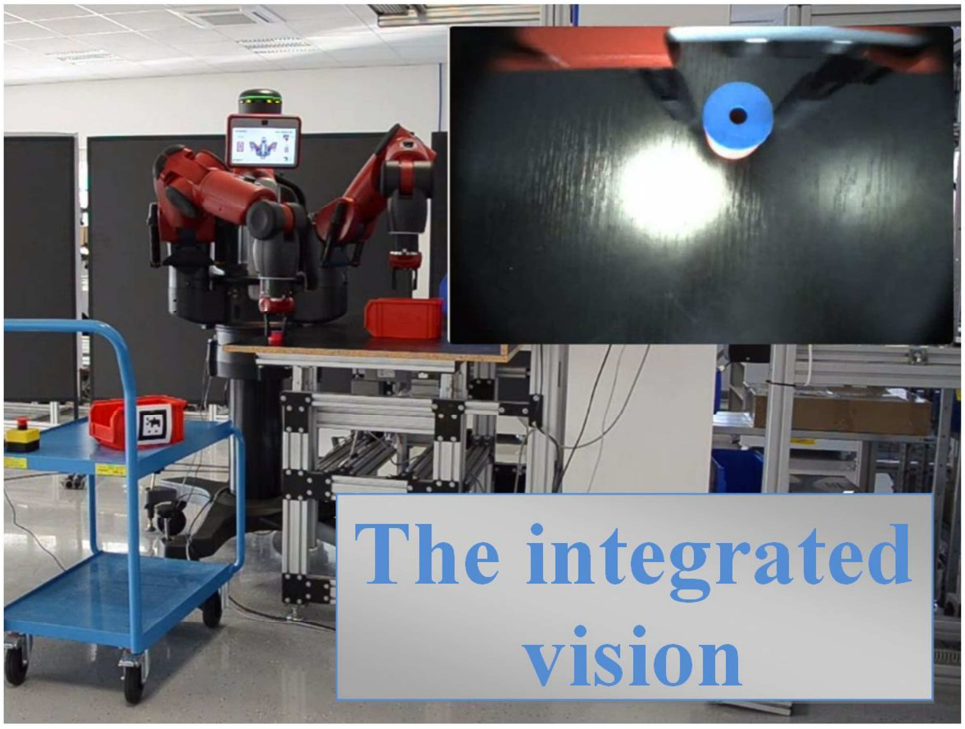


**Fig. 4.** Execution of the application "pick and place"

## 5. Conclusion

The main goal of the article was to introduce to the reader a new approach of robotic workstation designing. As the reader could read in the article, industrial co-workers can cooperate with human that is the most important benefit of the usage of co-workers in the industry. Using this kind of robot has a big benefit. Especially it is because of the cooperation that helps reduce the downtime and thus raise the profit of the corporation. Equally important is the fact that programming is very simply, hence the operator can teach the robot some new movements without any knowledge about the architecture or without any robot functionality details.

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# Customer Relationship Management as a Marketing Strategy in the Pharmaceutical Sector in Slovak Republic

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**Abstract.** The aim of this paper is to highlight the most important advantages and disadvantages arising from the use of CRM strategy in the pharmaceutical industry in the Slovak Republic. Customer relationship management is a key strategy to help businesses gain a competitive advantage over other businesses that are not considered important in the relationship with business partners. Furthermore, the contribution deals with the existence of a relationship between the size of the enterprise in terms of its average annual turnover and the number of companies using CRM. Our results show that the studied variables, there is a statistically significant dependence.

**Keywords:** CRM, customer, company.

## 1. Introduction

The theoretical framework CRM strategy is documented in many international publications, although not all companies know full use of CRM strategy and associated systems and evaluate the success of this strategy and proposes measures to enhance and improve these strategies. Enterprises operating in the B2B market cannot be compared with each other; it is the companies of different sectors, sizes and legal forms.

## 2. Customer Relationship Management

Gartner, Inc. defines the conceptual framework of CRM as a customer-oriented company strategy, which is designed to optimize profitability, revenue and customer satisfaction. The successful implementation of CRM requires implementation of processes and technologies that support customer interaction through all channels. [1 ,2, 4]

The amount of managers and economists are questioning how they are different concepts. In essence there are differences between them. All of these concepts are not in fact nothing more than a lot of components across business philosophy, thinking and processes. [2, 3]

Bob Thompson defines additional terms as follows. Partner Relationship Management (PRM) or VRM also as an important part of CRM processes. [3]

Parntner Relationship Management is an interesting trend with increasing balance profitable results. The goal of PRM is to create long-term competitive differentiation with indirect distribution costs. It is also a key part of the overall concept of CRM, which should encourage employees, customers and partners. [4, 13]

DRM is a new category of enterprise software products that use the global reach of the Internet to provide continuous exchange of information between remote devices, business systems and people in real-time. DRM enables businesses, manufacturers and service providers use the Internet to monitor, manage and service intelligent devices deployed at sites around the world, and is cost-effective and real-time. [5,13]

Conventional marketing planning, strategic planning, market research and other management disciplines over the years gradually replaced and new concepts such as discipline. Total quality

management, and the like. The extent to which companies comply with customer oriented approach determines the extent to which the firm would be able to compete in the market. If the customer orientation is great, company does not use only CRM but VRM and DRM, too. [6, 3, 7]

In case the company decides to engage in customer relationship management and support of suppliers and partners, there is a need to involve VRM and PRM within the overall concept of CRM. If the company assumes responsibility for equipment and instrumentation equipment is a need for DRM involvement in the management of the company. [7, 8]

In our market conditions, most B2B companies use the concept of CRM although the content that term often includes other already mentioned Partner Relationship Management, Vendor Relationship Management and Device Relationship Management. Currently, the CRM strategy is one of the key strategies, allowing successful negotiation and conclusion of transactions with partners. It is certainly not the only possible strategy to which enterprises can focus, however represents one of the most effective forms of creating long-term relationships with customers. [9]

## 3. Research Methods

In processing the issues that we have used relevant information resources:

- Domestic and foreign book publications,
- Scientific and technical articles,
- A sample of the Business Register of the Statistical Office of the Slovak Republic,
- Identification of the studied materials.

In the research, the following methods were used:

- the method of data collection and information for creating theoretical basis research problems,
- Excerpted method for selecting data and essential information,
- method of description in the processing of information received and data,
- method of comparison when considering the dissertation topic at home and abroad,
- method of reasoning used in generalized and making conclusions based on collected data and information,
- Method anonymous questionnaire to determine the level and use of CRM applications strategy and CRM systems in the pharmaceutical industry and commerce in terms of its product portfolio correspond to the basic attributes of undertakings operating in the B2B market and finding the fundamental attributes to create a model for measuring performance and effectiveness of CRM strategy,
- mathematical and statistical methods and the use of visual aids necessary to present the partial results of the work,
- method of working with statistical data through the software program SPSS Statistics Standard 16.00.

## 4. Discussion

J. Němeček (2013) in his paper deals with the understanding of CRM - level strategy or system. The result of research GAČR show that CRM represent the majority of the information system, which is offered by various companies: Microsoft, SAP, Oracle, IBM etc. Furthermore, the research shows that only a small manager aware of the fact that CRM is not just an information system, but quality of information system is part of the whole CRM. From this perspective, CRM can be characterized as the overall business and marketing strategy including a methodology which sets out the main objective to obtained the customer to maintain, ensuring its requirements, purchasing and consumption behavior and develop a long-term relationship with him. It is lifetime customer value for the company (Customer Life-time Value). [10,13]

Similar results in understanding the differences between CRM strategy and CRM information systems we arrived in the context of our research on the pharmaceutical sector in Slovak Republic. Up to 64.92% of respondents said that in the course of his business does not distinguish between CRM strategy and CRM system, and only 35.08% of companies and managers distinction terminology CRM strategy and CRM information system.

Although these strategies are known in our market for over 15 years and currently CRM strategies for moving towards parallel use of all three strategies in one entity to the maximum to meet the needs of all customers. Adjustments individual customers should differ according to the current and especially the total potential benefits for company customers. This combined strategy can be collectively called differentiated CRM strategy. [1, 10]

Our results show that 70.18% companies pursuing a strategy of mass personalization, which requires special communication with individual customers, the offer is standard for all customers. On the other hand, only 5 businesses within the studied samples representing 8.77% uses a strategy of differentiated customization, which is trying to meet all their customers individually.

In 2008, a research on the use of CRM in the Slovak Republic under which identified the most important problems encountered in the implementation of CRM in enterprises. Up to 31.5% of respondents said as the most important problem of training and low level of motivation of the employees to transition to the new system. As another very important problem respondents identified do not conform to the definition of needs prior to implementation in 28.8% of surveyed enterprises. On the other hand, only 17.81% sees the biggest problem of insufficient service before installation.

Our results show that respondents likewise biggest problems in inadequate training - up to 19.4% of surveyed companies and also in a very long period of implementation, which as a key issue of the implementation of said same percentage of respondents 19.4%. On the other hand, in our case, only a small percentage of respondents 4.48%, sees a major problem in the implementation of CRM in poorly defined needs from users.

According to the website its4you.sk key benefits of implementing CRM can be seen in building customer loyalty, shorten sales cycles, reduce costs, increase efficiency in customer care, adjustment of supply to customers, identifying the needs of key customers and increase the effectiveness of marketing campaigns. [11,12,13]

Our research showed that demanded companies consider as the greatest benefits can be a repository of information and improving inter and intra communication. To the detriment of companies said that the lowest percentage of respondents only 2.63% understands key advantage resulting from the implementation of CRM in the expansion of the customer base. Based on these data, we can say that the introduction of a CRM system in the surveyed companies rarely led to the expansion of the customer base, which would require improving the level of CRM. Most companies still understands CRM as an opportunity to effectively store their data, and they also cannot use at a level that would bring them an added benefit from the use of this strategy.

Chlebovský (2005) argues that the key disadvantages of CRM companies are necessary investment in CRM, customer need analysis, adaptation thinking servants towards CRM strategy, long-term process of implementation.

Through research we have identified as the most serious disadvantages complexity of system and necessity of training. Almost a third of respondents identified the disadvantage of system complexity; we can say that companies should pay more attention to the choice of a particular system and define the essential elements of CRM strategy and then careful preparation of all employees for change.

The subject of our research was the finding of the interdependence between company size in terms of the average annual turnover and using of CRM strategies. To test this dependence, we used the Mann-Whitney test, which tests the ordinal and binary variables.

P-value is less than the chosen significance level rejects the null hypothesis and accepts the alternative hypothesis. We can therefore conclude that the size of the company in terms of the

average annual turnover and using of CRM strategy, there is a statistically significant dependence. What is the size of the company in terms of the average annual turnover greater, more companies use CRM strategy within the company marketing strategy.

## 5. Conclusion

Strategy for customer relationship management increasingly used primarily by companies in the B2B market, which for maintaining quality relationships with businesses on both sides, that of the other suppliers and customers must necessarily develop their communication skills and be able to react flexibly to the demands of its partners. Despite the growing informatization of Slovak business environment, there are still companies that for various reasons, do not use a strategy of customer relationship management, and even in spite of the use of this strategy is not directly dependent on the use of technological background of customer relationship management.

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# The Brand Communication

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**Abstract.** Brand communication makes a relevant part of the marketing communication strategy of the organisation. Marketing communication is an important tool and also can produce stronger message consistency and greater sales impact. It also gives someone responsibility to unify the various brand images and messages and it improves the company's ability to reach the right customers with the right messages at the right time and in the right place.

**Keywords:** brand; communication; marketing

## 1. Introduction

As a communication theorist Paul Watzlawick writes: "It is impossible not to communicate." [1] The way the packs are designed, the words used, the way the phones are answered or not, the products the name is put to, the shops in which these are sold: all these can say powerful things about a brand. Other messages about the brand are not under the control of the brand manager, such as the things that people who use the brand or others say or write about it. According to Križanová and Majerová et al. [2] a brand is a very broad concept. It is a combination of everything that a customer takes into account when making a purchasing decision. It is not only trademark but also association that arises in the minds of customers when thinking of a specific brand.

As well as managing the design and language of a brand, most brand managers also invest money in a direct communication with various stakeholders of the brand using direct mail and PR, telemarketing and website design, events and sponsorship programs, and not least, the various advertising media of TV, print, cinema and radio.

From their beginnings as mass phenomena in the 19$^{th}$ century, brands and advertising have improved together. Early mass-market brands, such as Pears Soap, Kodak or Coca-Cola, built their business on huge advertising investments; by 1912, Coca-Cola was spending one million dollars a year on advertising. To the present day, it is exceptional to find a large or successful brand that does not continue to invest heavily in communications.

Traditionally, brand communication has been divided into categories known as "above the line". These names were originally connected with agency accounting procedures. The media paid commission for activities above the line but not for those below the line; clients of an advertising agency do not pay directly for its services; the agency makes its money as a sales agent for the media. Press, TV, outdoor, radio and cinema are above the line; direct mail, PR, sales promotions of various sorts, events and sponsorships are generally below.

Originally, advertising agencies would offer all these services and could subsidize the below the line activities with commissions from the others. Over the time, bellow the line activities have become more specialized and separated, agencies grew up to deal with them, and as advertisers negotiated to have rebates on commissions or to switch to fee payment, the economics of the old-style full service became unsustainable. Today a wide range of communications agencies offer specialized services, so that brand communications are normally fragmented among a number of different suppliers. The expressions above and below the line linger on, but there discussions about

the importance of "integrated marketing" or "through the line", which is about how best to bring back together the fragmented pattern of activities in the better interests of the client.

Nowadays, it is fashionable to predict "death of advertising", meaning the classic above-the-line media. This is unlikely to happen. Certainly, things have changed in the advertising business. It is no longer easy to obtain the huge, monolithic mass-market audience that the United Kingdom or American network television delivered until the 1970s. Meanwhile, advances in computing power have made that individual targeting of consumers appears to be more practical, and the direct-mail industry has sold itself hard on this basis.

However, it is probable that all types of paid-for brand communication will continue to play an important role in building brands in the future much as they have in the past. TV, despite the prophets of doom, is still one of the world fastest-growing media, with the worldwide number of TV homes trebling in the past 20 years; one quarter of them in China. And it still seems to work. Many advertisers who thought that they could get more efficient results by shifting their TV money into sponsorship or direct mail found the results disappointing. This is not to say that sponsorship or direct mail are not valuable, but few brands have created or maintained strong brand identities using only these channels.

## 2. How do Communications Build Brands?

Brand communication programs make part of the marketing communication strategy of the organisation. Marketing communication is an important tool by which organisations inform, teach, persuade and remind consumers about their products and brands that they sell. Marketing communications represent the voice of the brand and are one way to establish a dialogue and build relationships with consumers. [3]

Marketing communication explains to customers what the company and its brand stand for, it is a way to link brands to other people, places events, brands, experiences, feelings and things. Thus, it is vital for companies to communicate with present and potential stakeholders and the general public. Valuable brand is always a source of competitive advantage for the enterprise. It has a positive impact on buying decision making of consumers. [4]

According to Kotler and Keller, marketing communication is a way to build brand equity. They suggest the following marketing mix, which consists of six major models of communication (Figure 1):

- Advertising – any paid form of non-personal presentation and promotion of ideas, goods or services by an identified sponsor.
- Sales promotion – short-term incentives to encourage trial or purchase of a product or service.
- Events and experiences – these are company-sponsored activities and programs designed to create brand-related interactions.
- Public relations and publicity – programs promoting or protecting company or product image.
- Direct marketing – use of mail, telephone, fax, e-mail or Internet to communicate directly with specific customers and prospects.
- Personal selling – face-to-face interaction with prospective purchasers for the purpose of making presentations, answering questions, and procuring orders.

Figure 1 show how communications contribute to brand equity by creating brand awareness, crafting a brand image, eliciting brand responses and/or facilitating a stronger consumer-brand connection.

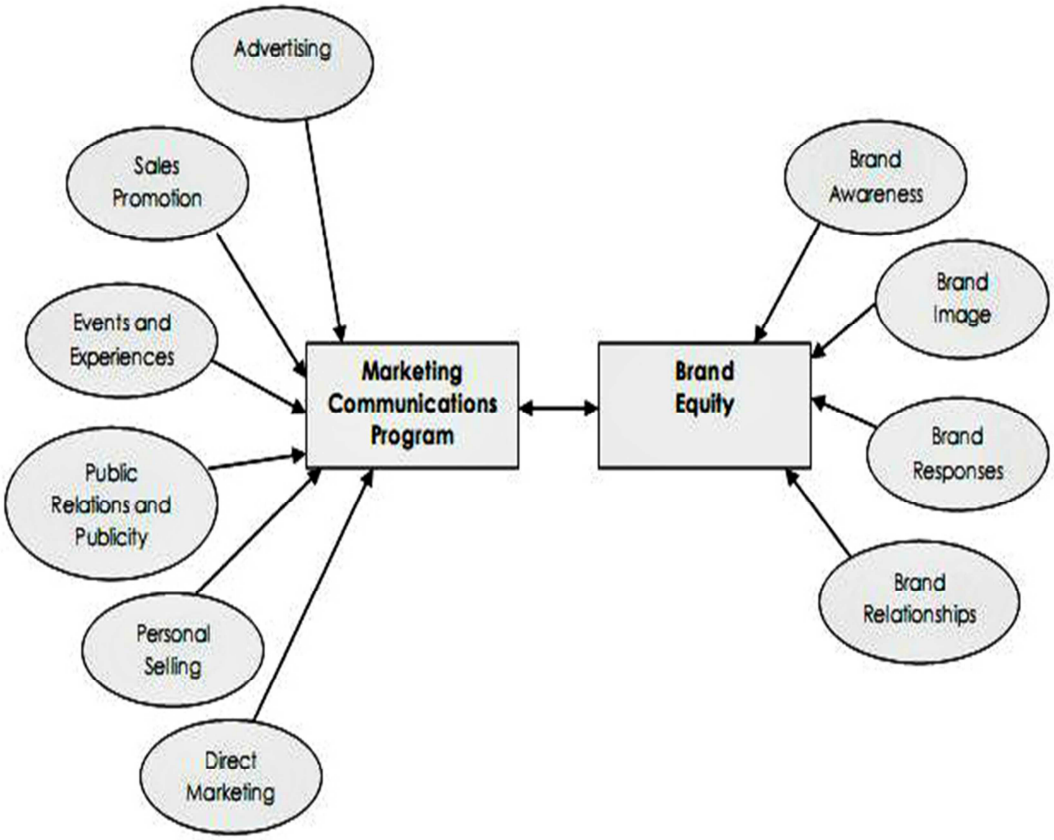


**Fig. 1.** Integrating marketing communications to build brand equity

To achieve effective communication of their products and brand values, organisations should very carefully determine the communication objectives and select the exact communications channels and decide on the marketing mix.

Rossiter and Percy [5] identify four possible objectives for marketing communications, as follows:

- **Category need** – establishing a product or service category as necessary to remove or satisfy a perceived discrepancy between a current motivational state and a desired emotional state.
- **Brand awareness** – ability to recognise or recall the brand within the category in sufficient detail to make a purchase. Recognition is easier to achieve than recall, but recall is important outside the store, whereas brand recognition is important inside the store. Brand awareness provides a foundation for brand equity.
- **Brand attitude** – evaluation of the brand's perceived ability to meet a currently relevant need. Relevant brand needs may be negatively oriented (problem removal, problem avoidance, incomplete satisfaction normal depletion) or positively oriented (sensory gratification, intellectual stimulation, or social approval).
- **Brand purchase intention** – self-instructions to purchase the brand or to take purchase related action. [4]

Certain types of brand communication give information, or are aimed at leading directly to a transaction: brochures, coupons, mail shots, direct response advertisement and certain uses of websites and of most other media. But taking brand communication as whole, through all channels, past and present, a great deal cannot be explained in either way. Communication with an immediate selling aim may appear more productive. Their direct results may be more easily measurable, but in terms of the long-term health of the brand it may be others that create more competitive advantage. Brand strength, although it involves sales, is also about more than sales. It is about ability of a brand

to resist competition, to support a premium price, to weather negative publicity and thus to offer to shareholders a more reliable promise of future cash flows. Brand owners will want to ensure that their communications not only stimulate sales, but also enhance the underlying strength of the brand.

Another important step in marketing communication is to select the communication channels. There are two kinds of communication channels: personal and non-personal. Personal communications channels involve two or more persons communicating directly face-to-face, person-to-audience, over the telephone, or through e-mail. Instant messaging and independent sites to collect consumer reviews are another means of growing importance in recent years.

These channels derive their effectiveness through individualised presentation and feedback. For instance, there are companies which do not advertise or create exciting packaging; instead, it gives away free samples to anyone entering its stores, encouraging widespread word-of-mouth and positive publicity. [6] According to Dye, in many cases, word of mouth is managed. [7]

Non-personal channels are communications directed to more than one person and include media (newspapers, magazines, radio and television), sales promotions (samples, coupons and premiums), event and experiences (sports, arts and entertainment), public relations and publicity.

Besides determining the objectives and selecting the communication channels, companies must also allocate the marketing communications budget over the six major modes of communication – advertising, sales, promotion, public relations and publicity, events and experiences, sales force and direct marketing. Within the same industry companies can differ considerably in their media and channel choices. [8]

However, each communication tool has its own unique characteristics and costs:

- **Advertising** – can be used to create a long-term image for a product, for example Coca-Cola or generate quick sales. According to Kotler and Keller [2] it offers opportunities of amplified expressiveness and is also pervasive, able to reach geographically dispersed buyers efficiently. Certain forms of advertising, such as TV advertising, require a large budget; other forms, such as newspaper advertising, do not.
- **Sales promotion tools** – coupons, contests, premiums, offer three key of benefits: communication – gaining attention that may lead the consumer to the product; incentive – offering a concession or and inducement that gives value to the consumer; and invitation – including a distinct invitation to engage in the transaction now. Sales promotion can be used for short-run effects such as dramatising product offers and boosting sales. [3]
- **Public relations and publicity** – the appeal of public relations and publicity is based on three qualities: high credibility – news stories and features are more authentic and credible than advertisements; ability to catch buyers off guard – reaching prospects who prefer to avoid salespeople and advertisements; and dramatisation – the potential for dramatising a company or product.
- **Events and experiences** – a well-chosen event or experience seen as highly relevant can get the consumer personally involved. Because events and experiences are live, consumers find them more actively engaging. Also, events are more of an indirect “soft sell”. [3]
- **Direct marketing** – all forms of direct marketing –direct mail, telemarketing, Internet marketing – share three characteristics: they are customised – to appeal to the addressed individual; up-to-date – can be prepared very quickly; and interactive – can be changed depending on the person’s response.
- **Personal selling** – as per Kotler and Keller [3], personal selling is the most effective tool at later stages of the buying process, particularly in building up buyer preference, conviction and action. Qualities of personal selling are personal interaction – and immediate and interactive relationship between two or more persons; cultivation – all kinds of relationships can spring up, from a matter-of-fact selling relationship to a deep personal friendship; and response – the buyer feels under some obligation for having listened to the sales talk.

## 3. Conclusion

Brand communications do three things for a brand. They can provide information about the brand, make a brand famous and familiar and create distinctive patters, associations and meanings that make the brand more attractive and saleable. These associations and meanings may not be non-verbal and non-conscious. The communication will be analogue as well as digital and its purpose is about creating a relationship with the brand as well as about its actual content. This may all sound theoretical, but it is simply trying to find words to bring things that we all experience every day in all types of communication into consciousness. These ideas may not be the ones we could ever objectively call right or wrong, but they may be more useful in conceptualizing the ways in which communications build brands. Certainly these ideas help make sense of many aspects of successful advertising which are poorly explained by the models of information or persuasion or simply saliency.

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# Research Survey of Strategic Management in Companies in Slovak Republic

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**Abstract.** The article is dedicated to the theoretical aspects of strategic management followed by research survey of the usage of strategic management in companies in Slovak Republic. It highlights the importance of strategic management in today's dynamic and competitive environment, which enables the company to succeed and to find their place in the market. Based on this theoretical knowledge of research problem were made the research survey and from these results were tested three hypotheses. In the conclusion are suggested recommendation for companies in Slovak republic based on results of research survey.

**Keywords:** strategy, company, strategic management, Slovak Republic

## 1. Introduction

Definition of goals of the company and selection of the appropriate strategy is the main task of strategic management but it has to be followed by other activities. In recent years the strategy was considered only as the science about planning and defining directions of military actions. First mention about company strategy is referred to Alfred Chandler who in 1962 in his publication demonstrated the problem solving by managers in American companies in the connection with long-term objectives, allocating resources and creating a structure to enable and support their implementation. [1] Increasingly the idea of strategy has become more significant and has been expressed by several authors so nowadays is the strategy one of the key factors of the company competitiveness and success.

*„Strategy solves fundamental questions of existence and development of the company. Strategic decisions are particularly important, usually long term and provide an adequate support and orientation for the company in a complex and changing environment."* [2]

*„Strategy is a complex process defining activities need to be undertaken to achieve company objectives and prefers medium-and long-term goals before operational solutions."* [3]

*„Strategy is a trajectory or course towards a predetermined goals, which is formed by areas of company, competitiveness and functional and which management of the company tries to apply while defining the position of the company and managing the overall structure of company´s activities."* [4]

Another perception of the strategy is defined by Grunig and Kuhn who considered *strategy as a managerial directive or declaration, which serves as decision support providing the possibility of appeal.* [5]

## 2. Theoretical Aspects of Strategic Management

Concept of the strategy in the company is inappropriate if it is not connected with strategic management as a complex of activities. In general the process of strategic management can be considered as a system of formulation of the vision, mission and goals of the company followed by the analysis of external and internal environment of the company, selection of appropriate strategy

for the business and corporate level, changes in organizational design, administrative measures and control system for implementation of the strategy. From these steps, the analysis of the external and internal environment and the selection of an appropriate strategy referred to as the phase of strategy formulation and a set of measures to establish and implement the strategy referred to as the phase of implementation of the strategy. [6]

A different view on the strategic management can be found in the publication of authors Grunig and Kuhn [5] who considered process of strategic management as a parallel, despite the fact that it consists of three separate processes (strategic management subsystems) – strategic planning, strategic implementation and strategic control. The first phase, strategic planning, defines long – term goals, resources and activities which are necessary and provides a clear direction and basis for the implementation of the strategy, which is the second phase. Strategic control, the last phase of the process, performs two functions:

- the feedback on how is the strategy implemented,
- the view if the conditions defined in the strategic plans fulfilled.

If strategic control discovers some deviation or the implementation is not sufficient it is necessary to start over again the whole planning process. As is shown in Figure 1, the phases of strategic management interact while the leading role is a strategic planning. Exactly strategic planning can be seen as a process that operates independently from the operational activities, the implementation and control are included in the operational management (daily activities). Strategic management is therefore largely influenced by strategic planning.

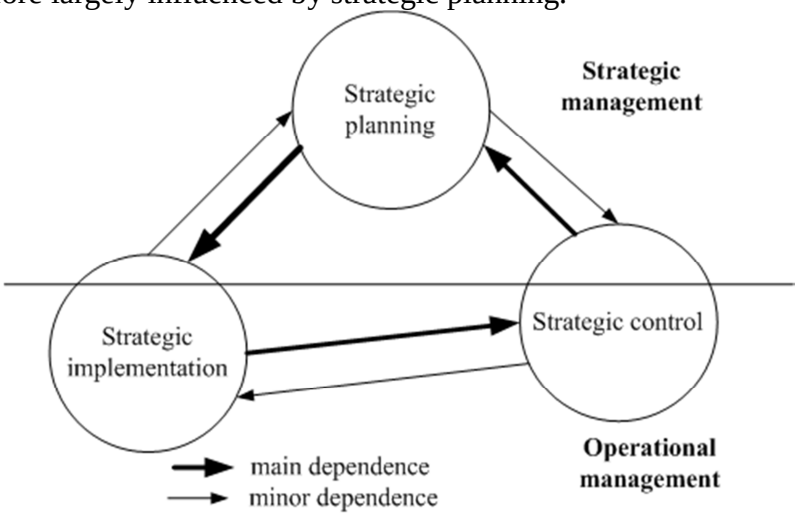


**Fig. 1.** Three subsystems of strategic management. [5]

## 3. Hypothesis and Research Methods

The main goal of the article is to provide research survey of the usage of strategic management in the companies in Slovak Republic.

So firstly definition of the subject of the research is necessary. The survey was applied on the companies in Slovak Republic. The appropriate sample size was defined by the sample size calculator on the confidence level 95% with the margins of error 5 which represents the width of the confidence interval. According to statistic server of Slovak republic in Slovakia are 628569 companies (data to date 31.12.2014). So the necessary statistic sample size calculated with the free on – line calculator of the company Creative Research Systems is 384 companies. The survey was made through the questionnaire and conducted electronically.

To fulfill the goal of the article following hypothesis have been set:

***Hypothesis 1***: Most of the companies define strategy.

***Hypothesis 2***: There is a significant relationship between formulation of the strategy and the size of the company based on the amount of employees.

***Hypothesis 3***: There is a significant relationship between formulation of the strategy and the type of the company.

Statistical methods used for the test of hypothesis are binomial test for hypothesis 1 and the chi – square test of independence for other two hypotheses. [7]

## 4. Research Results and Discussion

Based on the obtained responses from the questionnaire can be made statistical tests of set hypothesis.

***Hypothesis 1***: More than half of companies define strategy.

*$H_0$: More than half of companies don´t define strategy.*

*$H_1$: More than half of companies define strategy.*

The hypothesis will be test on the 5% level of significance by binomial test which is an exact test of the statistical significance of deviations from a theoretically expected distribution of observations into two categories.

| **Binomial Test** | | | | | | |
|---|---|---|---|---|---|---|
| | | Category | N | Observed Prop. | Test Prop. | Exact Sig. (2-tailed) |
| 7. Does the company have formulated strategy? | Group 1 | Yes | 236 | ,61 | ,50 | ***,000*** |
| | Group 2 | No | 148 | ,39 | | |
| | Total | | 384 | 1,00 | | |

**Tab. 1** Binomial test for hypothesis 1 calculated in SPSS (self-processed)

Based on the tab. 1 where is shown the calculation of p – value for the hypothesis we can assume that 0,000 < 0,05 so the null hypothesis is reject and the alternative hypothesis is accept so we can assume that **more than half of companies define strategy**.

***Hypothesis 2***: There is a significant relationship between formulation of the strategy and the size of the company based on the amount of employees.

*$H_0$: There is not a significant relationship between formulation of the strategy and the size of the company based on the amount of employees.*

*$H_1$: There is a significant relationship between formulation of the strategy and the size of the company based on the amount of employees.*

For the test of hypothesis will be used Paerson Chi – square test of independence which is used for the calculation of correlation in contingency tables. It is test also on the significance level $\alpha = 0,05$.

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | ***80,090[a]*** | 3 | ***,000*** |
| Likelihood Ratio | 83,570 | 3 | ,000 |
| Linear-by-Linear Association | 4,785 | 1 | ,029 |
| N of Valid Cases | 384 | | |
| a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 11,18. | | | |

**Tab. 2.** Chi – square test of independence for hypothesis 2 calculated in SPSS (self-processed)

From the table 2 is clear that Paerson Chi – square is 80,090, while Chi – square value from the table for 3 degrees of freedom and 95 % quantile is $\chi^2_{0,95} = 7,814278$. Whereas 80,09 > 7,814278 and also the calculated p – value is 0,000 which is smaller than 0,05 then the null hypothesis on 5%

level of significance is reject and alternative hypothesis is accept. **There is a significant statistic relationship between formulation of the strategy and the size of the company based on the amount of employees.**

We also need to define the power of the relationship between examined variables. For this can be used Cramer´s V (Cramer´s contingency coefficient) or Paerson´s contingency coefficient. Calculated values of these coefficients are shown in the tab. 3 and the value 0,457 represents moderate positive correlation.

| Symmetric Measures | | | |
|---|---|---|---|
| | | Value | Approx. Sig. |
| Nominal by Nominal | Phi | ***,457*** | ,000 |
| | Cramer's V | ***,457*** | ,000 |
| N of Valid Cases | | 384 | |

**Tab. 3.** Calculation of the power of the relationship between examined variables of hypothesis 2 (self-processed)

***Hypothesis 3***: There is a significant relationship between formulation of the strategy and the legal form of the company.

*$H_0$: There is not a significant relationship between formulation of the strategy and the legal form of the company.*

*$H_1$: There is a significant relationship between formulation of the strategy and the legal form of the company.*

Hypothesis 3 will be test also by the use of Paerson´s Chi – square test of independence on the significance level $\alpha = 0,05$.

| Chi-Square Tests | | | |
|---|---|---|---|
| | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | ***34,551[a]*** | 4 | ***,000*** |
| Likelihood Ratio | 36,923 | 4 | ,000 |
| Linear-by-Linear Association | 33,379 | 1 | ,000 |
| N of Valid Cases | 384 | | |
| a. 2 cells (20,0%) have expected count less than 5. The minimum expected count is 1,54. | | | |

**Tab. 4.** Chi – square test of independence for hypothesis 3 calculated in SPSS (self-processed)

Paerson Chi – square for test hypothesis is 34,551 and calculated p – value is 0,000. These means that compare to 0,000 < 0,05 and also 34,551 > 9,487729 (Chi – square value from the table for 4 degrees of freedom and 95 % quantile is $\chi^2_{0,95} = 9,487729$ ) that the null hypothesis is reject and we accept alternative hypothesis which **confirms the significant statistic relationship between formulation of the strategy and the legal form of the company.**

After identification of the relationship we need to identify the power of this relationship which is based on the tab. 5 0,300 and represents moderate positive correlation.

| Symmetric Measures | | | |
|---|---|---|---|
| | | Value | Approx. Sig. |
| Nominal by Nominal | Phi | ***,300*** | ,000 |
| | Cramer's V | ***,300*** | ,000 |
| N of Valid Cases | | 384 | |

**Tab. 5.** Calculation of the power of the relationship between examined variables of hypothesis 3 (self-processed)

## 5. Conclusion

The research survey was conducted on companies in Slovak Republic and it was focused on strategic management. The main part of strategic management is the formulation of the strategy so also the research was focused on the analysis of this task.

All hypothesis were confirmed so companies formulate strategy which means that strategic management plays significant role in the companies in Slovak Republic. There is also a connection between formulation of the strategy and legal form of the company and size of the company based on the amount of employees. Based on the research survey can be also assumed that not only medium and large companies formulate strategy but also small and micro companies (based on the amount of employees) formulate strategy. So companies nowadays realize the importance of the strategy and strategic management. On the other side mostly limited liability companies (LLC) and joint – stock companies formulate strategy so we recommend that also cooperatives, national companies and small traders should formulate strategy and focus on strategic management. The main reason why companies don´t formulate strategy is that they don´t consider formulation of the strategy as an important part of business activities. Subsequently one quarter of questioned companies without strategy plan to implement strategy in the company and another quarter not only plan to implement but they already work on it.

Competitiveness, dynamic and changing environment affect the life of the company so companies have to adapt to these which can be realized through the implementation of the strategy and strategic management. So there is a significant potential for further research in the area of strategy as who creates the strategy in the company, on which is the strategy focused, the time horizon of the strategy, what methods are used for the implementation of the strategy, if companies accomplish also strategic control and so on. Based on the further research and knowledge of these additional important information about strategic management in companies in Slovak Republic can be assumed other recommendations.

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# Cause-related Marketing as a New Trend in the Field of Corporate Social Responsibility

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**Abstract.** This paper focuses on the importance of marketing tool called cause-related marketing. This is a promotional activity that helps companies achieve business objectives through the promotion of socially useful non-profit projects which is connected to the normal activities of the company. Customers appreciate civic engagement of companies and they are more willing to trust company and that also influences their buying behaviour. The idea is that the company pays a specific amount or percentage of each product sale to charity. This paper describes the issue of cause-related marketing and highlights its benefits. A survey, we conducted, showed that Slovak consumers would accept more activities especially in the area of health service, environment and activities for children and youth by companies. We used methods such as information analysis which are obtained from the survey, a synthesis of this information and deduction.

**Keywords:** cause-related marketing, corporate social responsibility, customer, business, non-profit organizations

## 1. Introduction

Nowadays, economic subjects are being much more often forced to justify their existence in the market. Application of the traditional marketing tools in many cases not enough to achieve business objectives. Part of the customers defends yourself against the amount of information that reject all what is offered to them for purchase. The question is how to alleviate the impression that companies are trying to get from tired customers the most, without providing them a corresponding consideration. Within the broader ethical behaviour of businesses there is particular marketing tool, about which we can argue that is able to restore customer confidence in the business, improve reputation of promotional tools, expand their human dimension and from passive philanthropy realise socially stimulating initiative in the field of customer. This tool is a cause-related marketing representing the traditional promotional activities which connects the product of the enterprise with a socially useful purpose.

## 2. Cause-related Marketing

Corporate Social Responsibility (CSR) can be divided into several levels, mostly we talk about the level of economic, social and environmental. Into social plane includes the corporate philanthropy. Businesses are daily encouraged to get engaged in solving global problems or improving the surrounding area within a local scope. Appeals are not directed only to the internationally important companies, but also are focused on the companies on a national and regional level. The most common manifestations of the corporate philanthropy are donation, establishment of corporate foundations, cause-related marketing, matching funds, training, education and support, participation on management boards and commission grant the non-profit organizations and corporate volunteering. [4] Company can demonstrate their philanthropic approach in the context of cause related marketing (CRM), which represents the connection of commercial activities - the use of marketing tools - with the philanthropic activities. [1] Concept of cause related marketing was first described by American Express in 1983 in its marketing

campaign, which should help to gain funds for the benefit of the Association for the recovery of the Statue of Liberty. From every payment by card it gave a penny for this association and from every new request about credit cards issue gave one dollar. The result of the campaign was the increase cardholders by 45% and 27% increase in their use. In order to restore the Statue of Liberty was collected 1.7 million. USD. [5]

### 2.1. CRM as a New Tool for Achieving Business Objectives

Pokorná defines CRM as "*connection of public benefit affairs with the company marketing activities. The result is a socially engaged marketing campaign, which has the potential to be more attractive and more profitable than the standard campaign using traditional marketing tools.* "[8] According to Clow and Black CRM "*is program, within which the company is going to link your marketing program with a specific charitable projects to gain public confidence.*"[2] Kotler explains that CRM "*pays contributions on a predetermined event - to promote problem solving of certain target groups in society*." [7]

Mutual benefit is one of the factors that distinguishes CRM from traditional marketing, but also from other forms of profit and non-profit subject cooperation, which include:

- creating social value and value for stakeholders,
- collaborative partnership,
- interconnection and ability to attract key components of the enterprise, including employees and customers,
- expression civic values. [3]

The main objectives of CRM include two areas. First, it tries to gain and forge relationships with their customers, who more support brand and sympathize with her through CRM projects. The second area is greater involvement and activity of the consumers into consumer process. It also strengthens the customer's sympathy and faithfulness of product. [8]

CRM is often confused with corporate donations and sponsorships, but their goals are not the same. Substance of corporate donations is a one-time contribution to a specific non-profit purposes, which may or may not be pre-defined. Sponsorship is a form of advertising that is designed to remember, recognize and imagine brand or logo. [7]

CRM represents a number of advantages for company. The most important is strengthening relationships with customers, because company can extend its name to other values, emotions and credibility with CRM. From CRM campaigns can also benefit non-profit organization that through this projects receive financial support, which is the objective of the project. CRM is a win-win strategy that is benefit for all stakeholders. [8]

### 2.2. Forms of CRM Implementation

There are many ways through which customers can contribute to non-profit project.

Purchase of a product or service - the company may propose a new design products in a limited edition or add on product packaging logo or symbol of the project in the CRM campaign, or can produce special products to help the project. From the sale of each product or service is paid a certain proportion to the non-profit project account.

Reward for buy - is realized in retail chains where customers can add to the price of their purchase sum of money as a gift for the benefit of certain non-profit organization in the cash zone.

Purchase a license to use non-profit organization logo / brand - company pays for location of non-profit organization name, logo or mark on their products or adds to their products recommendation and mark of quality in context of non-profit organization.

Event co-branded - it is a deeper cooperation non-profit and corporate partners, which includes in addition to providing a product or space for the presentation of non-profit organization, also expending force in hosting a particular event. This may be charitable and commercial.

Social Marketing Program - it seeks to change the behaviour of a particular target group. The purpose is removing some of the negative social effects for the benefit of whole society. [3]

The issue of CRM is well developed in abroad, as evidenced by the business activities in this area such as McDonalds, Procter and Gamble or Avon. In Slovakia this issue is in its beginning and there is little business that use it.

## 3. Slovak customers and CRM

In the United States there are granted for corporate efforts Halo Awards in different categories such as best educational, environmental and health campaign, best print advertising or best locally oriented project. We can therefore state that the tradition of CRM is here quite long. In comparison with Slovakia there are significant differences.

Corporate philanthropy is applied through cause-related marketing only 4% of Slovak companies. In comparison with the cash donation (39%) or in-kind donations (20%), it is quite a few. [6]

In January 2015 we conducted a survey on "Corporate social responsibility in terms of customers." The survey involved 397 respondents and the aim was found out how customers perceive the concept of Corporate Social Responsibility.

One of the questions was focused on determination of customer satisfaction with a number of CSR activities.

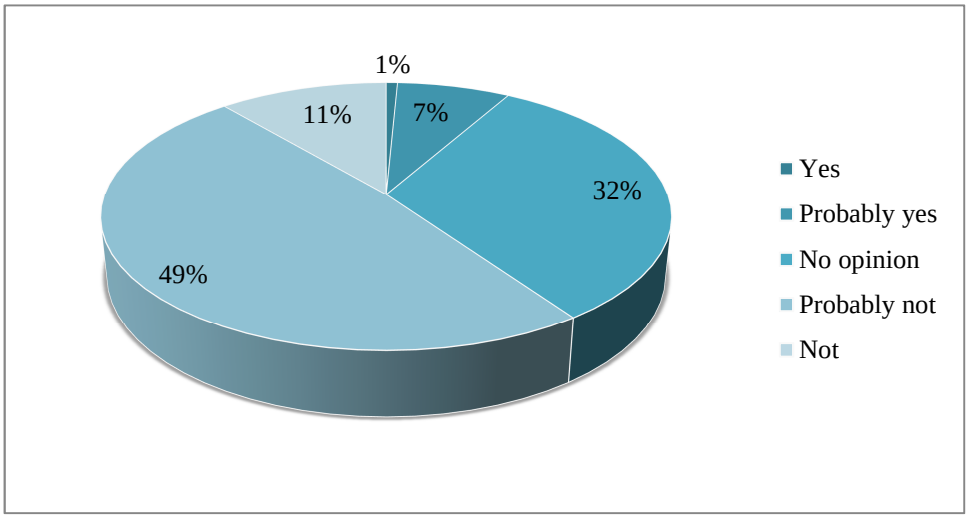


**Fig. 1**. Customer satisfaction with a number of CSR activities in Slovakia

According to the survey, only 8% of respondents are satisfied with the activities of companies in the area of CSR. On the other side, the answer "Not" and "Probably not" said 60% of customers. We were also interested in social responsibility area, which needs more activity from companies according to respondents dissatisfied with the amount of CSR activities.

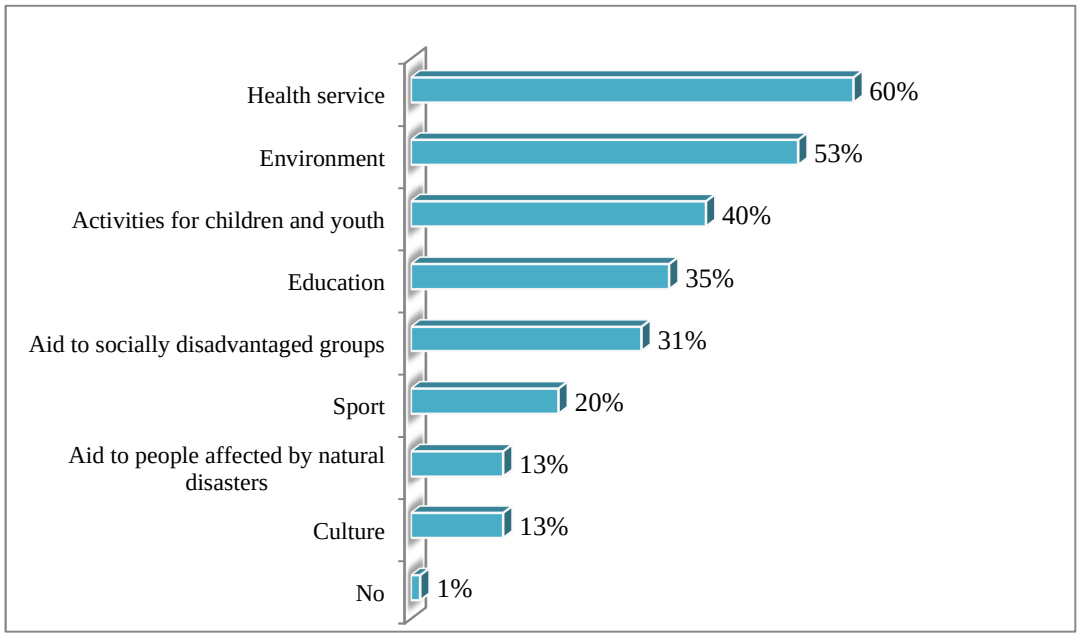


**Fig. 2**. Areas in which the Slovak customers would like greater activity of companies

Respondents could choose 3 most important areas in which companies could be more engaged. According to the survey results, respondents wish that companies focus their activities mainly on the health sector (60%), it is followed by the environment (53%) and activities for children and youth (40%).

We can state that company in Slovakia within CSR would like to orient in the issue of cause related marketing should focus on the health sector. In this case, it might pay a specific amount or percentage of its each product, for example, to purchase equipment to health facilities or to restore their departments. If it would focus on environmental, resources could be directed to support separate collection. Company could also provide funds for the construction of children's centres and playgrounds or to promote leisure centres.

## 4. Conclusion

Cause Related Marketing is a new trend within the concept of Corporate Social Responsibility. In Slovakia, the term is quite new and Slovak consumers are not very accustomed to this form of assistance of commercial companies. That depends on individual companies how they are able to use this marketing challenge. Cause-related marketing is a win-win strategy that is benefit for all stakeholders - company, non-profit organizations and customers.

Slovak consumers are not satisfied with lots of activities in the CSR. They should accept more activities particularly in the context of health, environment and activities for children and youth. If companies in Slovakia would like to carry out cause-related marketing, they should particularly focus on this areas.

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# Clinical audit in Emergency Medicine

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**Abstract.** This article informs what clinical audit is and how it helps managers of different healthcare facilities to measure the clinical performance and to improve the quality of clinical practice. In this article are mentioned and described the different steps of the clinical audit cycle. Although the publications of clinical audit are in the medical literature rare, clinical audit should be mandatory for all healthcare providers, and emergency physicians are no exception. In the first section there is shown the evolution of audit definition since 1989 till nowadays. The core of this paper deals with the position and people who should be involved in the audit cycle process and the last part is dedicated to detailed description of all phases of audit cycle.

**Keywords:** Healthcare, clinical audit, audit cycle, quality improvement.

## 1. Introduction

The professional life object of, whether physicians, as well as managers, should be the effort of ensuring optimal, effective and quality care. On the other hand, as our society becomes more and more affluent and demanding and better informed, expectations for the quality of clinical services are constantly growing. Measuring and monitoring must be carried out to maintain the trust and respect from the public. As a tool for improving the quality, clinical audit is a way how to show to public that a genuine effort comes from the health professionals in order to provide high-quality patient care [3].

### 1.1. Definitions of clinical audit

In 1989, the book "Working for Patients", published by the Ministry of Health in the United Kingdom (UK), defines medical audit as "a systematic critical analysis of the quality of health care, including the procedures used for diagnosis and treatment, the utilization of resources as well as the final output and life quality of the patient. “As it was later considered the audit was extended to all healthcare workers and health audit later evolved into a clinical audit.

In 2002, the National Institute for Health and Clinical Excellence (NICE) in its publication "Principles of best practice in clinical audit" defines clinical audit as "Improving the quality of processes that seek to improve patient care and outcomes through systematic evaluation of care against explicit criteria and the subsequent implementation of change. Aspects of the structure, processes and outcomes of care are selected and systematically evaluated according to clear criteria. Where problems are indicated, changes are implemented at an individual, team or service level and following monitoring serves to confirm improvements health care.


**Fig.1.** The national Institute for Health and Clinical Excellence [2].

The latest definition of 2009, according to NICE is: "Clinical audit is a process that helps to ensure the delivery of right treatment, right man and the right way, to patients and users of health services." This is made through measurement and comparison of care and service provided with evidence-based standards and then attempt to narrow the gap between existing practice and what is known as a best practice [2].

### 1.2. Who should be involved in clinical audit?

Clinical audit is a multi-disciplinary activity and should involve everyone who is involved in the provision of health care. As part of the clinical audit program, all projects should be recognized and approved by the Board. Manager and physicians should be aware, or should be involved in various projects, from the outset so that they are ready for leadership and management of resources and the necessary changes in practice or service that will lead to a higher quality of care of patients and service users. Representatives' providers and care recipients who are under investigation should be involved at all stages of clinical audit. This includes clinicians from different professions, patients, service users and carers. Clinical audits should also follow the patient flow, and this may include working in different sectors, for example in the context of primary, secondary and tertiary health and social care.

## 2. The place of clinical audit in modern healthcare

Clinical audit is an essential and integral part of clinical governance or management. Clinical audit is a part of the clinical management and part of a system which improves the level of clinical practice. Clinical governance is the system by which the organizations and hospitals response for continuously quality improving of services. This ensures that they are complied with clear lines of responsibility, and the ongoing comprehensive program of quality improvement systems.

The six pillars of clinical governance is "Fig.2" [1]:

- Clinical effectiveness / efficiency.
- Research and development.
- Openness.
- Risk Management.
- Education and Training.
- Clinical Audit.


**Fig.2.** Pillars of clinical governance

### 2.1. Why is clinical audit so important?

Clinical audit provides a framework for improving the quality of patient care in cooperative and systematic way. If the clinical audit is performed well, it allows objectively assess the quality of care within an approach that is supportive, developmental and that focuses on improving.

The advantages of clinical audit include [2]:

- Support and facilitate best practices.
- Improving the patient experience and outcomes.
- Provide evidence to demonstrate where the services are clinically and cost effective.
- Providing opportunities for training and education.
- Enable better use of resources and the consequent increase in efficiency.
- Improve communication and connection between doctors, managers, patients, users services and organizations.

## 3. The process of clinical audit

Clinical audit can be described as a cycle “Fig.3”. In this cycle, there are number of phases which are identifying best practices, and compare them with the criteria for the improvement of care and pursue sustainable improvements. As the process continues, each cycle aspires to a higher level of quality.

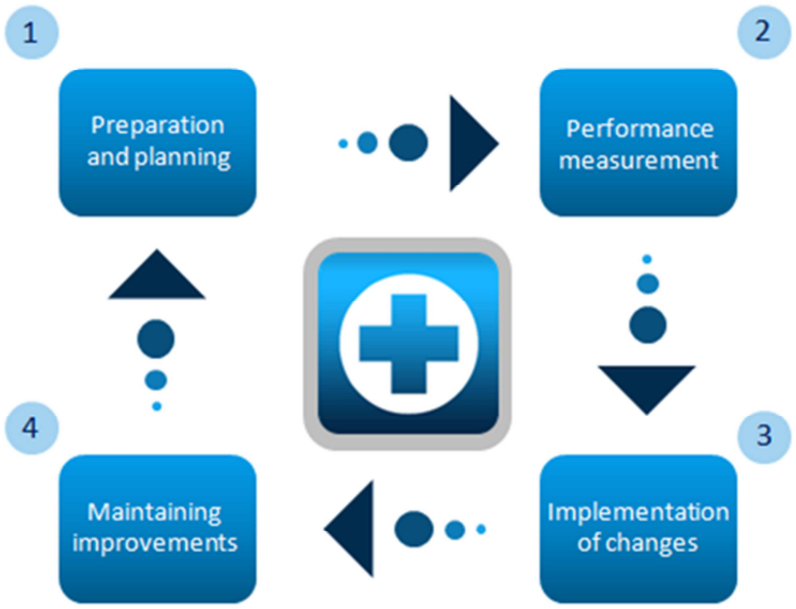


**Fig.3.** Cycle of clinical audit

### 3.1. Phase 1 - Preparation and planning (including re-audit)

This phase includes the selection of topics of clinical audit, ensuring that it is a priority agreed by all those, who are involved in the process, and the standards that the current practice measures, are based on evidence. A clear project plan should be developed to comply the structure, responsibilities, and timelines and proper financed by all the participants. Any financial costs of the clinical audit should be established and agreed with the people who are responsible for carrying out the necessary changes and provide the necessary leadership.

### 3.2. Phase 2 - Performance Measurement

The detailed methodology and data collection process must be designed and tested, including a sufficient sample size and a clear and concise set of data. The data are analyzed using appropriate statistical methods and measurements and are reported in a manner that maximizes the impact of clinical audit to ensure that the results are effectively communicated to all key stakeholders.

### 3.3. Phase 3 - Implementation of changes

As soon as the audit results and recommendations for change are made, there should be drawn up an action plan to monitor implementation of these recommendations.

### 3.4. Phase 4 - Maintaining improvements (including a re-audit)

After the agreed period, the process should be audited again. The same strategy for identification of samples, methods and data analysis, should be used, to ensure comparability. Re-audit should demonstrate that the changes that have been made, made improvements. Further changes can then be required, resulting in a further re-audit [4].

## 4. Conclusion

An audit may be seen as a threat of critics. It may be considered annoying and time-consuming distraction from the busy everyday practice. However, with the clear objective, to create a transparent and supportive culture that is effective in improving employee performance and patient care. As a tool for improving the quality, audit is way how to demonstrate the responsibility of those who truly seek to provide high-quality patient care, to those who come from outside.

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# The Knowledge economy

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**Abstract.** This article talks about the development of the economy. After the industrial society, globalization and the development of information and communication technology have contributed to creation of knowledge society and associated knowledge economy. Knowledge is becoming one of the most important sources for companies. Efficient use of knowledge brings competitive advantage for companies.

**Keywords:** Knowledge economy, knowledge, knowledge economy index

## 1. Introduction

The knowledge economy is driven primarily by technological advance and rising domestic prosperity increasing the demand for knowledge based services. Global competitive pressures are of course important, and overall, the knowledge economy may be increasingly engaged in the global economy for the following reasons:

- The stock of ideas and knowledge is a global stock that firms and organizations can access from around the world via the Internet: globally engaged firms use more knowledge and have access to a wider stock of knowledge through their suppliers and customers.
- Global labour markets may be emerging for knowledge workers, with world-class universities competing for the best and brightest. Some argue that knowledge economy firms in the future will increasing turn to Asia for "cheap smarts" rather than rely exclusively on home produced talent.
- National measures of R&D effort may be increasing misleading as a guide to overall R&D intensity and as a proxy for innovation.[1]

In light of current developments and changes, some authors say about the third wave of lifestyle changes[1]. The second wave created mass companies that reflect and require mass production. In the third wave of the economy, based on intellect, mass production is already obsolete form. Demass production - a small series of highly specialized products - is a privileged form of production. [2]

## 2. Knowledge economy

Many authors define knowledge economy in different ways. According to Powell and Snellman, knowledge economy is production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. [3]

The OECD has spoken of knowledge-based economies in very general terms, as meaning "those which are directly based on the production, distribution and use of knowledge, information." [4]

[1] The first wave of change is civilization transition from nomadic to agrarian way of life. The second wave created industrial society and the industrial revolution.

The knowledge economy is the use of knowledge to generate tangible and intangible values. Technology and in particular knowledge technology help to transform a part of human knowledge to machines. This knowledge can be used by decision support systems in various fields and generate economic values. Knowledge economy is also possible without technology. [5]

Economic success is increasingly based on upon the effective utilization of intangible assets such as knowledge, skills and innovative potential as the key resource for competitive advantage. The term "knowledge economy" is used to describe this emerging economic structure. [6]

Definitions of the knowledge economy have something in common - the knowledge economy mean a new stage in the development of society, the essence of which is sustainable economic growth based on knowledge and innovation. Sustainability are understood in all its dimensions, it mean environmental, economic, social and institutional dimension. [7]

### 2.1. Knowledge as an economic good

The ability to store, share, and analysis knowledge through networks and communities using the new ICT technologies allows firms to exploit the unique properties of knowledge to gain competitive advantage. Perhaps the most important property is that knowledge is the ultimate economic renewable - the stock of knowledge is not depleted by use. Indeed, the value of knowledge to an economy comes from sharing with others.

A distinction is often made between codified or rule based knowledge that can be written down and stored and tacit knowledge that is acquired on the job and resides with the individual as know-how and experience. Some argue that one of the key distinguishing features of the knowledge economy is deploying new technologies to allow the more systematic exploitation of tacit knowledge. [1]

### 2.2. Indicators of knowledge economy

Most used indicators could be grouped into six categories:

- Knowledge creation, such as BERD, GERD, and other R&D related indicators (input indicators) and patent indicators (output indicators).
- Human resources and mobility (education related input indicators and employment related output indicators).
- Transmission, application, and output covering clustering, networking, knowledge building and knowledge sharing, collaborative R&D, connectedness, transfer of knowledge, linkages between science and innovation, linkages between universities and businesses, spin offs, as well as new to market (products and services) , new to firm (products and services) and nontechnological innovation.
- Innovation finances, such as venture capital and entrepreneurship, ICT expenditure and innovation expenditures (input indicators).
- Macro–economic performance (structurally related as input indicators and performance related as output indicators).
- Broadband, e-government, e-commerce, and e-health (input indicators). [8]

### 2.3. Knowledge Economy Index

Knowledge Economy Index (KEI) is an aggregate index that represents the overall level of development of a country or region in the Knowledge Economy. It summarizes performance over the four KE pillars and is constructed as the simple average of the normalized values of the 12 knowledge indicators of the basic scorecard.

The base of KEI is Knowledge Index and Economic and Institution Regime Index. Economic and Institution Regime Index have three basic pillars: tariff and nontariff barriers, regulatory quality and rule of law.

The Knowledge Index (KI) measures a country´s ability to generate, adopt and diffuse knowledge. The KI is the simple average of the normalized scores of a country or region on the key variables in three Knowledge Economy pillars – education, innovation and ICT. [9]

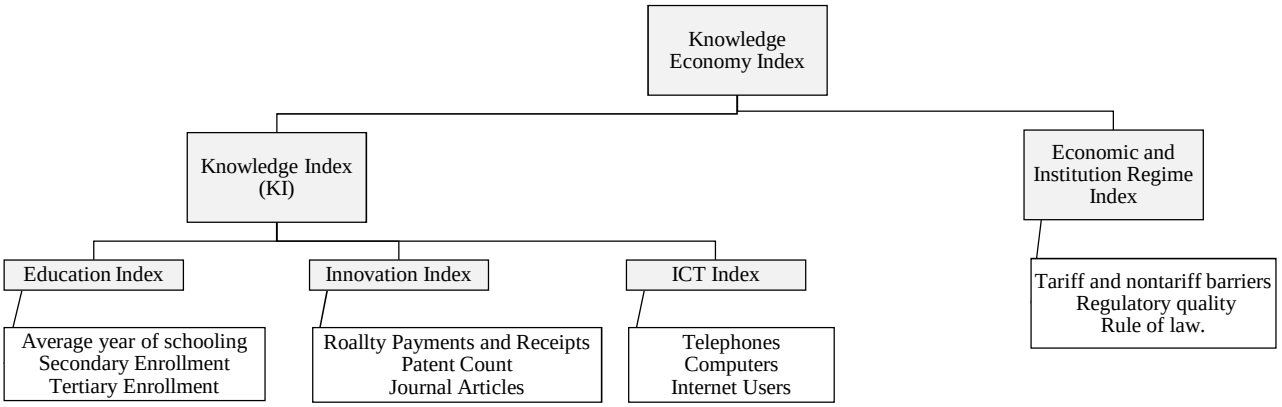


**Fig 1** Knowledge Economy Index – description [9]

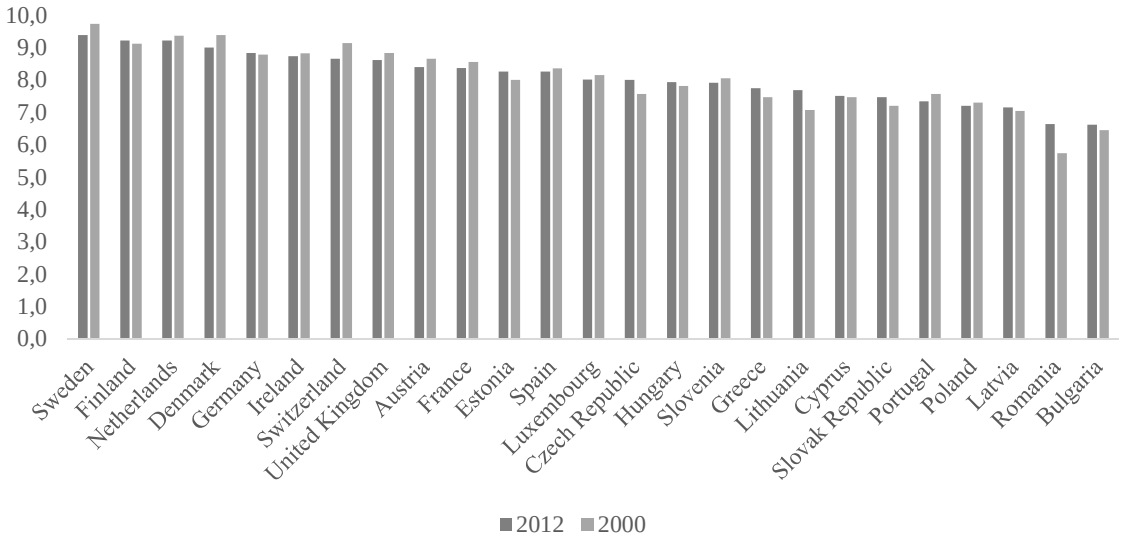


**Fig 2.** Knowledge Economy Index of Europe Union Country [9]

## 3. Conclusion

The knowledge economy is a new trend. Proof of it are many definitions of knowledge economy by different authors, definition of knowledge by OECD and also KEI of World Bank.

The base of time of knowledge is expanding use of ICT. But ICT work mainly with data and information, which must be combined with human experience to become knowledge.

Also economic success is increasingly based on upon the effective utilization of intangible assets such as knowledge, skills and innovative potential as the key resource for competitive advantage. The most important property is that knowledge is the ultimate economic renewable - the stock of knowledge is not depleted by use. Indeed, the value of knowledge to an economy comes from sharing with others.

Therefore companies should take emphasis on employees and their knowledge. They are an inexhaustible source, which by using increases their value and therefore provides a competitive advantage for companies.

Successful use of knowledge is important not only for companies but also for the state. Successful companies bring more money to the state and employ more people. Therefore States, in cooperation with enterprises, should promote the knowledge management.

In practice, it means supporting of education, innovation, ICT and economic and institution regime. Support of education means raising the average year of schooling, promotion of university education and also third grade. In education would have to be the emphasis on quality rather than quantity. Promotion of innovation means promoting innovation and patents, their legal protection and promotion of articles about innovation (new knowledge), i.e. share knowledge with more people. ICT support means supporting the use of modern technologies to all citizens. Economic and institutional regime is setting the rules of law, regulate the quality and setting barriers.

Joint efforts of companies and States support work with the knowledge and help build successful companies in the market and hence support for the state budget.

Joint efforts of companies and state to support work with knowledge and thereby help building successful companies. Successful companies bring more money to state.

## Acknowledgement

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# How Much Does Piracy of Intellectual Property Cost: Case Study of Bulgaria

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**Abstract**. The main aim of the study is to present the results of estimated losses for the rightholders and other stakeholders from a single torrent site. A single torrent site is chosen and a simple sample of 120 torrents is made. The market price for each torrent is found using information from online shops. The estimation of the losses is calculated using statistical methods. The result is valid for some assumptions. The study covers the period from 04.01.2005 to 20.02.2015.
Loses for the right holders are between 4 896 588 and 6 635 221 Bulgarian levs, which is equal to 2 503 586 and 3 392 535 euros for the observed period. It is important to note that these results are based on the assumption that every torrent is downloaded only once.

**Keywords:** torrent, estimation, rightholder, intellectual property

## 1. Introduction

With the development of new technologies transmission of information has become increasingly easier. The World Wide Web gives the opportunity for everyone to access a large amount of information for a very short period of time. Nowadays intellectual property is mainly in digital form, which makes it quite easy for processing, sending or using without the permission of the rightholder. It is not surprising that opportunities appear for "free downloads" of content that is copyrighted. One of these ways is torrent sites, which use "Peer to Peer" file sharing technology. Although this technology is completely legal, many of the files traded through it are copyrighted. The main aim of this paper is to present the estimated results of estimated losses for the rightholders and other stakeholders from a single torrent site.

## 2. Methodology

There are over 15 Bulgarian torrent sites. Fig. 1 shows the quantity of torrents for each of the four biggest torrents sites in Bulgaria. We needed to select one of the sites for the purpose of this study.

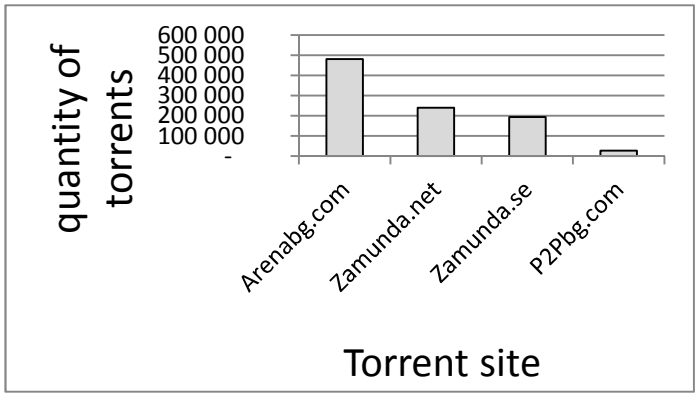


**Fig. 1.** The quantity of torrents for each of the four biggest torrents sites in Bulgaria.

As we can see Arenabg.com is the site with the largest number of torrents, but its interface is not suitable for the purpose of ensuring the representativeness of the sample. Zamunda.net has a suitable interface and it is the second largest torrent site by quantity of torrents which makes it appropriate for the purposes of this study.

The study covers the period from 04.01.2005 to 20.02.2015. The date the survey was conducted is 20.02.2015.

To estimate the total losses from this website it is necessary to make a representative sample of torrents and to find the market price of each of them. Unfortunately it is not possible to find a price for all categories. This requires excluding some torrent categories. These categories are TV Series, TV Shows, Adult Content and Sport TV Shows. After the exclusions the population size of torrents on Zamunda.net is 164 457.

One hundred and twenty torrents were randomly selected. A price from an online store was found for each of them. It should be noted that most of the torrents could be bought neither from a Bulgarian online store nor from a physical one in Bulgaria. Therefore Amazon.de, Amazon.com and Bulgarian online store, Store.bg were used. The prices that have been used were minus any discounts. The prices from Amazon.com are in US dollars and from Amazon.de in euros, requiring them to be converted to Bulgarian levs. For that purpose the exchange rate of the Bulgarian National Bank was used for the day of the study. On 20.02. 2015 the exchange rate USD/BGN was 1,733113. It is necessary to note that the Bulgarian lev has a fixed exchange rate of 1.95583 to the euro.

The obtained data was described in a table with 120 rows. Because of the size of the table it is not possible to apply the table.

The average price of a torrent for the sample is calculated using the formula for weighted arithmetic mean (1):

$$\bar{x} = \frac{x_1 . f_1 + \cdots + x_{120} . f_{120}}{f_1 + \cdots + f_{120}} \tag{1}$$

where:

$\bar{x}$ – average price of a torrent

$x_1$ – price of the first torrent

$f_1$ – number of downloads for the first torrent

$x_{120}$ – price of the 120$^{th}$ torrent

$f_{120}$ – number of downloads for the 120$^{th}$ torrent

Using the collected data the following equation is reached (2):

$$\bar{x} = \frac{648407}{18494} = 35{,}06 \tag{2}$$

The average price of a torrent is 35,06 Bulgarian levs, which is 17,926 euros.

Based on the weighted average mean for the sample the weighted average for the population size is estimated. For that purpose it is necessary to calculate the standard error with equation (3)

$$\mu_{\bar{x}} = \frac{\sigma}{\sqrt{n}} . \sqrt{1 - \frac{n}{N}} \tag{3}$$

where

$\mu_{\bar{x}}$ – standard error

$\sigma$ – standard deviation of the population

$n$ – number of units in the sample

$N$ – number of units in the population

Information for the standard deviation is not available therefore calculating its estimate is required. For this purpose the following equation is used:

$$\sigma = \sigma_{sample} \cdot \sqrt{\frac{n}{n-1}} \tag{4}$$

To calculate the standard deviation of the sample the following equation is used:

$$\sigma_{sample} = \sqrt{\frac{\sum \left(x_i - \bar{x}\right)^2 . f_i}{\sum f_i}} \tag{5}$$

where:

$x_i$ – price of the i[th] torrent

$f_i$ – number of downloads for the i[th] torrent

Using the collected data and (5) the standard deviation of the sample is calculated:

$$\sigma_{sample} = \sqrt{\frac{16019002}{18494}} = 29{,}43076 \tag{6}$$

Then, the estimation of the standard deviation of the population will be:

$$\sigma = 29{,}43076 \cdot \sqrt{\frac{120}{119}} = 29{,}55416 \tag{7}$$

The standard error will be:

$$\mu_{\bar{x}} = \frac{29{,}55416}{\sqrt{120}} \cdot \sqrt{1 - \frac{120}{164457}} = 2{,}696929 \tag{8}$$

To find the maximum allowable error it is necessary to multiply the standard error by z multiplier. For the purpose of the study the z multiplier is chosen at the 95% probability level, being 1,96. The maximum allowable error will be:

$$\Delta_{\bar{x}} = z.\mu_{\bar{x}} = 1{,}96.2{,}696929 = 5{,}28598 \tag{9}$$

where:

$\Delta_{\bar{x}}$ – maximum allowable error

To find the confidence interval of the mean it is necessary to apply the following equation:

$$\left[\bar{x} - \Delta_{\bar{x}}; \bar{x} + \Delta_{\bar{x}};\right] \tag{10}$$

The confidence interval of the mean of the price of downloaded torrents from Zamunda.net will be:

$$[29{,}774; 40{,}346] \tag{11}$$

By multiplying the ends of the interval by the total number of torrents in the population the losses for the rightholders in Bulgarian levs will be estimated:

$$[4\,896\,588; 6\,635\,221] \tag{12}$$

Loses for the right holders are between 4 896 588 and 6 635 221 Bulgarian levs, which is equal to 2 503 586 and 3 392 535 euros for the observed period.

It is important to note that these results refer on the assumption that every torrent is downloaded only once.

## 3. Conclusion

The results show the huge amount of torrents available for downloading and their market price. The economy loses millions from this unethical consumption behavior. Stakeholders concerned by this behavior are not only authors and other rightholders, but also marketplaces, especially small ones.

The opportunity for “free downloading” tolerates this unethical behavior and adversely affects business. In many cases even when the consumer wants to, it is impossible to buy the required product from a shop located in Bulgaria. It is necessary to order from a shop outside the country which is much more inconvenient then downloading it free from a torrent site. But this deficit of product is due to the low demand which is insufficient to return the required profit for distributors.

On the other hand the level of incomes for the country should be considered. The minimum wage is 360 Bulgarian levs per month and the average is 847 levs per month. Compared with that amount, 29,77 to 40,26 levs on average is very high price for the torrent content.

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# Content Marketing as an Initial Part of the Green Marketing Strategy

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**Abstract.** Green marketing, as the main current business mainstream, is based on building long-term oriented relationship between customer and company. Here is necessary to involve customer to the process of setting strategy direction. This article is ambitious to explain the importance of content marketing as an initial part of green marketing strategy that is nowadays the most effective form to attract customers. It is an overview of main stages and conditions, what have to be met. Marketers have to set right content that will be followed by customers. Paper offers a summarization of research view and steps that company should assure if it would want to be successful in high competitive market.

**Keywords:** green marketing, content marketing, customer, engagement, conversion.

## 1. Introduction

Economic and political crisis has not only stopped economic development, but also given the difficult task to many managers – to restart effectively growth and prosperity of their companies. Current internal and external environment conditions make this situation even more challenging. Managers are focused on using business tools with more realistic expectations. Majority of companies sees the source of the future growth in investments to environmental sustainability.

According to Bain Company research, six of ten companies would invest to sustainable initiatives even they could have higher costs [1].

Several companies very fast accepted Environmental Management Systems (EMS) and have started to implement eco friendly approach in every business processes and activities. Sustainable initiatives are provided with win-win attitude that allow saving costs on the one hand and on the other hand, it demonstrates the customers´ awareness that are looking for responsible companies. Customers are fully aware that environmental issues are connected with all activities of human being.

Marketing is one of the business activities where the questions of sustainable development have found substantiation. Marketing is traditionally defined as the process of planning and implementation of business strategy, which determines the pricing, promotion and distribution of ideas, goods and services in order to replace for achieving the objectives and needs of individuals or organizational goals [2].

According to Kotler, marketing is the science and art of exploring, creating, and delivering value to satisfy the needs of a target market at a profit. Marketing identifies unfulfilled needs and desires. It defines, measures and quantifies the size of the identified market and the profit potential. It pinpoints which segments the company is capable of serving best and it designs and promotes the appropriate products and services [3].

Despite the fact that this definition does not explicitly specify the fixed link between marketing and society and the environment, it is clear that it would be not here without them. The necessity of involving the society's needs and environmental conditions led to the development of marketing, and follow to the culmination of a new concept of green marketing.

### 1.1. Core of Green Marketing

Green marketing involved wide range of activities, which including modification and innovation of product, changes in production process, packaging, and communication and promotion.

Jacquelyn Ottman stated that today there is a difference between business activities and processes and the way company communicates with its customers and neighbourhood. However, it is expected that we will not find any differences between green marketing and green company in future [4].

Therefore, companies have started to set up new aims in the context of green marketing. Their effort is focused on development of products that have adequate quality, performance, and price and at the same time, they are responsible to the environment and looking for business processes that have minimal negative impact on environment. Currently, terms as green, sustainable or ecological are used regularly and this reflects the raising interest of society about impact of growing consumption on the natural environment. According to the American Marketing Association (AMA), Green Marketing can be defined in three different ways: retailing, social marketing and environmental definition. First, green marketing is the marketing of products that are presumed to be environmentally safe. Second, green marketing is the development and marketing of products designed to minimize negative effects on the physical environment or to improve its quality. Third says, that green marketing is the efforts by organizations to produce, promote, package, and reclaim products in a manner that it is sensitive or responsive to ecological concerns [5]. Green marketing is related to each activity and process in a firm. Vanda Lieskovská fulfils mentioned definition and says that there is a mutual cohesion and support between customer and company and at the same time. The main importance is made by involving the protection of the environment, because the natural characteristic of consumption is waste caused by a drain on natural environment [6].

Charter [7] defines green marketing as a holistic and responsible strategic management process that identifies, anticipates, satisfies and fulfils stakeholder needs, for a reasonable reward, that does not adversely affect human or natural environmental well-being.

Holistic approach means that company has to take care about every single key issue and their relations and dependence. According to Ottman, Green marketing is ambitious to reach two objectives; it improves the environmental performance and customer's satisfaction [4].

Dacko [8] states, that company should its green marketing activities presents to customer by motivational and relevant form of communication, therefore customer's buying behaviour contributes to worldwide development.

Grant [9] confirms it with words: "the aim of green marketing is to educate customers, make effect on their behaviour and the change of lifestyle what should create natural need and determination to behave environmentally friendly. The basis of the green marketing is to present the importance of protection of the environment and product's consumption that is related to this issue. Green marketing highlights the long-term relationship building that is based on both side communications not only with customer, but also with all stakeholders. It will be seen from customer service, product design and to support, sponsoring and active solving social problems. The main task is to create and support the sale of products that are meeting with need and wish of customer and at the same time they have minimal negative impact on the environment in whole life cycle process. Green marketing is currently considered as the mainstream, as the main trend in business by many authors.

To sum up these definitions, the most important in promotion and communication is to join and educate stakeholders and create sustainable strategy. This period is characterised by innovation, technological and technical changes and using electronic communication by Internet and social media. Therefore, the most effective form of the marketing that can be currently used and has all the required attributes of green marketing is **content marketing**. As was mentioned, customer has to be joined to the process of setting strategy; he has to have the space to comment and express his feeling and needs and those have to be met.

## 1.2. Content Marketing

Content marketing is a strategic marketing approach focused on creating and distributing valuable, relevant, and consistent content to attract and retain a clearly-defined customer with the intention of changing or enhancing consumer behaviour [10]. Moreover, it leads to a profitable customer action. Therefore, it is ongoing process integrated into green marketing strategy, focused on owning media, not renting it. Content marketing is communication with customer without selling. It is delivering consistent, ongoing valuable information that makes buyer more intelligent. Content marketing includes six main stages: listening to a customer, decision about the form, topic and themes that will be delivered, creating content, promoting content, measuring, evaluating, and re-purposing. Process is displayed in the figure 1 below.

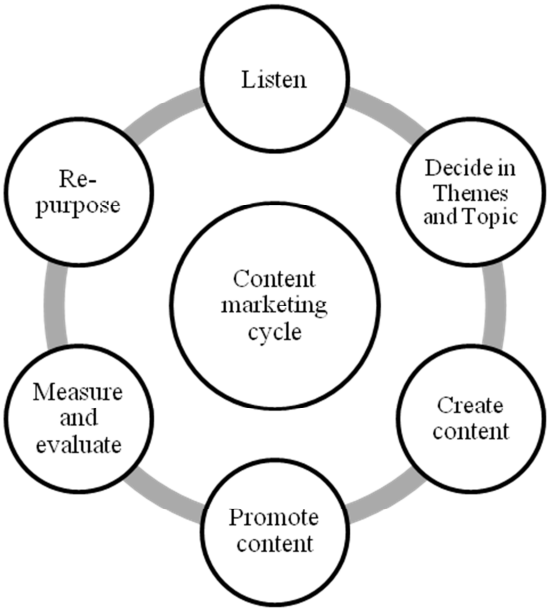


**Fig. 1.** The process of content marketing

## 1.3. Statistics Overview

Eighty-two percent of B2C marketers and 95% of B2B marketers use content marketing. Seventy-eight percent of CMOs believe custom content is the future if the marketing industry. Only 12% of companies ignore content in their marketing efforts. Despite the fact that content is proven valuable, only 32% of marketers believe they are executing an effective strategy [11]. Marketing is impossible without content. Regardless of what type of marketing tactics is followed in company, content marketing should be part of process, not something separated. Quality content is part of all forms of marketing as:

- Social media marketing: Content marketing strategy comes before social media strategy.
- SEO: Search engines reward businesses that publish quality, consistent content.
- PR: Successful PR strategies address issues to readers care, not their business.
- PPC: It is necessary to have content behind PPC work.
- In bound marketing: Content is a key to driving inbound traffic and leads.

According to Roper Public Affairs and its research, customers feel more involved if the company educate them. Eighty percent of business decision makers prefer to get company information in a series of articles versus an advertisement. What is more, 70% say content marketing makes them feel closer the sponsoring company. Sixty percent say that company content helps them make better product decisions [12].

***Types of content tools*** that are possible to use are blogs, webcasts and podcasts, magazines, websites, microsited, online communities, events, email, video, mobile apps.

Content should start with clear set up the:

- core audience - target group;
- useful information, advices, insights, resources and inspiration that will be delivered to the audience;
- the outcome for the audience [10].

## 2. Content Marketing Process

If company would like to set up good content, it should know its customers. Therefore understanding the lifecycle is paramount for company to enjoy years of business success. Like all lifecycles, it consists of a series of steps. The customer life cycle is a term used to describe the progression of steps a customer goes through when considering, purchasing, using, and maintaining loyalty to a product or service [13]. The chain of customer life cycle is displayed in the figure 2 below. Different marketing and social media tools are used during all these stages.

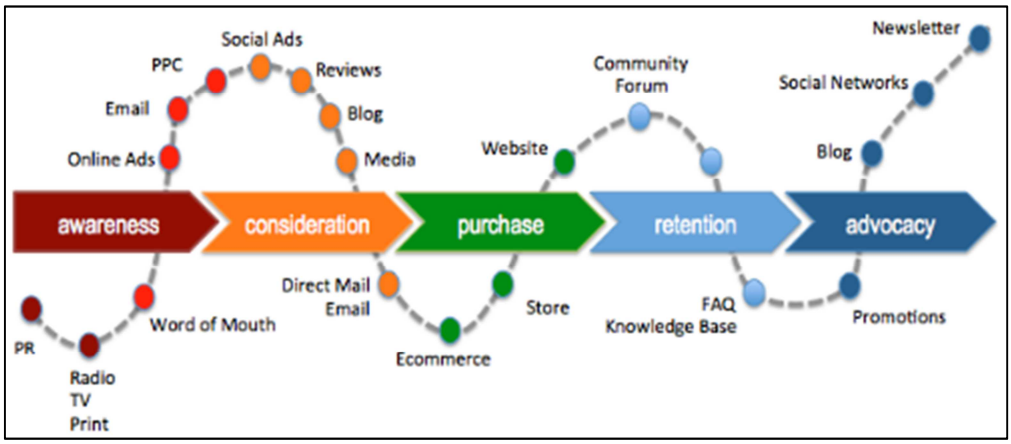


**Fig. 2**. The customer life cycle

### 2.1. Building Strong Content

In the text was already mentioned, why is content between different marketing tools and education of customers so important. Paper offers several steps how to build strong content marketing strategy. It includes following steps:

1. **Defining the target audience** – here company should define target customers before start to produce content, moreover company should think about audience rather than customers. The aim is to produce content that is compelling, but also aligned to the company brand. Here is necessary to take a look at best customers and the most engaged visitors and try to figure out what kind of content attracts these people. Moreover, there is necessary to discover kind of content that transforms a visitor into a customer.
2. **Creating consistent content –** it is important to provide consistent approach to the presentation and formatting of articles across all used media and site. However, it is more important to listen to customer. The content should be necessarily based on customer need and wants.
3. **Investment in visual content –** currently we live in visual world, every investment in quality visual content is worth and it attracts customer's attention. Digital technology is evolving at a rapid pace and has given marketers the chance to tell stories using videos, infographics, and compelling imagery. Using the fact that 94 % of content with visuals get more total views than textual content, company should be aiming to incorporate visual elements in every single post, article, and tweet it produces. According to a Citrix report, nearly two thirds of the posts on social media are visual content. A Pew research study

found that 54% of all internet users have posted original visual content that they personally created.

4. **Using more images and video -** according to eMarketer photos accounted for 75% of content posted on Facebook with an 87% engagement rate, while other post types received no more than 4% engagement. Adding a photo URL can boost retweets by 35%, according to research by Media Blog. The proof that using images and videos pays off is results of the following statistics as well. Eighty percent of internet users recall watching a video ad on a website they visited in the last 30 days, 50% of users watch business-related videos on YouTube once a week. Sixty-four percent of website visitors are likely to buy a product on an online retail site after watching a video, 75% of users visit the marketer's website after viewing a video**,** 75% of executives watch work-related videos on business websites at least once a week [13].
5. **Creating top content list –** it should be spotlighted the company's most popular content, used advertising to support content and sales process and involved influencers.
6. **Providing a split testing**– it is necessary to test the influence of used tools and channels.
7. **Aiming for evergreen content** - while news and news-related content has a distinct shelf life, if there is provided useful content it can continue to perform well over a longer period of time.
8. **Focusing on social media** – social media have enjoyed a great popularity. The top social media platforms being used by marketers are LinkedIn, Facebook and Twitter. Use for both SlideShareand Google+ has increased, but marketers are still most likely to put their time and money into the top three social media channels because of their potential for engaged, targeted audiences.
9. **Learning to curate** – it is becoming increasingly clear that customers are less interested in promotional content and more drawn to thought leadership quality content. Companies should stop to try to force-feed sales copy and invest in developing as a reputable source of valuable content. The best way to do this is by learning to curate relevant content from across the web and providing your followers with information they want and need.
10. **No attention on news** –content marketers should go further than merely reporting facts and explain why this news is significant for our audience and what they should do about it.
11. **Segmentation – according to many market researches,** micro-segmentation will be key process in 2015 and beyond, because as the internet becomes increasingly saturated, only way for smaller companies and brands to stand out will be to target a niche community or a highly specialised segment of the larger market. This can be done by incorporating long tail keywords, linking up with industry blogs**,** focusing on social media to connect with a target market.
12. **Measuring ROI – it is important to focus on analysing 4 major components:**
    - content message,
    - content format,
    - distribution channel,
    - promotional efforts [12,13].

## 3. Conclusion

By understanding how company is performing in each of mentioned areas, it will be able to better allocate budget and retarget efforts for maximum return. It is useful to use GA reports and dashboards to see which days and times of the week are most popular for traffic. Companies can use the data to experiment with publishing schedule and to publish articles at the best time for maximum impact [13]. The process of content marketing is therefore followed by traffic,

engagement and conversion of customers, what means. Table below is summarization of every single effect in these stages and possible tracking metrics.

| GOAL | WHAT IT DOES FOR COMPANY | METRICS TO TRACK |
|---|---|---|
| **TRAFFIC** | • contributes to display ad impressions | • clicks |
| | • increases video views | • unique visitors |
| | • creates brand awareness and brand lift | • pageviews, videostarts |
| | • improves site metrics | • brand equity research |
| **ENGAGEMENT** | • builds readership/ audience | • pageviews per session, time on site |
| | • builds brand loyalty | • social shares and likes, bounce rate, return visits |
| **CONVERSION** | • acquires new customers, free trail sing ups | • conversion rate, leads |
| | • blog subscribers | • cost per acquisition |
| | • newsletter sing up | • sales |
| | • ebooks downloads | • ROI |

**Tab. 1.** Effect of content marketing

Education and involving the customers, as the main part of green marketing, is possible to ensure just by consciously providing content. Therefore, the aim of this article is to show the importance of creating strong content in daily marketing practice of company. Paper offers steps how to build strong content that is supported by statistics research and overview.

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# Insolvency of European Companies Due to the Late Payments

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**Abstract.** Four of ten companies in the Slovak republic are insolvent due to the delay or non-payment of its receivables. To assess the solvency of Slovak and European companies was used European Payment Index 2014. The situation in which all receivables in company are paid properly and in time is unrealistic. Receivables management includes activities that direct to the optimal guidance of receivables in the company. This article deals with implementation of receivables management as an effective tool to prevent bad debts.

**Keywords:** insolvency, receivable, bad debts, European Payment Index, receivables management

## 1. Introduction

Late payments cause additional costs and pressure in the company. This fact has an impact on its competitiveness. Currently, the insolvency is very frequent situation. It means that the company is unable to meet its debts. We distinguish between primary and secondary insolvency. Primary insolvency is caused by non-economical behavior of company. On the other hand, secondary insolvency arises most often as a result of non-economic behavior of the customer. Effective receivables management is one of the possible measures before the occurrence of secondary insolvency, payment indiscipline and payment unwillingness of customer [2]. Receivables management begins with a selection of customers to whom company will provide trade credit and whom company will not. It continues with monitoring of the status of receivables, and ends with proposal for recovery and following the recovery process in some cases.

## 2. Insolvency of European Companies

Intrum Justitia Europe's provider of credit management service has carried out a written survey in 31 European countries plus Turkey and Russia every year during January, February and March. The results of this survey, which involves several thousand companies, are published in European Payment Index Report. According to European Payment Index bad debt loss increased from 3.00 % to 3.10 % and now stands at 360 billion euros. Bad debt loss also increased from 3.90% to 4.00 % in Slovakia [5]. Majority (88%) of companies said that the main reason for being paid late was the financial problems of their debtors. Further mentioned reasons for late payment by respondents were also intentional late payment by debtor (more than 60%), administrative inefficient (41 %) and disputes (more than 30%) [5]. As we can see bellow, many respondents were pessimistic about the risk of late payments forecast. European Payment Index is the result of a survey conducted by the company Intrum Justitia. The table shows the European Payment Index 2014 of chosen countries.

There is no difference compared to the last year. Scandinavian countries have the best position. Low risk profile is achieved not only through effective legislation but also by respecting unwritten business rules. As we can see Slovak republic has high risk profile and immediate actions are necessary. 65 % of Slovakian business respondents said they experienced loss of income, 64 % of them experienced reduced liquidity and 59 % see no growth due to late payments. Nearly half of Slovakian respondents predicted a further increase in risk [5].

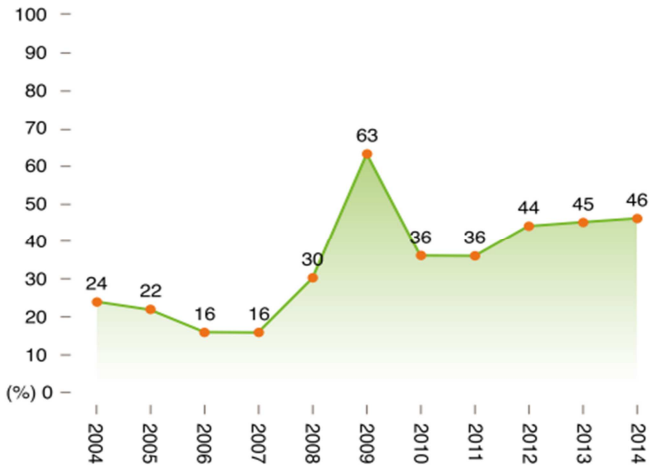


**Fig. 1.** Weighted average in percentages of European business respondents that see the risk from their company debtors increasing during the next 12 months.

| Country | Risk Index Legend |
|---|---|
| Norway, Sweden, Finland | 101 – 129 |
| Iceland, Denmark, Switzerland | 130 – 139 |
| Germany, Austria | 140 – 149 |
| Estonia, Belgium, Netherlands, France | 150 – 159 |
| Ireland, United Kingdom, Latvia, Lithuania, Poland, Slovakia, Italy | 160 – 169 |
| Portugal, Spain, Czech republic, Hungary, Croatia, Slovenia, Bosnia and Herzegovina, Serbia, Romania, Bulgaria, Macedonia, Albania, Greece | More than 170 |

**Tab. 1.** European Payment Index 2014.

Risk index explanation of the Payment index values: [5]

| | |
|---|---|
| 100 | No payments risk, cash delivery, payment, no credit; |
| 101 – 129 | Low risk profile, stay alert to keep this profile; |
| 130 – 139 | Low to medium risk profile, necessary intervention, take action now; |
| 140 – 149 | Medium risk profile, action needs to be taken; |
| 150 – 159 | Medium to high risk profile, take immediate actions to lower risk; |
| 160 – 169 | High risk profile, immediate actions are necessary; |
| More than 170 | Emergency risk profile. |

There is a table of mentioned consequences of late payments.

| Consequences | Weighted average of respondents that rate the consequence (%) |
|---|---|
| Liquidity squeeze | 63 |
| Loss of income | 55 |
| Prohibiting growth of company | 50 |
| Additional interest charge | 46 |
| Threat to survival | 36 |

**Tab. 2** Consequences of late payments.

Many north European countries have bigger liquidity problems due to late payments than liquidity problems related to the recession. Loss of income to late payments has worsened or at best stayed at the same levels in 18 of the 31 surveyed countries. Only 7 of 31 surveyed countries showed decrease of bad debt loss, namely Norway, Iceland, Denmark, Italy, Belgium, Estonia and Poland. Croatia (10.10 %), Greece (10.00 %) and Serbia (10.00 %) still showed the greatest bad debt losses in percentages. In general bad debt losses are higher in southern and eastern Europe. Northern countries like Norway, Finland and Switzerland have the lowest percentage in written of debts.

## 3. Receivables Management

The existence of receivables becomes commonplace in the area of functional and effective market economy. Nearly half of all respondents suppose increasing the risk of late payments in the coming 12 month. There are signs of hope. European Payment Index clearly underlined the key role of receivables management and its tools in reducing bad debts risks [3]. The survey also showed that more companies have receivables management processes in place. In extreme cases, receivables form 50% of total assets in the company. Offering trade credit to customers will always be associated with level of risk that it will not be paid properly and on time. On the other hand, there is a range of tools that can be applied in the company to minimize this risk. One of these tools is the effective receivables management.

According to Alexy and Sivak main tasks of receivables management are [1]:

- to determine the optimal amount of trade credit,
- to establish accurate sales and payment terms,
- to verify the credibility of customers,
- to monitor the status of claims,
- permanent control of overdue receivables,
- to determine the method of recovery.

### 3.1. The Effectiveness of Receivables Management

Companies can use following indicators to assess the effectiveness of receivables management *Days Sales Outstanding* [4]:

$$DSO = \frac{Accounts\ Receivables}{Total\ Credit\ Sales} \times 360 \quad (1)$$

DSO is the most widely used indicator. It expresses the average number of days from the emergence of the receivable to its debt collect. It is necessary to recognize some limitations of this indicator like the impact of seasonal fluctuations in sales, amount of advances received, bad debts and occasional sales of assets.

***The best possible DOS***- it takes into account only the receivables before maturity.

***The average time of delay payments***- shows how average days of receivable´s overdue; it is differential indicator between DOS and the best possible DOS.

***Collection effectiveness index***- percentage evaluates the effectiveness of debt collection. The higher the value of this ratio is, the lower efficient of debt collection is. Collection effectiveness index reflects the company's ability to receive debts on time.

$$CEI = \frac{Beginnig\ Receivables + Credit\ Sales - Ending\ Total\ Receivables}{Beginning\ Receivables + Credit\ Sales - Ending\ Current\ Receivables} \times 100 \quad (2)$$

Companies should be very cautious not only in the situation when they provide a business loan to new partner. To verify the credibility of regular customer is important, too. The state plays a very important role in the process of recovery. Many entrepreneurs indicate poor law enforcement as the most common barrier to business environment. According to The World Bank insists recovery in Slovak courts takes 545 days. It is in average 100 days more than in other OECD countries. Satisfying the receivables through the bankruptcy takes four years in Slovak republic (OECD average is 1.7 year) It is necessary to understand the importance of the receivables management and all of its phases. Trade credit is a strategic tool in the hands of the entrepreneur. The application of receivables management is an effective tool in the prevention of insolvency.

## 4. Conclusion

Sufficient amount of money does not always ensure effective business. There is a need to manage the assets to create profit. The risk of insolvency is extremely dangerous. A survey of Intrum Justitia shows that bad debts losses in surveyed countries increased to 360 billion euros last year. Period of turbulence in international financial markets have tested capital strength and prudence of businesses. Many of them did not survive. Offering trade credit is not granted. Proactive approach to the receivables management claims is necessary. Effective management of receivables is an important tool of prevention of secondary insolvency.

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# Management of Cooperation Activities in a Company

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**Abstract.** Aim of this article is to offer a proposal for effective planning and organization of cooperation activities in a company, based on a comprehensive analysis of scientific literature and performed empirical research. The article thus provides a tool for company managers for managing their cooperation activities. Use of this tool is meant to help minimize occurrence of conflict situations and to support smooth progress of cooperation activities from the organizational and planning perspective.

**Keywords:** cooperation, cooperation activities, cooperation management, planning, organization.

## 1. Introduction

The topic of managing cooperation activities is currently highly up to date. In present, cooperation as such represents for a company an important tool for increasing its competitiveness.

The purpose of the article is to offer, in a comprehensible form, a coherent overview of managing cooperation activities in a company. This includes a methodology of planning and organizing company cooperation activities, which is based on a detailed mapping of theoretical and practical knowledge in the area of cooperation management and a performed research of the level at which it is used in Slovak enterprises.

In order to address the points in question, as set by this article, it was necessary to use several methods, depending on and fitting to the character of the individual parts of the solution. In order to accumulate necessary data, we used the method of document analysis (for analysis of current as well as historical data about the topic), a questionnaire method and a method of semi-structured interview (gathering data in an empirical research) and a method of observation (used during visits of selected companies).

For processing the data, we mainly used a method of quantitative evaluation (statistical methods and tools were applied) and a method of comparison (for comparing data gathered by empirical research and data from the analysis of secondary information sources).

## 2. Current State of Dealing with the Issue

Based on the performed analysis and evaluation of various approaches to managing company cooperation activities ([1], [14], [16], [18]), as presented by multiple authors, we are able to proceed to systematization of these findings. Here we provide a summary of the main contributions of each approach to managing cooperation activities. These represent a basis of the proposal for effective planning of cooperation activities in a company (see Table 1).

| Author(s) | Emphasis | Contribution |
|---|---|---|
| Sahut a Peris-Ortiz [11] | Role of innovations in planning cooperation activities | Basis = favourable environment for entrepreneurship and innovations |
| Ritala a Sainio [10] | Determination and close collaboration between cooperating parties | Application of the business model |
| Mutak [8], Kultti [6] | Creation of cooperation networks | Application to the area of innovation of services |
| Felzensztein et al. [3] | Portfolio of the areas of collaboration and its gradual expansion | Application to marketing activities and innovations |
| Weck and Ivanova [20] | Trust between cooperating parties | Gradual adaptation of business cultures of partner organizations |
| Wicks et al. [21] | Company performance | Cooperation process based on trust |
| Fawcett et al. [2] | Correct understanding of trust | Dynamics of trust building in cooperation |
| Monczka et al. [7] | Information background of cooperation processes | Quality of information and their sharing |
| Jassawalla a Sashittal [5] | Organizational factors | Organizational structure that supports cooperation |
| Schmoltzi a Wallenburg [12] | Organizational and strategic complexity in building cooperation management | Efficient planning of cooperation activities |

**Tab. 1**. Summary of the contributions of individual approaches to managing company cooperation activities

Based on the performed analysis of the current state of dealing with this issue ([9], [15], [18], [22]) and related aspects, it can be concluded that effective planning of cooperation activities in a company should take into account the following attributes:

- *Innovations:* a suitable environment should be established in a company that would support entrepreneurship and innovations, characterized by determination and close collaboration between the cooperating parties.
- *Trust:* this aspect is an important part of strategic decision making. Managers who use optimal trust in the relations with the involved parties improve performance of the company. For this reason it is necessary to correctly understand the character of trust and the dynamics of building trust within cooperation, and to pursue gradual adaption of the business cultures of the cooperation partners.
- *Information background:* it is necessary to ensure the quality of information in the company, as well as its sharing for the needs of managerial decision making. Effective work with information within a collaboration can help prevent conflicts and aid with solving complex cooperation tasks.
- *Organizational factors:* this aspect involves change of organizational structures to support cooperation, interest and support from top management of the partners, openness to changes while maintaining mutual goals of the partner companies.

## 3. Situation in Slovak Enterprises – Results of Empirical Research

Between September 2012 and February 2013 we conducted a research, with the primary goal to gather and interpret information about the level of use of cooperations in the environment of Slovak enterprises. The main goal of the research was to identify the key aspects of efficient management and functioning of cooperations, related issues, degree of satisfaction of companies within cooperation and the opportunities for improvement of already functioning cooperations. Data that was gathered provided complete picture about readiness of Slovak enterprises to use (implement) cooperation management. In total, 273 managers of small, medium and large enterprises took part

in the research, from companies active in Slovak republic. Data from the respondents was gathered via personal interviews.

It could be considered positive that almost half of the respondents (47.62 %) plans in the near future (within one year) to establish a more intense cooperation with a company or an organization. When selecting partners for cooperation, companies make decisions based on the following factors: costs (8.12), insolvency (8.03), market position (7.25), profitability (7.18) and certificates (7.05). In contrast, the lowest importance was assigned to the factors such as the legal form (4.16) and company seat.

The main challenges and problems that were listed by respondents to occur in the process of cooperating with companies and organizations were mainly insufficient adherence to the agreed contractual terms (58.39%), financially demanding (35.04%), distortion of information (34.41%), low effectiveness of cooperation (29.56%), unwillingness to provide internal information by a cooperating company, i.e. concerns about providing internal information to a company (28.83%).

## 4. Effective Planning of Cooperation Activities in a Company

Existence and justifiability of cooperation management is strongly influenced by the *dynamic development* of the market environment. For this reason *planning* represents a crucial part of all important processes here. Planning is ongoing on all levels of the goals – long-term (strategic goals, ca. 3 – 5 years), mid-term (tactical goals, ca. 1 – 3 years) as well as short-term (operational goals, ca. less than 1 year) (see [4]). In case of the planning within already existing cooperation connection, this is in the theoretical sense the case of standard methods. *Specific situations arise in two cases:*

- *Planning as part of facilitation:* Start and establishment of cooperation is a separate and specialized managerial process labeled as facilitation. Here is planning focused on the activities needed for start and successful launch of cooperation (analyses, agreements, negotiations…). This specialized managerial activity then ends.
- *Planning in dynamic environment:* Decline or significant change of a cooperation bond is a frequent occurrence. Planning then becomes specific to the situation such as successful termination of the cooperation (division of shares, settlements etc.) or a transformation in relation to the set goals.

*Strategic planning* relates to the start of cooperation and to setting parameters of its existence. The term “existence” here means that on the strategic level exact parameters of competitiveness of the cooperation bond are specified. If it happens that these cease to be achievable in a given situation, termination or modification of the cooperation follows. *Tactical planning* relates to specific cases of facilitating cooperation and its termination or transformation. *Operational planning* is used in the standard meaning as well as in the case of the mentioned specific cases.

Competitiveness and efficiency (power and reciprocity) are in general the long-term strategic goals of cooperation groups. In concrete cases – strategic goals adjusted to fit given situation. Other goals (tactic and operational) are managed by mutual agreement of the cooperating parties and are primarily dependent on the market situation.

## 5. Efficient Organization of Cooperation Activities in a Company

Organization, whether commercial or not, is a social group. Its goal is to fulfill the set goals. Cooperating organization have certain categories in common. Most often these are common goals that can be reached more effectively via cooperation. Organizations assume culture of the society from which they stem and at the same time they create their own (organizational or company culture). Success represents an important aspect – this is represented in a way by company survival,

market success, profit etc. If organization is not in the long-term successful in fulfilling its goals or it is not competitive, one of the solutions is to connect with other organization or organizations.

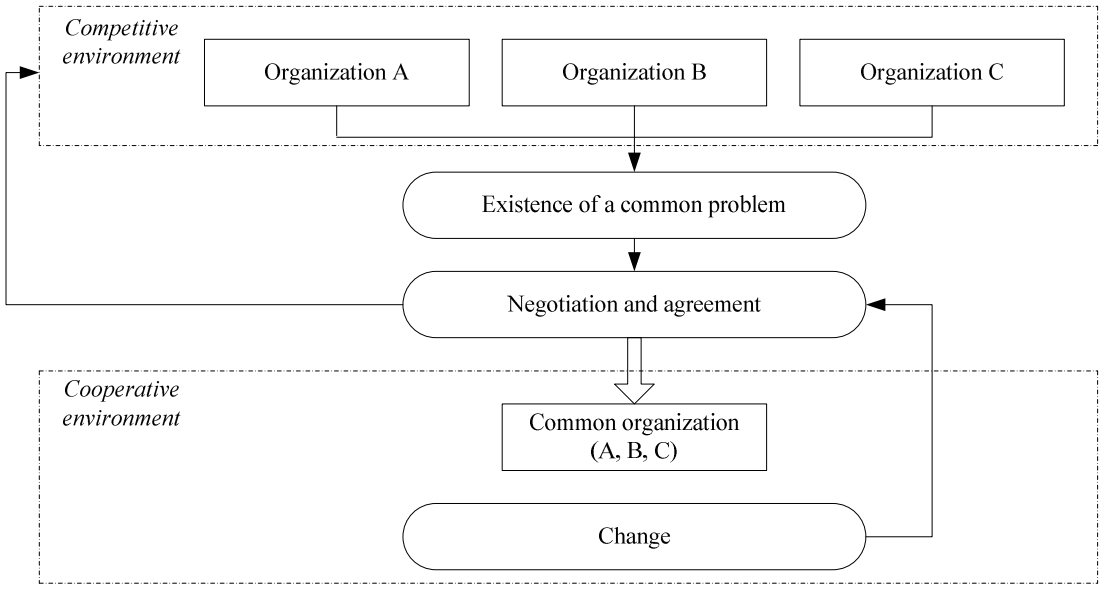


**Fig. 1.** Process of creating cooperation organization [13]

Figure 1 represents basic steps necessary for creating cooperating organization. Organizations exist in a state of mutual competition. In case a certain problem turns out to be significant enough, it may represent a potential stimulus for establishing mutual cooperation. Mutual discussion and agreement leads to cooperation. Organizations exist in a dynamic environment that creates further changes, that in turn create need for another discussion (planning and decision making). This may result in a decision to continue the cooperation, to modify it or to terminate it and to return to mutual competition.

The described aspects form dynamic cooperation organizational structures, that are created, modified and terminated, depending on current goals and tasks. One organization could participate in multiple dynamic organizational structures. It could also be the case that only a part of organization participates. This arrangement enables individual structures and employees to work on tasks from multiple projects, depending on the current needs. The cooperation organization itself takes on standard organizational structures.

Frequently we encounter matrix organizational structure, which suitably addresses the needs created by the environment dynamics. This type of organizational structure is also partially defined by the management literature: “Virtual organization or organization with virtual organizational structure is a special type of organization. It differs significantly from the hierarchical organizations. It is a temporary connection of companies, based on information technologies. Its purpose is to rapidly and efficiently use available entrepreneurial opportunities. Subjects connected within the virtual organization are not connected via ownership, and do not form formal organizational structures. Rather, they are independent and each of them contribute to taking advantages of the opportunity by its specific skill and obtains that what could not be obtained in being isolated.” [17]

## 6. Conclusion

Ideas about complexity of managing cooperation activities in a company are justified. The topic of managing cooperation activities is currently very relevant among Slovak enterprises. Managers in Slovak enterprises strive to build cooperation management in their companies, aiming to enable creation of successful cooperations and fulfillment of set cooperation tasks. In order for this initiative to be successful, it is needed to use elements of project management and to establish such

environment that will support new cooperations, enable communication and effective work with information within created partner relationships [19].

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# Utilization of the games theory in decision-making about technological variants

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**Abstract.** The article deals with decision-making in companies about technological variants. Despite the fact that the selection of a technological variant can be easily calculated with mathematical methods, such decision-making in practice is often difficult as the input data are not always unambiguous. The ambiguity consists primarily in the forecast of future income. The forecast therefore strongly influences the decision. The article analyzes application of the games theory on selection of the optimum strategy for a company.

**Keywords:** Games theory, selection of a technological variant, investments, operating leverage.

## 1. Introduction

The games theory is a scientific discipline which describes conflict situations encountered in real life. The conflict is defined as a situation in which a person needs to decide between specific variants. As an example we can mention a situation in which a customer is choosing a product and decides between the products A and B.

Real life can bring numerous conflict situations but in the course of development of the games theory some classifications were made which have made it possible to subsequently analyze such situations and describe them in mathematical terms. In case of a conflict you can determine whether the decision is made only by the person and the rest is coincidental or if there is another person involved trying to win over the first person – you can observe a number players involved in the situation. You also need to know what the involved persons can gain and whether the conflict will recur in the future and the players can learn a lesson.

A list of areas in which the games theory is used to resolve conflict situations clearly indicates that it can be applied in the most diverse scientific disciplines, such as biology, transport and economy. In those fields the theory mostly seeks to find the optimum strategies so that the decision made by the entity is as efficient as possible. The efficiency in this case is defined as the input/output ratio which may be achieved by the activities.

If an enterprise needs to be efficient, i.e. if the inputs are to be utilized to the maximum extent and produce maximum outputs, then it needs to address all activities performed in the course of transformation of inputs into outputs. An example of such activities is the selection of suitable technology or checking on employees whether they use company assets as required.

The objective of this article is to analyze the possibility to use the games theory in decision-making about the best technology.

## 2. Theory and methods

In any enterprise there are numerous processes performed and there are many conflict situations associated with the processes, in which a manager or employee decides about future development of the given activity. Such activities include e.g. selection of a particular technological

variant, which is associated with operating leverage and inspections associated with management processes.

In many processes a company faces situations in which it needs to choose the best technological variant to manufacture parts. The variants are usually associated with different fixed and variable costs. If you accept the assumption that one technology is more expensive from the viewpoint of fixed costs and the other is more expensive from the viewpoint of variable costs then you can use a relatively simple mathematical calculation to calculate the breakeven point which differentiates between the two variants. The specific calculation is based on the following principle:
Technological variant 1:

$$TC_1 = FC_1 + VC_1 \tag{1}$$

where TC are total costs
FC are fixed costs,
VC are variable costs.
Technological variant 2:

$$TC_2 = FC_2 + VC_2 \tag{2}$$

If you want to find the point in which the two variants have the same costs then you need to equalize the two equations and substitute VC with direct costs $vc_{f1u} \times Q$, which represent the sales. Then you can calculate Q with the following formula:

$$Q = \frac{FC_1 - FC_2}{vc_{f1u2} - vc_{f1u1}} \tag{3}$$

A graphical solution of the described case is shown in Figure No. 1

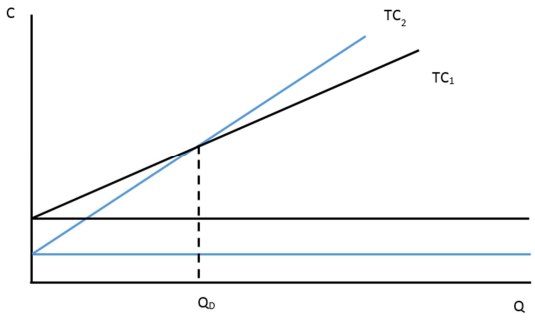


**Fig. 1.** Graphical solution of the selection of a technological variant [8].

The Figure 1 shows that the technological variant 2 is more profitable for the company up to the production volume QD. If the production is higher than QD then the technological variant 1 is more profitable because the overall costs are lower.

A situation in which you substitute variable costs with fixed costs is called operating leverage. If the share of fixed costs (in the indicated example the variant 1) is higher then the variable costs increase more slowly but, on the other hand, the breakeven point is also higher due to the higher fixed costs. The variant is therefore more risky but it is profitable for high production volumes.

In practice it is difficult to be absolutely sure about the future volume of products the company will be able to sell. This means that the company needs to use some assumptions which are based on market research or on historical data. Nevertheless, the company should also take into account the risk which can be associated with a decline of the entire market or with a new competitor on the market.

The games theory also deals with decision-making with regard to risks or uncertainty, while the term risk means that you are aware of the variants which may occur and you know probabilities of

such situations. The term uncertainty means that you do not know the probabilities or even all the variants.

The game, which specifically deals with a risk situation, is played against a non-intelligent player. A non-intelligent player can be described as a natural force which does not seek to optimize its strategy but chooses its strategy based on a previously specified list of probabilities. For example, when playing against nature in which one situation is represented by rain and the other by sun then either of the situations will occur with a certain probability. Subsequently, an intelligent player will adapt his strategy, takes /does not take an umbrella etc.

Gross [1] has defined the potential strategies in games as follows:

1) Bayesian criterion – if the probability distribution is known
2) Laplace criterion – if the probability distribution is not known,
3) Wald´s pessimistic criterion – assuming the worst possible situation,
4) Savage criterion – minimizes potential losses
5) Hurwitz criterion – takes into account the relation of the decision-maker to the risk

For reasons of brevity the article will further deal only with the Bayesian criterion.

## 2.1 Bayesian criterion

Harsanyi [2] was the first to replace the incomplete information with complete but imperfect information. This replacement consisted in assigning of certain probabilities to individual strategies, while the imperfect character of the information consists in the principle of probability. In other words, you know which situations may occur and what are the probabilities of such situations but you do not know with certainty whether they will occur. It is the nature that decides whether the given situation occurs.

A classical game is defined by Chvoj [4]:

1) a set of players N = {1, ..., n}
2) a set of strategies X = {1, …, i}, where $x_n \in X_i$ is a specific strategy
3) a set of pay-offs M = {1, …, i}

A Bayesian game additionally includes [5]:

1) a set of opinions of the players p = {1, …, n}
2) a set of pay-off functions f = {($x_1$; $p_1$), …,($x_i$; $p_n$)}

A major advantage of the games is the fact that the principle of Nash equilibrium [7] applies. Also in this case the player seeks to identify the counter-player´s strategy and to respond to it with the best possible strategy. However, if one of the players is non-intelligent you are concerned only about the maximum value for the strategy of the intelligent player. This can be defined as follows:

$$x = max_i \sum_{1=j}^{n} p_j \cdot m_{ij} \qquad (5)$$

where: x is the optimum strategy,

$p_j$ – probability that the situation **j** occurs (the non-intelligent player uses the strategy **j**),

$m_{ij}$ – pay-off in case of the strategy **i** and **j**

# 3. Application

Let us assume that a company received a marketing research which indicates how much it can sell on the market. Individual probabilities are provided in Table No. 1.

| Quantity (pcs) | 3 000 | 4 000 | 5 000 | 6 000 | 7 000 | 8 000 | 9 000 |
|---|---|---|---|---|---|---|---|
| Probability | 7.8% | 13.4% | 18.5% | 20.6% | 18.5% | 13.4% | 7.8% |

**Tab. 1.** Distribution of probability of demand for the product.

Further, let us assume that the company can choose from several technological variants. The company then uses its calculation formula to calculate fixed and variable costs for each of the variants. The costs of the individual variants are shown in the Table 2 below.

| Variant | Fixed costs | Variable costs per unit |
|---|---|---|
| 1 | 5 000 | 4 |
| 2 | 10 000 | 3 |
| 3 | 20 000 | 2 |

**Tab. 2.** Technological variants of the production.

Based on those data it was possible to create a matrix of pay-off functions, while the price of the product was determined based the competitor´s price of 6 CZK. The pay-off amount was then calculated as follows:

$$Z = Q_j \cdot p - \left(FX_i + VN_i \cdot Q_j\right) \quad (6)$$

where: Z is the pay-off .
p is the product price,
$FX_i$ are fixed costs of the technological variant **i**,
VNi are variable costs per unit for the variant **i**,
$Q_j$ – quantity of sold product for the variant **j**.
The resulting pay-off values are shown in Table 3.

| | Demand | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variant | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Average | Min | Max |
| 1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 7 | 1 | 13 |
| 2 | -1 | 2 | 5 | 8 | 11 | 14 | 17 | 8 | -1 | 17 |
| 3 | -6 | -2 | 2 | 6 | 10 | 14 | 18 | 6 | -6 | 18 |
| Max | 1 | 3 | 5 | 8 | 11 | 14 | 18 | | | |

**Tab. 3.** Pay-off values - in thous. CZK.

However, the Table 3 does not take into account probability of demand for a certain quantity. Therefore the pay-off values must be multiplied by the respective probabilities. The resulting figures are shown in Table 4.

| | Capacity load | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variant | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Sum |
| 1 | 0.08 | 0.40 | 0.92 | 1.44 | 1.66 | 1.47 | 1.02 | 7 |
| 2 | -0.08 | 0.27 | 0.92 | 1.65 | 2.03 | 1.88 | 1.33 | 8 |
| 3 | -0.47 | -0.27 | 0.37 | 1.23 | 1.85 | 1.88 | 1.41 | 6 |
| Average | -0.16 | 0.13 | 0.74 | 1.44 | 1.85 | 1.74 | 1.25 | |

**Tab. 4.** Pay-off matrix after taking probability into account.

When using the Bayesian criterion you need to find the maximum value from the sums indicated in the last column of Table 4. In this case the technological variant No. 2 is the most appropriate – the maximum value of all the sums is 8.

## 4. Conclusion

In real world it is not always possible to use accurate mathematical models as we do not know future development of many activities encountered in companies. However, the future development

of activities can be simulated and historical data or models can be used to assign certain probabilities to them. This procedure can also use the games theory to select the best strategy for the given specific case.

Apart from selection of the best strategy, it is also recommended to take into account approaches of the managers and owners to the risk because mathematical models cannot take into account stress and other factors which may influence the work in general and the atmosphere in the company. This evaluation may be performed with application of other strategies, as mentioned by Gross. For example, the Hurtwitz criterion takes into account relation of the decision-maker to the risk.

Before making the final resolution it is also important to take into account quality of the input information which is used as inputs into the game. They include particularly a list of situations which may occur and their respective probabilities. If we conclude that the probability distribution may not be certain then it is better to use, instead of the Bayesian criterion, the Laplace criterion, in which all the probabilities are equal.

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# Who is Liable for Damage Appearing on Carriage during the Taking over?

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**Abstract**. In her paper, the author deals with the interpretation of the Article 8 of the CMR Convention in connection with the Article 9 of the CMR Convention. The point is to search for answer to controversy question- who is responsible for damage to consignment incurred during loading or unloading operations?

**Keywords:** liability, damage, loading of goods.

## 1. Introduction

Essentially, I think it is important to point out that the CMR Convention or Code of commercial law does not regulate the legal regime of loading or unloading and does not control the question of liability for damage or loss of consignment which may occur during the loading or unloading. Therefore, the agreement between sender and carrier on who will load the goods is crucial to be implemented into the transport contract. If no such agreement exists, the resulting conflict can be solved per curiam. In that case, the court examines who should have performed the loading and who has actually done it. The fact that neither national nor international legislation contains rights and obligations of the parties under the transport contract when loading the goods does not mean it is irrelevant. At the very moment of loading, the carrier should be alert when he does not want to take responsibility for damage to the consignment.

## 2. Taking over the Goods

As mentioned above, the CMR Convention does not regulate the duty to the loading or unloading and the responsibility for these operations. The only allusion to this responsibility is exhaustively mentioned so called privileged reason for absolving the carrier of liability for damage or loss of the consignment under the provisions of Article 17.4 (c) of the CMR Convention. To explore the question of who is responsible for loading or unloading, it is crucial to determine who the "master of loading or unloading" is. From this perspective, the following situations may occur:

a) In the transport contract, the carrier has undertaken to do the loading or unloading of goods;
b) In the transport contract, the sender or recipient has undertaken to do the loading or unloading of goods or he actually did it;
c) Loading or unloading was actually carried out by the carrier according to the instructions of the sender or recipient;
d) Loading or unloading was carried out wholly or partially by the sender´s or recipient´s employees but the carrier controlled it;
e) Loading or unloading was carried out by the carrier without being obliged under the transport contract.

Even if the carrier does not execute the loading or unloading and he is not committed under the transport contract, he should meet legal "obligation" under Article 8 of the CMR Convention. Article 8 of the CMR Convention refers to the actions of the carrier during the taking over the goods for consignment, in particular the examination of its weight or the investigation of the

apparent condition of the goods and condition of their packaging. According to Article 8.1 of the CMR Convention [1], it may seem that the carrier is also responsible for packaging, marking or numbering of the goods. However, in compliance with the CMR Convention this obligation rests with the sender [2]. The sender shall be obliged to provide the transported goods in the necessary way against the dangers of road traffic, because not the carrier but only the sender has the expertise knowledge. Hence, the sender has the responsibility for the safe storage, assemblage and fixation of goods against shock and slip while transporting, even when driving in high speed [3]. That provision shall not therefore establish any material - legal exploring obligation of the carrier it is just the legal regulation helping to establish the evidence in favour of the carrier. The provision must be interpreted in the way that only the sender has legal responsibility and if the carrier breaches its obligation under the transport contract, the sender can propose the carrier´s complicity in the claim for damages. So far, there is no sufficient case law that would clarify the issue. There is, however, eventual counterproof submitted by the sender. Article 8.1 of the CMR Convention requires the carrier to do two things when taking over the goods:

### 2.1. Examination of the Data Accuracy in the Consignment Note regarding the Number of Parts, their Marks and Numbering

Firstly, he needs to examine the data accuracy in the consignment note regarding the number of parts, their marks and numbering. If the carrier has no appropriate means of testing these data, he must indicate his objections into the consignment note along with the explanation. These deficiencies may be factual (e.g. the impossibility to control the temperature of the frozen consignments) and temporal. Therefore as a precaution, the carrier shall always state into the consignment note the complaint of the inability to examine the number of pieces when either the sender or the very nature of the consignment does not allow such inspection. Likewise, if he finds the differences during the examination of the loaded consignment he shall state it into the consignment note, although he does not need to justify such a result. In the case of a dispute between the carrier and sender over the actual number of pieces of the consignment, it is possible to invite a third party to determine the accuracy of the data or the justness of the carrier´s complaint. It results from the Article 8.3 of the CMR Convention [4] that the carrier is really not required to do a detailed examination of the quantity of transported goods. It only emphasis the carrier's obligation to state his objections to the shipment into the consignment note at the very moment of taking over the goods for transport. This obligation shall never be neglected! There is a presumption [5] that if the carrier did not state in the consignment note any objections to the accepted consignment he had taken over the goods explicit in the consignment note [6] in quality and quantity as specified therein. The consignment note is evidence of the condition of goods and pursuant to Article 9.2(a) of the CMR Convention, the shift of the burden of proof from the carrier to the sender is caused. So, if the carrier does not meet his obligation under Article 8 of the CMR Convention, the penalty is imposed in Article 9.2 of the CMR Convention, which has an amplifying effect on Article 9.1 of the CMR Convention and it assumes the performance of the obligation to check the certain characteristics of the goods by the carrier.

In the event of absence of the consignment note as proof of receipt of goods, the presumption of the quantity and quality of the accepted goods by the carrier is not used and the claimant shall find other evidence to support his claim that the loss or damage was caused when the carrier was responsible for the goods [7]. The rule is the same if there is a missing signature on the consignment note which is required by Article 5.1 of the CMR Convention [8]: if it is not possible to find another proof, the sender´s claim fails because the consignment note proves nothing against the carrier who has not signed it [9]. If a presumption occurs, it may be overcome by the carrier, not only against the sender but also the recipient [10]. The essential point is that reservations applied by the carrier shall be always justified and raised at the moment of the taking over the goods for transport. Posterior alleged reservations may not be considered relevant by the court.

## 2.2. The Apparent Condition of the Goods and their Packaging

Secondly, the carrier shall examine the apparent condition of the goods and their packaging. As obvious condition, it is considered the outside state detectable by conventional means, namely, the apparent condition. This shall not need to use any measurement or test equipment. It concerns such findings that are feasible in a conventional manner or by general inspection of the consignment (e.g. by the naked eye) [11]. The apparent condition refers to what can be outwardly discernible to the naked eye under normal examination – "what is coughed by eye" [12]. The carrier has no status of the goods expert, and therefore he cannot be requested to establish the condition of the shipments in other than in a conventional manner. More detailed examination would impose a disproportionate burden of examination to the carrier [13]. Moreover, the scope of the declaration of an apparent state depends and in the practice is limited by the knowledge and experience of the person actually accepting the consignment. Often it concerns the truck drivers [14]. Meanwhile, all carriers including the road ones are expected to have some knowledge of the characteristics of goods that they transport.

The carrier is not obliged to examine only the apparent condition of the consignment but also the apparent condition of its packaging. CMR Convention does not point to the examination of the actual quality of packaging, i.e. its ability to protect goods adequately, but whether the packaging sufficiently covers the goods, whether it is torn, soaked, dirty and so on. The carrier is not considered to be an expert on the packaging. The condition of the consignment packaging is also related to the question of consignment loading on the vehicle. When loading and securing of the consignment on the vehicle was done by the sender, recipient or a third person, the carrier´s obligation to conduct the examination of the goods and their packaging is dropped. However, if the carrier, in the transport contract, undertakes to ensure the placing and securing of the goods on the vehicle, he is responsible for incurred damages.

If the carrier finds some on the consignment or its packaging during a routine examination, he shall state his reservations in the consignment note request a correction, possibly refuse to perform transport. The presumption of Article 9.2 of the CMR Convention [15] is limited to the apparent condition of the goods. It is therefore presumed that any damage to the goods discovered at delivery has occurred during transport. This is a rebuttable presumption and burden of proof lies with the carrier. The carrier may overcome the presumption by evidence that the loss or damage appeared before the goods were taken over by the carrier, whereas if the carrier was not liable for goods in that moment, despite the absence of the objections on the quantity or quality of the goods in the consignment note.

## 2.3. Recognition or Non-recognition of the Carrier´s Objections by the Sender

Effects of the reservation made by the carrier in the consignment note as proof of consignment defects occur depending on whether or not they were claimed by the sender. In the last sentence of Article 8.2 of CMR Convention is mentioned: *"Such reservations shall not bind the sender unless he has expressly agreed to be bound by them in the consignment note."* If the carrier's reservation is claimed by the sender, it results in the disappearance of the presumption under Article 9.2 of the CMR Convention and in the absolving the carrier of liability pursuant to Article 10 of the CMR Convention. If the carrier's reservations have not been recognized by the sender, the carrier is put to the position that his reservations do not have any legal relevance and it is assumed that the consignment is perfectly fine. The only solution would be if the carrier refused to transport the consignment or if he invited a third party in order to verify the condition of the goods and to persuade the sender to acknowledge the carrier's reservations. Other authors tend to believe that the refusal of carrier's reservations does not lead to the disappearance of the presumption under Article 9.2 of the CMR Convention nor does it create a legal presumption that the consignment is perfectly fine. Article 9.2 of the CMR Convention supports this opinion, as the consent of the sender to the carrier's justified reservations is not necessary. Even without it, the fact that under Article 10 of the

CMR Convention, the sender's approval to the carrier's reservations is not necessary is in favour of sufficient importance of carrier's reservations. So if the sender does not want to acknowledge the carrier's reservations his only solution shall be to withdraw from the transport contract.

For the practice, this contribution may be concluded by an urgent recommendation for a truck crew:

- Try to perform the usual examination of the consignment when taking it over and if it is not possible contact your dispatcher;
- Make a written complaint of the identified defects of the consignment, imperfections of packaging, or consignment placing. It should be included along with the explanation in the first print of the CMR consignment note, and hand over a copy of the consignment note to the sender;
- If you notice that the initiating of the transport would cause the damage of the consignment, or a risk to road safety because of the defects on the goods, their packaging or storage, you shall seek the sender to agree on a redress, to contact your dispatcher and possibly do not perform such a transport because the responsibility for consequences of such perform would undoubtedly lead to undesirable burden.

## References

[1] Article 8.1 of the CMR Convention: "On taking over the goods, the carrier shall check: (a) The accuracy of the statements in the consignment note as to the number of packages and their marks and numbers, and (b) The apparent condition of the goods and their packaging."

[2] LG 17.12.1965

[3] OLG Dusseldorf 7.2.1974

[4] Article 8.3 of the CMR Convention: "The sender shall be entitled to require the carrier to check the gross weight the goods or their quantity otherwise expressed. He may also require the contents of the packages to be checked. The carrier shall be entitled to claim the cost of such checking. The result of the checks shall be entered in the consignment note."

[5] Rb Breda 16.12.69, 1970 ULC 298, 303

[6] The presumption does not apply to the information specified not in the consignment note but in other documents to which it may be attached, such as customs documents ensured by the sender in accordance with Article 11 of the CMR Convention.

[7] BGH 9.12.79 (1980) 15 ETL 215; BGH 17.4.97, TranspR 1998.21. In Limoges 2.6.67, BT 1967, 273 the court decided that also in the event of absence of the consignment note, there is a presumption that the carrier took over the goods in good condition. In the event of absence of the consignment note, there can be a conclusion that even if the carrier did not make the objections that the goods appeared in good condition; this argument was rejected in BGH 9.12.79, 220 in relation to Article 9.2 of the CMR Convention, the court overcame the burden of proof and when there is no consignment note and Article 9.2 of the CMR Convention cannot be invoked, normal burden remains with the claimant who shall prove that the loss or damage incurred during the transport.

[8] In City Vintages Ltd v. SCAC Transport International (High Court, 1.12.21987, unreported); BGH 17.4.97, TranspR 1998.21, although it can be perceived in some countries such as the Federal Republic of Germany as a gap in the CMR Convention and the consignment note may therefore have some effect on national law.

[9] In the sender´s case: the seller may refuse to be the sender responsible for not stating the transport of dangerous goods: Douai 11.3.82, BT 1982.199

[10] TC Paris 13.3.72, BT 1972.230; Paris 17.5.74, BT 1974.297; Cass. com. 29.10.91, BTL 1991.735. This rule was perceived as une présomption simple, which implies that the truth in the matter has not yet been verified by the carrier. However, if there is une vérification contradictoire, the resulting presumption cannot be rebutted against the sender. See also Article 3.4 of the Hague Rules - Visby which do not allow the rebutting against the receiver.

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[13] RbAntwerp 13.10.72 (1973) 8 ETL 330, 331

[14] In this sense, for the maritime transport: In Moine Comte v. East Asiatic Co (1954) 20 Mal LJ 113; Shachar 10 JMLC 74 (1978); The Hoyanger [1979] 2 Lloyd´sRep 79 (CanFedCt)

[15] Article 9.2 of the CMR Convention: “If the consignment note contains no specific reservations by the carrier, it shall be presumed, unless the contrary is proved, that the goods and their packaging appeared to be in good condition when the carrier took them over and that the number of packages, their marks and numbers corresponded with the statements in the consignment note.”

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# Value-based Management and Maesuring Company Value

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**Abstract.** In past, the ultimate goal of any company was to maximize profit. As time passed and markets evolved companies started seeing other important goals than profit. Market share and value of the company are just few of them. Now as the competition is getting bigger it is harder to achieve increase in company value. Value-based management helps a company to increase its value by focusing on value increase not only for the owners of the company, but also for all parties that are involved with company. Being able to measure the value of a company is crucial, but widening of understanding of value has rendered some value indicators less accurate.

**Keywords:** value-based management, value, shareholder value, measuring value.

## 1. Introduction

A market economy is commonly linked to the fact that companies should strive to achieve a profit. Most people, however, agree that companies should have a certain social responsibility. Thus net income and responsibility should be combined, although sometimes they are partly contradictory interests of the enterprise.

On the one hand, companies need profits to survive and profit is not only the result but also the source of a company's health. On the other hand, the company consists of a network of people and groups of people who work to achieve common goals. Since these people represent the intellectual capital and a large part of the value of any enterprise, it is necessary to build up mutual trust with them. It is also necessary to build such trust with external groups such as suppliers, customers and the state and to take into account the interests and values of all these groups.

## 1. Value-based Management

Managerial accounting has faced ever greater challenges during the past few decades. Ever-changing economic environment is forcing it to adapt to new approaches. These approaches should eliminate lack of effectiveness in existing management structure that is focused on traditional financial indicators constructed form Profit and Loss Statement.

The mission of the organization is to offer the products and services that meet customer needs best they can. Value-based management is a management system that measures and supports the creation of net assets. When we look at society as a set of relationships among production factors, we find that the separation of the management of the company and its owners ensures effective form of economic organization. This separation, however, is simultaneously a frequent source of dysfunction in the company.

It is necessary to select the appropriate governance mechanism for proper and efficient alignment of interests of owners and management. This alignment of interests may be complicated by two major problems:

1. Problem of the management is based in the assumption that the expectations and objectives of management are not always consistent with the expectations and objectives of the owners. It is difficult and costly for owners to track exactly what management is doing.

2. The problem of risk sharing is based on the assumption that the owners and management companies have different attitudes towards risk-taking, and thus opt for different processes.

Both of these problems have arisen due to lack of correlation between the tasks of management objectives and company owners. The value-based management is designed to reduce this lack of uniformity of goals. This leads to the fact that management should thought and behaved more like owners.

There are many definitions of value-based management. They are partly different, but the essence of the definition expresses the same. Some are focused on the function and process itself:

Value Management is a management style focused mainly on people's motivation, developing skills, encouraging collaboration and innovation to maximize the overall performance of the organization. Value management applied at the level of organization depends on the values of the culture of the organization, taking into account the value for the business stakeholders as well as for the customers. At the operational level, in project-oriented activities it utilizes appropriate methods and tools. [2]

Other definitions emphasize the result of this approach:

Value-based management is a management approach that aims to maximize value for the shareholder. This can be achieved through the objectives of the company, its systems, strategies, processes and methods of analysis. Performance measurement and company culture aim to maximize value for the shareholder. [1]

Various definitions show, that value-based management is based on three basic principles:

- creation of value,
- management of value,
- measurement of value.

Providing positive and consistent shareholder value is one of the main objectives of the management. Improvement of cash flow generated from operations as well as minimization of capital cost by having optimal capital structure can result in positive shareholder value. Many value drivers and managerial decisions determine this.

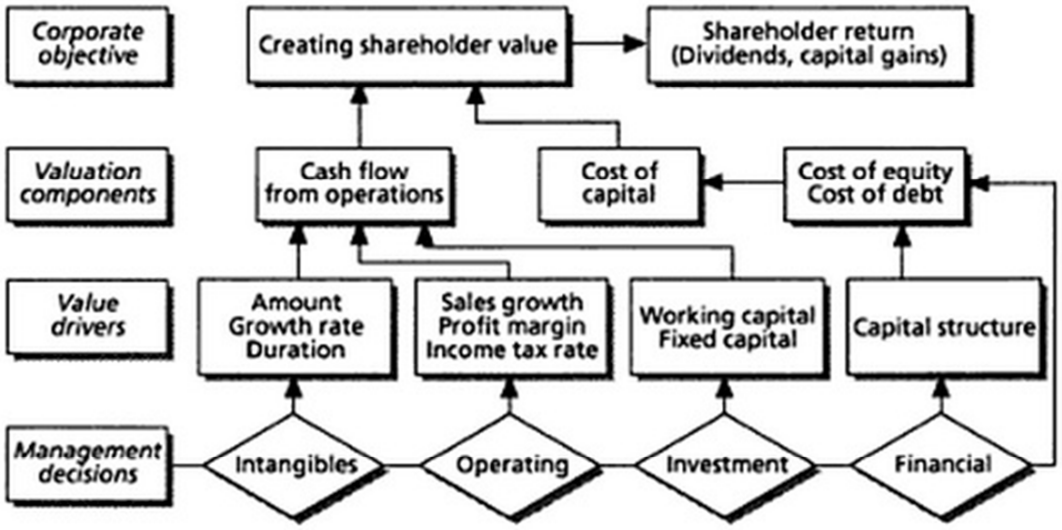


**Fig. 1.**Corporate objectives and value drivers (9)

## 2. Company Value

Value-based management implemented in company has a potential to increase profitability (for example increase for insurance companies is estimated up to 4%) and therefore increase company value. Most big companies (around 70%) have a value-based management concept or plan to implement one.

Traditional indicators of financial performance are mainly based on profit maximization and on indicators of financial analysis. The basic indicators are based on:

- profit,
- cash flow,
- profitability.

Earnings After Taxes, Earnings Before Interest and Taxes, Total Cash Flow, Return on Sales, Return on Assets, Return on Investment are few of these indicators.

The main source of calculating the traditional indicators for evaluating financial performance are the financial statements. If the individual items of these statements are not regulated, they may a tendency to express accounting rather than economic data. Profit may be affected by the valuation of assets, the creation of reserves, provisions and depreciation method. Another limitation in calculating the traditional indicators is the problem of the use of historical cost and assets. Traditional indicators do not take into account either the risk arising from the use of foreign capital or the opportunity costs.

These restrictions of traditional indicators is solved by methods of modern financial performance evaluation indicators, based on economic profit, as the main criteria of performance, or cash flow of the enterprise. The financial statements are adjusted to reflect the economic reality and not to distort data due to accepted accounting policies in the company. Modern indicators take into account the risk of working with the cost of capital, and some even deal with the influence of inflation. Unlike traditional indicators, with modern indicators of financial performance modification to express value of the company accordingly to value-based management

Economic Value Added (EVA) is among one of the best-known and most widely used measures of performance. Stern Stewart & Co. as a value-oriented performance measurement introduced EVA in 1991 and EVA today is a registered trademark. The main essence of this indicator is that it is based on economic profit that respects all costs of invested capital, therefore, both the cost of foreign capital and the cost of equity capital, thereby it substantially differ from traditional performance measurement indicators. [8]

It is defined by (1):

$$\mathrm{EVA} = \mathrm{NOPAT} - \mathrm{Capital} * \mathrm{WACC} \quad (1)$$

Where:
NOPAT = Profit from operating activities of the enterprise after tax.
Capital = Capital tied in assets, used for operating activities of the enterprise.
WACC = Weighted average cost of capital.

EVA indicator is one of the most popular modern indicators to measure the financial business performance. Proponents of EVA are dedicated to it for its simplicity and broad applicability in comparison with other indicators, and also because it is similar to the category of Net Present Value. However, it has some drawbacks, especially the need to regulate financial statements, problem with quantifying the cost of equity capital due to the possibility of using different kinds of models, none of which does give an ambiguous result. Another drawback of EVA is that is does not take inflation into account.

The American company HOLT Value Associates, which was taken over by Boston Consulting Group, created Cash Flow Return on Investment (CFROI) indicator. It represents a comprehensive model of performance measurement, unlike the indicators based on the principle of residual profits like e.g. EVA. It is an indicator of dynamically conceived profitability for the entire company, which is based on the internal rate of return. Its main advantage is that it works with quantities at fair value, therefore deprived of inflation and it focuses on cash flows as a measure of economic performance. [5] Equation (2) shows the principle of calculating CFROI, but this indicator is far more complicated.

$$CFROI = \frac{Cash\ Flow\ before\ Interest\ and\ Taxes}{Operating\ Assets - Interest\ Free\ Capital} \quad (2)$$

Among the main advantages of CFROI indicator is the ability to compare companies, regardless of sector, size and territorial location. The resulting values are expressed as a percentage, which is also more advantageous for most analysts than the absolute values, e.g. at EVA. The concept of CFROI is more complex, considers inflation and precisely removes the accounting deficiencies. Inability to accurately consider which projects and how extensively affect the value creation in the company is acknowledged as one of the drawbacks of this indicator. Other disadvantages are the overall complexity of construction and difficulty with redesigning the parameters.[6]

Another widely used measurement tool is Market Value Added (MVA). MVA is a registered trademark of Stern Stewart & Co. Stewart. [7] It essentially determines a growth of market value, which the owners of the company have achieved by investing capital into the company. Market value may be used externally as an indicator for measuring the performance of publicly-traded firms and cannot be used for measurements at lower management levels. MVA is given by (3):

$$MVA = Market\ Value\ of\ the\ Company - invested\ capital \quad (3)$$

Added market value for foreign capital is often different from zero only as a result of changes in interest rates. Therefore, MVA is equivalent to maximizing shareholder value. This observation reduces the explanatory ability of MVA as indicator of managerial performance, since MVA is partially sensitive to changes determined by macroeconomic variables that are not influenced by management.

These are just a few measurement tools for company value when considering value-based approach. There are many others like Total Business Return, Total Shareholder Return, Cash Value Added, Cash Return on Gross Assets and many more. Some are just derivations of previously stated indicators, while others utilize completely different mechanics.

## 3. Conclusion

Increased productivity and value of the company is a very important strategic goal of every enterprise. Achieving this goal is becoming increasingly difficult, as the competitiveness of companies and saturation of almost all markets are increasing. Implementing value-based management and its basic principles will help companies to align goals of management and owners of the company and focus on maximizing value. Through these changes, the company can increase its value, to prosper and achieve their goals with greater ease. Since profit was no longer the only tool to measure value of the company, traditional value measurement tools were unable to measure it properly. New modern methods were and are being developed. These modern methods can measure value of a company based on the VBM. There are many of them and one of the most used is EVA. But EVA, as well as any other indicator has its pros and cons. Calculating value and value creation of a company considering all the circumstances affecting it, is a very complex and challenging process. There is no ultimate value indicator that works on all companies with 100% success. Considering the difficulty of this task, there may never be a value measurement tool like this.

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University of Žilina, Žilina, Slovak Republic

# Innovation strategies and performance of Slovak Republic

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**Abstract.** Innovation is part of every state, organization, person, etc. As our needs constantly escalate, innovation must be accelerated, so that they can fulfill. All States shall endeavor to achieve the best performance on the innovation performance and beat the other states. The article discusses the innovation performance of Slovakia and the National Innovation Strategy for the years 2007-2013 and 2014-2020, under which Slovakia is governed and managed.

**Keywords:** Innovation, Slovakia, innovation performance

## 1. Introduction

Enterprises are always trying to increase their revenues and market share, they want to beat their competitors. In order to improve, they have to innovate. And as the saying goes, if you wish to improve something, you need to measure it. This is the main reason why enterprises, businesses as well as states themselves are measuring their innovation performances. They need to know, in which areas they are doing good, and which they need to improve. Innovation performances of states are compared together and organized into categories – from modest innovators to innovation leaders. The goal is to become innovative as Sweden, which is their leader.

## 2. Innovation

We can imagine many things, when we say innovation. From an insignificant change of product. to entirely new one.

Term innovation has several meanings. The author is Joseph A. Schumpeter. (Schumpeter, 1926) analyzed business conditions in which organization is able and willing to carry out “new combination of development changes – innovations.”

Generally, the term innovation means positive change of state of certain system. Innovation exists in many forms, depending on characteristics of system or object they relate to.

When speaking about business, we can deduce, that innovation can take effect in each and every process and area of the organization. Management should ensure, that innovations are implemented in complexity and interdisciplinary as organic part of the whole innovation process.

## 3. Innovation performance

Rating innovation performance of countries include 25 indicators under which countries divided into 4 groups:

- Innovation leaders,
- Innovation followers,
- Moderate innovators,
- Modest innovators.

Indicators can be divided into 5 groups:

- Input – bearers of innovation,

- Input – creation of knowledge,
- Input – innovation and entrepreneurship,
- Output – application,
- Output – intellectual property. [3]

Using these indicators, assesses innovation performance of each country and divided into four categories - from modest innovation after innovation leaders Individual input and output are the most important indicator that the country increased innovation performance . The main indicators are subsequently divided into 26 smaller indicators. [3]

## 4. National innovation strategy

Up until 2013, Slovak Republic followed innovation strategy for 2007-2013 period. Strategic goal of said strategy was "innovations will become one of the main tools for knowledge economy development and Slovak Republic economic growth assurance in order to achieve level of the most advanced EU economies". [4]

"First priority was high-class infrastructure and effective system for innovation development. The intention was to achieve transparent and effective mechanism ensuring stimulation and expansion of third generation innovations.

Second priority were quality human resources. The intent was to obtain highly competent, professional HR with international experiences that will greatly contribute to development of private sector innovation activities.

Last priority were effective tools for innovations. The intention was to achieve environment where innovations were integral part of as many business activities as possible. Especially in small and medium enterprise. " [4]

In the present day, Slovakia is following National innovation strategy for 2014-2020 period. "Strategic goal is to improve the ability to commercialize and adopt innovations and technologies" and to include Slovakia into the group of successful industrial countries of 21st century and to double the business expenses on innovations from research and development activities. The outcome of this strategy will be improvement of Slovak Republic position in innovation performance index defined with SII (Scoreboard Innovation Index) by 5 points.

To accomplish this goal, "it will be necessary to accomplish following in order to achieve said goal:

- Structural change in research, development and innovation financing, because without permanent finance support and trough finance support specific financial support these areas trough specific financial instruments and impulses with use of public and private resources achieved significant progress in promoting subjects with high-tech products and knowledge intensive services and the increasing competitiveness of domestic entities.
- Change the existing state science, technology and innovation policy so that ultimately was for the development of all these policies is responsible only supreme authority.
- Creating conditions motivating businesses to increase activity in the field of applied research and innovation. One possibility could be the creation of favorable conditions for the development of clusters and clusters of other businesses (eg. Alternative trading platforms which implies revised General Block Exemption Regulation) with dominant private actors as cofinancing." [5]

## 5. Slovak innovation performance

Individual countries are still trying to improve and increase their innovation performance. Slovakia also increased innovation performance in recent years and is trying to move closer to the

average of EU 27. Slovak Republic for its innovation performance below the EU average among the moderate innovators (Figure 1).

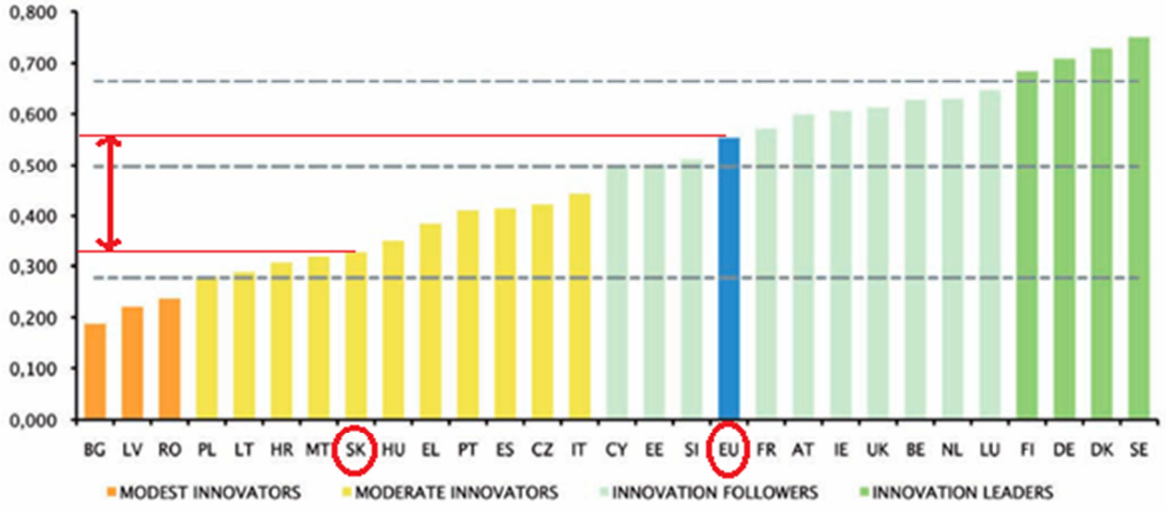


**Figure 1:** Innovation performance [1]

Since 2010, when Slovakia was at the bottom of mild innovators (5th worst country), it climbed up to 8th position in mild innovators. Its position worsen in compare to Hungary. Currently Slovakia innovation efficiency is lower by about 0,23 in compare to EU 27. In compare with 2013 this difference did not change.

During innovation strategy for 2009-2013 difference in innovation efficiency of Slovakia in compare to mean EU raised from 0,16 to 0,23, which means that innovation efficiency of Slovakia is raising slowly, mean innovation efficiency of EU 27 is raising faster, mainly in innovation leaders. [2]

## 6. Summary innovation index of Slovakia

Evaluation of national innovation performance is carried out on the basis of indicators, divided into, maybe 5 groups (see 3. Innovation performance). Based on the data collected through "application summary innovation index (1) quantify the convergence time" (the period during which the country with the lowest values of the indicators reach the EU average, respectively, a period that will be needed to the EU as a whole to approach the level of values of indicators achieved by most developed countries, i.e. innovation leaders). Convergence time is calculated in two ways, using a linear approach according to the following equation:

$$SII_x^T = SII_x^{T-1} * \left(1 + \frac{TREND\_SII_x}{100}\right), \tag{1}$$

where:
$SII_x^T$ – summary innovation index at time T and
$TREND\_SII_x$ - intensity of growth summary innovation index. [3]

Or using a non-linear approach (demanding procedure) by the following equation:

$$SII_x^T = SII_x^{T-1} * \left(1 + \left(\sqrt{\left(\frac{SII_{EU}^{2007}}{SII_x^{2007}}\right)}\right)^{\sqrt{T}} * \frac{TREND\_SII_x}{100}\right) \tag{2}$$

A non-linear approach is based on the recognition that the amount of growth of each country decreases with the decrease of the intensity depending on the size of the starting disparities across. " [3]

## 7. Conclusion

Slovakia in recent years has increased its innovation performance and improve its position in the EU 27. From the position of the end of the moderate innovators it managed to the position in the middle of these countries, despite stagnant positions in recent years. Achieving the average of the EU countries will take a few more years.

## Acknowledgement

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# Individual Motivational Programme

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**Abstract.** Motivation is a phenomenon which has been attracting the attention of many theorists and practitioners for years. Despite the fact everyone has embedded motivation within their motivational profiles, we know very little how to effectively address this inner motivation and ensure long-term motivated behaviour. The purpose of this article is to identify, describe and analyse the motivational profile of employees regarding motivation incentives which drive outstanding performance. The research adopts a case study research method and a quantitative methodology analysis bases on a questionnaire among all employees of the researched industrial company in the Slovak Republic. The main findings of the article are: the identification of main motivational incentives of employees and managers and especially, the way in which they are incorporated into motivational effort of managers to motivate their subordinates. The practical implication of knowing which motivational incentives are driving high performance enables managers to deploy an individually attractive and potent motivational programme. The value of this article is that it proposes the motion of individualization of motivational programme to drive high performance at particular company.

**Keywords:** motivation, motivating, incentives, motivational programme, job satisfaction, job performance, appraisal

## 1. Introduction

Since every company is a live and dynamic system managed and influenced by people and their diverse intentions, expectations and motives, the problematic of motivation and motivating at the workplace is closely interconnected with all corporate processes being management, operational or supporting. Motivation is closely interconnected with an employees´ job performance, job productivity and job satisfaction or dissatisfaction. For this article the motivation is defined as an inner force that drives employees to engage in high performance. The article is divided into two major parts, the literature review and key findings of the research. The conclusion summarises the most important parts of the article and further research possibilities.

## 2. Motivation, motivational incentives and programmes

Not only academic theorists but also practitioners have tried to define the concept of motivation and motivational incentives. There has been conducted an enormous research on what motivates human beings and why they respond to similar stimuli in different way. The result of this research is a tremendous amount of motivational strategies, programmes and theories as well as various recommendations for managers how to engage employees in desired behaviour and achieve performance goals [4, 2006]. Nevertheless, it is still a complex task to determine the right motivational incentives in generating an employee commitment [13, 2012, pp. 17].

In general the concept of motivation can be defined in many ways. Motivation has been defined as: *the psychological process that gives behaviour purpose and direction* [12, 1995]; *an internal drive to satisfy an unsatisfied need* [9, 1994]; and *all those inner-striving conditions described as wishes, desires, drives, etc.* [8, 1995]. High performance is achieved by well-motivated people who are prepared to exercise discretionary effort [1, 2012 pp. 182]. However, when compared with other

psychological constructs, the motivation is the less satisfactory defined since it refers to the most comprehensive and the most difficult isolable psychological processes. Besides, the motivation of every person is remarkably complex issue. We are not motivated only by one motive, but always by a complex of various interconnected motives which change over the time. A motive can be defined as a reason for doing something [1, 2012 pp. 182]. To understand individual´s behaviour it is important to understand individual´s motives.

The more we know about the structure of motives, e. g. needs, interests, ideals, values, goals, aspirations of the individuals, the best we can prepare the set of motivational incentives to effectively address the individuals´ intrinsic motivation and consequently job performance and satisfaction. There have been conducted plenty of miscellaneous researches aimed at gaining knowledge of what motivates people. Generally, it is claimed that the most effective motivational tool is financial reward for a done job, but recently non-financial incentives have been becoming increasingly important [6, 2010], [10, 2009], [15, 2006]. The impact of money as a motivational incentive can be short-lived and even act as a demotivator [7, 2008]. Depending on the character of researched respondents (workers, administrative employees, managers, students, etc.), the most important motivational incentives could be: *interesting and challenging work, career and personal development,* appreciation *of work,* feeling *of being "in on things", job security, good wages, two-way communication* [5, 2011], *work-live balance*, etc. [2, 2012].

When talking about motivation at the workplace, it means the interventions into intrinsic motivational structures and directing work behaviour of individuals in a desired way aligned with corporate strategic goals. In this context, motivation and motivating become extremely complex because of its interdisciplinary nature, i.e. its cross connection with other vital business and HR processes, e. g. performance appraisal, rewarding and development.

Interestingly, [14, 2001, pp 26] you cannot motivate anyone you can only create a situation to which individuals will respond because they choose to. Commitment is a voluntary response which cannot be mandated, but it will be the outcome of relationships which create a shared purpose. Therefore we have to think of work environment and atmosphere when talking about effective and enduring motivating. People tend to do their best work when they are in an environment that makes them feel valued, where they get a "pat on the back" or a "thank you" for a job well done [2, 2012].

Knowing about motives and the most influential motivational incentives enables mangers to create a working and powerful motivational programme. Motivational programme (incentive programme) can be defined as a set of wide range of motivational incentives provided to all employees of the company. In praxis managers may lack knowledge in implementing successful motivational programmes that increase production and create a positive work environment [2, 2012].

Solid evidence support claims that motivational programmes can increase the quality and quantity of performance. Stolovitch, Clark and Condly found that financial motivational programmes increase work performance more than 20 percent and the more effective programs produce increases in the 40 percent range [3, 2003, pp. 21]. However, there is also a critical research of effectiveness of motivational programmes [11, 1993].

## 3. The methodology

The qualitative research was chosen as a core method for data collection. In particular, a case study method was used to analyse the problematic in a company involving semi-structured interviews with a personal manager. The qualitative research was verified by a questionnaire which was distributed both electronically and in print among all employees. The questionnaire was created in two variants, for managers and employees from production and software department. Data was collected during a month period. It provided information about current state of employees´ motivation and collected requirements of employees concerning motivation policy in the company as well. To ensure the results are relevant, the rejection criterions of incorrectly fulfilled

questionnaire were adopted. The employees of the company were asked to answer questions regarding their motivation factors, job and salary satisfaction, educational needs, work atmosphere at the workplace, etc. There was used a ten-point scale.

# 4. The findings

The research was done in the manufacturing company situated in North Slovakia with 200 employees in an average. The main object of the company is to produce software and hardware for transport and railway systems. The outcome of the research provided a subjective opinion of employees, their satisfaction with a current motivational programme and the effectiveness of currently used motivation tools. At 5 per cent margin of error and confidence level 95 per cent the questionnaire was distributed to all employees. There was 39.4 per cent return of questionnaires. The average age of respondents was 26 – 40 years; the prevailing education at production department was secondary school education and university education at software department.

## 4.1. Key findings of the questionnaire

Researching current motivational situation required asking managers how they motivate their subordinates and employees which motivational tools they actually perceive as motivational.

On the one hand, from the above mentioned set of motivational tools managers as the most used chose these: „Praise for quality work", "Managers respect their subordinates", "Flexible working hours", "Providing space for innovation and new ideas" and "Listening to complaints and effort to solve them." However, only 20 per cent of respondents said they check effectiveness of these tools. Regarding the effectiveness of particular motivational tools, flexible working hours is claimed to be the most effective by managers (the average value 8.75 of 10). There was a rather high variability discovered based on standard deviation in respondents' answers, which indicates the different perception of particular tools effectiveness.

On the other hand, answers of employees are as follows: Praise as motivational tool is perceived by 53 per cent, respect is perceived by 67 per cent, and listening to complaints by 61 per cent and 38 per cent expressed they are provided with the space for innovations and new ideas.

For employees, the importance and satisfaction with motivational tools are as follows in Table 1. Since every employee is an individual with his or her own sense of importance of motivational tools, there is computed a variability of importance based on standard deviation. The biggest variability of importance is observed with the tools "Providing space for innovation and new ideas" (employees from production department, value 3.53) and "Family business culture" (employees from software department, value 3.05).

The importance of particular motivational tools was also researched regarding the age of respondents. The most important motivational tools for employees:

- aged <25 is *„Financial rewards for a job well done"* (the average importance 9.5 of 10),
- aged 25 – 40 is the same (the average importance 7.89 of 10),
- aged 41 – 55 is *„Personal and career development"* (the average importance 9.33of 10),

All employees agreed on the tools which they miss, i. e. higher financial reward for well-done job and successfully finished project.

Regarding job satisfaction employees were asked to identify barriers which they consider as constraints causing low job performance. Employees from production department identified these barriers: *"Insufficient salary"* (24.35 %), *"unequal salary for the same performance"* (20.87 %) and *"Misunderstanding between employees"* (11.30). Employees from software department identified these barriers: *"Insufficient communication between employees and managers"* (23 %), *"Routine work"* (23 %) and *"Limited space for career"* (18 %). Remarkably, barriers such as negative work environment, job insecurity or negative relationships between employees and managers were identified as the least.

| | Production department | | Software department | |
|---|---|---|---|---|
| ***Motivational tools*** | *Importance* | *Satisfaction* | *Importance* | *Satisfaction* |
| 1. Providing space for innovation and new ideas | 5.12 | 6.08 | 6.42 | 6.46 |
| 2. Praise for quality work | 5.69 | 5.29 | 6.50 | 6.06 |
| 3. Flexible working hours | 7.77 | 7.39 | 7.12 | 8.06 |
| 4. Modern and safe working environment | 8.10 | 7.32 | 6.96 | 7.11 |
| 5. Managers respect their subordinates | 7.70 | 7.35 | 7.23 | 6.48 |
| 6. Providing feedback regarding my job performance | 6.57 | 5.85 | 6.88 | 6.13 |
| 7. Non-financial rewards | 4.76 | 4.00 | 6.08 | 6.00 |
| 8. Financial rewards for a job well done | 8.00 | 5.20 | 8.35 | 4.70 |
| 9. Financial contribution | 7.79 | 5.94 | 6.04 | 4.92 |
| 10. Fair performance appraisals | 7.70 | 6.71 | 8.19 | 6.86 |
| 11. Organization of leisure time activities outside the workplace | 6.70 | 7.62 | 4.88 | 6.17 |
| 12. Organizing activities for other members of employees´ families. | 6.50 | 7.73 | 4.23 | 6.19 |
| 13. Providing relevant information in time | 7.00 | 6.79 | 7.50 | 5.27 |
| 14. Delegation of authority and responsibility. | 6.21 | 6.42 | 5.42 | 5.29 |
| 15. Personal and career development | 6.63 | 6.58 | 7.35 | 5.86 |
| 16. Listening to complaints and effort to solve them | 6.96 | 6.88 | 6.92 | 5.87 |
| 17. Family business culture | 6.59 | 7.07 | 5.58 | 6.67 |

**Tab. 1** The importance and satisfaction with motivational tools

## 4.2. Motivational programme in the company

Currently used motivational tools in the form of company benefits or perks are provided to all employees broadly. There are these benefits, attitudes and activities:

- *Financial motivation:* variable part of the salary, business loan at favourable conditions, and financial contribution at employee´s work jubilee, financial contribution at various life situations (birth, wedding).
- *Professional development:* technical courses, soft-skill development courses and language courses.
- *Non-work activities:* international children´s day, Christmas party, summer party, various sports activities and social events.
- *Motivational attitudes:* respectability and correctness when treating employees, delegating responsibilities and authority, extra holiday beyond the law and flexible work hours.

## 4.3. Individual motivational programme creation

There is a space to enhance currently used motivational programme by adding new motivational tools such as an instant feedback and thanks for well-done job, job rotation and interesting job content, 13. salary, profit-sharing for employees, change of participating in job and development related goals, small gifts for employees and many others. The best way to ensure that the motivational programme suits needs and motives of a particular employee is to ask him or her during personal motivational interviews or performance appraisal interviews. The basic steps regarding individualization of motivational programme is captured at the following Fig. 1.

**A. Analysis of a motivational profile**

1. To find out what motivates a particular employee (regarding various motivational theories it could be these motives):

- *Feeling of success and appreciation*
- *Effort to avoid a failure*
- *Need to step out from the line*
- *Need for self-actualization*
- *Need for career development*
- *Need for power and decision-making*
- *Need for friends and positive work collective*

- *Need for financial reward*
- *Need for a stabile job position*

2. To provide an employee with a current set of motivational tools and attitudes which the company is actually providing.
3. To find out employee´s sense of importance and satisfaction with particular motivational tools and attitudes

**B. Analysis of job satisfaction**

1. To find out barriers which employees consider as constraints causing low job performance or increased level of demotivation. It is required to ask these issues:

- *Achieved success and appreciation*
- *Satisfaction with job quality*
- *Satisfaction with work environment and conditions*
- *Satisfaction with work collective*
- *Satisfaction with a performance appraisal*
- *Satisfaction with a job reward system*
- *Satisfaction with motivational attitude of managers*
- *Satisfaction with a career development*

2. To find out the level of employees´ identification with the company. It is required to ask these issues:

- *The extent of knowing corporate goals*
- *Knowing of vision and strategy*
- *Pride of being a part of the company*
- *Willingness to bound own career development with the future of the company*
- *Loyalty and trust in the company*

**C. Formulation of "an action plan" for an individual motivational programme**

1. Based on knowing of an employee´s motivational profile and his or her job satisfaction manager identifies motivational tools and attitudes which are the most effective.
2. Manager works out the document where based on discussion and mutual agreement he identifies the steps necessary to ensure getting given motivational tools into day-to-day practise.
3. On the basis of self-control and self-evaluation an employee reports to the manager the feedback regarding satisfaction of like this prepared individual motivational programme.

**D. Evaluation of an individual motivational programme**

1. It means a complete evaluation of individual motivational programme effectiveness (based on questionnaires and individual motivational interviews) at the end of year, which results in specifying the following steps – the re-elaboration or replenishment of individual motivational programme.

The aim of evaluation of individual motivational programme is to find out real effectiveness of particular motivational tools and thus find out which tools boost job motivation and which do not. For this purpose it is necessary to investigate:

- *Satisfaction with motivational tools*
- *Importance of particular tools*
- *Effectiveness of particular tools according to employees*
- *Aspects of job satisfaction (salary, work environment, work collective, working hours)*
- *Employees´ initiative to come with innovative ideas*
- *Employees´ engagement and self-identification with the company*
- *Trends: positive of negative trends in these areas of investigation*

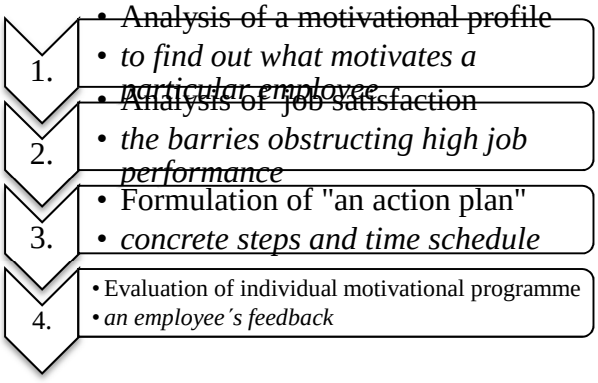


**Fig. 1** The sequence of steps of individual motivational programme creation

## 5. Summary and conclusion

Not only can regular surveys on employees´ satisfaction provide managers with the feedback on the effectiveness of particular motivational tools, also it can reveal other potent tools missing, which are crucial for an individual motivational programme creation.

Researched company is a stable and prospering which market success is achieved not only by high quality of its products, but also by recruiting, keeping and developing talented employees. Based on a thorough research of HR processes regarding recruiting, motivating, development, performance appraisal and rewarding enabled to depict the general picture of motivation situation in the company. In general, there is the effort to put motivational emphasis on every HR process.

Stable working environment is an excellent prerequisite for effective motivating. According to personal interviews, the management pays a due attention to motivating; it is not disparaged just to financial motivational tools as the only effective ones.

Based on some results, it would be necessary to conduct another research especially to investigate answers regarding deficiency of communication between employees and their managers. It requires further research to ensure that an individual motivational programme contains motivational tools reflecting employees´ individual perception of motivational tools effectiveness.

The problem which was researched was that many companies do not make motivational programmes more individual according to different individual preferences of the employees from various reasons (the lack of time, financial or human resources, underestimation of individual programmes, unwillingness to change…).

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# Benefits of online reputation management for organizations operating in various industries

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**Abstract.** Internet is a place where consumers exchange their experience. This process contributes to shaping online reputation of organizations. Positive online reputation is desired by most organizations. But only few organizations know that it can be changed from positive to negative per day. To avoid inconveniences, organizations need to manage their online reputation. The purpose of this study is to demonstrate the benefits of online reputation management based on analysis of related case studies. The purpose is achieved by the secondary research which consists of analyzing the case studies focused on online reputation management. Used methods are analysis, comparison and selection. The main finding is that online reputation can be managed in many indicators. In conclusion, proper online reputation management strategy is a benefit for every organization. Recommendations for organizations are to monitor their online presence and manage it properly, so they can gain more customers and of course higher profit.

**Keywords:** Online reputation, online reputation management, reviews, review volume, average star rating.

## 1. Introduction

In today's volatile economic situation, every organization is making efforts to succeed. Success of organization depends on many factors. One of these factors is reputation. Organization which has a good reputation today, tomorrow might be doomed. Globalization has brought growth of the Internet. Internet, inter alia, is a place where consumers exchange their experience. This process contributes to shaping online reputation of organizations.

Internet presence is desired by every organization. Being discussed, in fact, does not come without a price. If organization accepts customers' opinions, it also must be ready to face them promptly. But what if its products/services spark too much criticism? What if its employees are not social media savvy? What if its competitors take advantage of its wrong actions? These are some of the reasons why every organization needs to have a proper online reputation plan in action. Another reason is to learn not only from own mistakes, but also from the mistakes made by others. Here are three famous cases of reputation management failure in the digital era [1]:

- Dark Horse Café received a tweet criticizing their lack of electrical outlets for laptops. Their response was inappropriate because they indicate that they are in the coffee business, not in the office business. Many internet blogs reported their reaction as a negative example of public relations.
- Few years ago, Nestlé received negative comments about their environmental practices. They did not respond to them at all. Internet communities started to post altered versions of the Nestlé logo. They became so aggressive that they were forcing the organization to close their public pages.
- Amy's Baking Company received a one-star internet review, so they insulted the reviewer. Their insults were picked up by the local news and this sort of negative attention didn't do any good to their publicity.

The purpose of this study is to demonstrate the benefits of online reputation management based on analysis of related case studies. In support of the primary purpose, these secondary objectives were determined: theoretical determination of online reputation, theoretical determination of online

reputation management and its methodology, analysis of case studies aimed at highlighting the benefits of a strong online reputation. The study is divided into five parts: introduction, theoretical background, methodology, results, conclusion and recommendations. Introduction represents input to the problem. Theoretical background addresses definitions of online reputation and online reputation management. Methodology describes methods used in this study. Results part comprises secondary research that consists of analyzing the case studies focused on online reputation management. The last part – conclusion and recommendations evaluates the results of the secondary research. It also includes recommendations arising from this study.

## 2. Theoretical background

According to Reputation.com – the world's leading provider of online reputation products and services, online reputation is how others see the organization when they look for it online. Online reputation can include news articles, blog posts, social media profiles, people search sites, public records, Wikipedia articles and many other sources [2]. Online reputation is the addition of all the contents and comments about organization posted on the Internet. It is divided into [3]:

- Official communication channels: websites and social networks profiles related to and managed by organization.
- Channels that organization cannot master but should survey: any consumer can express his opinion about organization and publish it on the websites, blogs, social networks and forums.

Online reputation is formed constantly and anywhere in the world through the discussions about any organization and its products or services. While constructive criticism is always welcome, damaging information published through various internet channels can be destructive to the organization. Such information is spread by dissatisfied customers but also by competitors. The worst thing is that sometimes the organization doesn't even know about such attacks. Organizations therefore need to be informed about what is spread through the Internet about them [4].

Online reputation of every organization can be managed. Online reputation management (ORM) combines marketing, public relations and search engines. ORM enables organization to protect and manage its online reputation by becoming actively involved in the outcome of search engines results. The goals of ORM are high rankings in the search engines and appearance on all positive associated websites. Thanks to that, organization can gain visibility and good publicity. The result is an increase in organization's overall positive internet presence. Three steps of ORM are [5]:

1. to monitor and track what is being said online,
2. to analyze how the visible information affect organization's brand and reputation,
3. to influence the results by participating in the conversations and eliminating negative voices.

According to Wijngaard and Boermans, every organization does not have an online reputation, but it can get one. They described ORM as anything that a consumer might write about organization. It is important for three reasons: organization gets information, organization has a chance to react, organization can take control of the discussions about itself [6].

According to Reputation.com, ORM is about making sure the world sees the organization for what it truly is. With ORM, organization can get more internet referrals, better return on its marketing efforts and more time to focus on running its business. ORM was created because the Internet doesn't always tell the whole story and that's where ORM steps in [2].

In summary, positive reviews are the stanchion of successful business. In practice, however, things are more complex. All comments, no matters if they are negative or positive, are beneficial to organizations. That's why it is important to encourage all customers to give feedback online. Even more, it is important when organizations respond to criticism to provide the context [7].

To emphasize the impact of ORM, Reputation.com created ORM methodology. It is divided into seven steps. These seven steps lead organization to acquisition of a strong online reputation [2].


**Fig. 1.** Seven steps to a strong online reputation [2].

Online reputation consists of what people believe about organization, which is why external stakeholders' endorsements make up the cornerstone of a good ORM strategy. The main factors that affect online reputation of every organization are listed below [2]:

1. Presence: Organization has to claim and optimize its internet presence, including social media profiles, and make sure all its contact information is up to date.
2. Online reviews: Organization has to determine the place where it is being reviewed and then monitor its reviews and track the trends that appear.
3. Social media: Organization has to have an attractive presence on each of the top social media sites by including only the information that is most relevant to its customers.
4. Surveying: Organization has to set up digital survey kiosks to collect feedback from customers.
5. Analysis: Organization has to track new data and make regular reports.
6. Benchmarking & Scoring: Organization has to measure how well its competitors manage their online reputations, so it can look for clues on how to improve its own online reputation.
7. Location alignment: Organization has to coordinate efforts between its business locations and collect the data centrally.

People use internet tools because they need a quick and easy way to decide which organization can be trusted. Done right, ORM should open up organization's schedule, not give it extra tasks to do [2]. Time and money of organization that gains a positive online reputation can be saved by acquiring new customers. Customers' time can be saved as well, since there is no need for them to seek out a new organization to trust. Further, they can be assured that their money was spent wisely.

## 3. Methodology

The purpose of this study is to demonstrate the benefits of online reputation management based on analysis of related case studies. In support of the primary purpose, these secondary objectives were determined: theoretical determination of online reputation, theoretical determination of online reputation management and its methodology, analysis of case studies aimed at highlighting the benefits of a strong online reputation. To fulfill the purpose of the study, important terms as online reputation and ORM were described. After that, it is possible to pursue the secondary research. Case studies focused on ORM are regarded as data sources for the secondary research. They were conducted by the world's leading provider of online reputation products and services – Reputation.com. To get a more extensive view, case studies conducted in various industries are to be used. Methods used in the secondary research are analysis, comparison and selection. Results

from the secondary research will be summarized in the conclusion and will provide the ability to enunciate recommendations for the future.

# 4. Results

Reputation.com published case studies it had conducted. All of the case studies are focused on the impact of the mentioned Reputation.com's ORM methodology used in various industries. The purpose of every case study is to highlight the benefits of a strong online reputation created by the proper ORM strategy. Case studies were conducted in industries described in the following sections below.

## 4.1. Healthcare industry

This case study is about anonymous healthcare provider from the Fortune 500 – annual ranking of the top organizations and executives in the USA. Online reputation of this healthcare provider had a big offline impact on its hundreds of care centers across the USA. When the healthcare provider first consulted Reputation.com, it faced [8]:

- negative reviews and poor social media feedback that was driving new patients away;
- average loss of $3,000 to $50,000 in lifetime revenue per patient;
- an average rating between 2 and 3 stars out of a possible 5 stars.

Reputation.com's ORM methodology had aggregated thousands of patient reviews across dozens of medical and mainstream review sites across the USA, sorted them and analyzed feedback by site and region. It took two years to improve every metric [8]:

- review volume has increased by nearly 50%;
- positive reviews from actual patients and their families increased by 477%;
- star rating has improved by an average of 1.4 stars.

## 4.2. Real estate industry

The Don Pelletier Group, Inc., a 30 years old real estate agency from San Diego, had over 220 handwritten customer reviews. Number of home buyers searching online for realtors is constantly increasing. That, in fact, caused a major problem for this organization. When the organization consulted Reputation.com, it faced [9]:

- limited online presence;
- only 2 positive online reviews.

During 2013, Reputation.com helped the organization gain control over its online presence. They established an initial online presence by populating it on a wide range of business listing websites. They also established a custom landing page, with autopublished feedback from customers. The Don Pelletier Group, Inc. saw its online reputation growing on all major review websites. It achieved the following results [9]:

- review volume has increased by nearly 1950%;
- positive reviews from actual clients and their families has increased by 1800%;
- average star rating has improved to 4.9 stars.

## 4.3. Automotive industry

Another case study was conducted to demonstrate the effectiveness of Reputation.com's ORM offerings. Organization with locations across the USA contracted Reputation.com to monitor and improve the online reputation of its stores. The 15 months lasting trial contrasted two groups of stores [10]:

- control group with access to Reputation.com's technology platform only;
- managed group with ORM campaign run by Reputation.com.

Average volume of positive reviews for the managed group was more than 5 times higher than the control group during the trial. During the trial, the proportion of negative reviews for the managed group fell by nearly 60%. The control group's proportion of negative reviews stayed the same. Results of the fifteen months monitoring are in the table below [10].

| Group/ Results | Positive reviews generated | | | Proportion of negative reviews | | | Change in average sales volume |
|---|---|---|---|---|---|---|---|
| | 06-09 2011 | 06-07 2012 | 08-09 2012 | 06-09 2011 | 06-07 2012 | 09-09 2012 | |
| Control | ↑ 18%, ↑ | ↑ 12% | ↑ 17% | ↓ 25% | ↓ 33% | ↓ 23% | -6% |
| Managed | ↑ 20% | ↑ 36% | ↑ 87% | ↓ 44% | ↓ 38% | ↓ 18% | +14% |

**Tab. 1.** Key findings in automotive industry [10].

### 4.4. Car rental industry

International car rental brand asked Reputation.com to improve online reputation of its locations. Locations were spread across the USA. Group of pilot locations (provided with ORM platform including on-site review request kiosk) was compared to a similar control group (only monitored). Results of the three months monitoring are in the table below [11].

| Locations/ Results | Change in monthly review volume | Proportion of negative reviews | Change in average star rating |
|---|---|---|---|
| Control | ↑ 33% | ↓ 2% | ↑ 3% |
| Managed | ↑ 555% | ↓ 50% | ↑ 40% |

**Tab. 2.** Key findings in car rental industry [11].

### 4.5. Complex assessment

To demonstrate the importance of ORM, Reputation.com conducted not only industry-oriented case studies, but even a complex assessment. It was based on the following data [12]:

- 92% of internet users read product reviews;
- 89% of people say that reviews influence their purchasing decisions;
- 72% of consumers trust online reviews as much as word of mouth;
- 88% of consumers who search for local services will call or visit one of the businesses they find within the next 24 hours.

Complex assessment monitored two groups of organizations: managed only and managed with kiosk. Results of online reputation improvement of organizations using ORM methodology by Reputation.com are summarized in the table below [12].

| Locations/ Results | Change in monthly review volume | Proportion of negative reviews | Change in average star rating |
|---|---|---|---|
| Control | ↑ 178% | ↓ 89% | ↑ 16% |
| Managed | ↑ 650% | ↓ 400% | ↑ 25% |

**Tab. 3.** Key findings in a complex assessment [12].

In short, all users saw a marked gain for each metric. Although, kiosk users saw gains 2–3 times larger than non-kiosk users [12]. Apparently, well modeled and well targeted ORM can guarantee improvement in online reputation of any organization.

## 5. Conclusion and recommendations

Negative online reputation can cause significant damage to any organization. As shown by the three most popular online reputation failures, not just small local organizations may be affected. What is needed is effective ORM. The role of the ORM is to get the organization to awareness by increasing the number of positive reviews and a reduction in the number of negative reviews.

The purpose of this study was to demonstrate the benefits of online reputation management based on analysis of related case studies. In support of the primary purpose, these secondary objectives were determined: theoretical determination of online reputation, theoretical determination of online reputation management and its methodology, analysis of case studies aimed at highlighting the benefits of a strong online reputation. The first secondary objective was achieved in the second section – theoretical background by defining online reputation. Also in the theoretical background, the next secondary objective was achieved by defining online reputation management and seven steps of Reputation.com's ORM methodology. The last secondary objective was achieved by analyzing the Reputation.com's case studies. Used case studies were aimed at highlighting the benefits of a strong online reputation. According to the case studies, it is possible not only to monitor, but even to manage organization's online reputation. Reputation.com's case studies also showed that online reputation can be managed in many indicators. For example, review volume can increase by 50% or even by 1950%. Positive reviews can increase by 12%, by 87%, by 555% or even by 1800% and average star rating can increase by 3% or even by 40%. However, results of ORM also depend on the characteristics of the organization. The key is to adopt an appropriate ORM strategy. In many cases, the software is not enough. What is needed is a whole ORM solution. For example appropriately chosen ORM tools and campaign managed by a team of experts.

Recommendations for organizations are to monitor their online presence and manage it properly. With positive online reputation they can gain more customers and of course higher profit. Organizations must keep in mind that anything that cannot be found on the Internet may be even considered as nonexistent. As for the business, this applies twice.

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# UTILIZATION OF BANKRUPTCY AND CREDIT-WORTHY MODELS FOR THE DETERMINATION OF A CREDIT FRAMEWORK

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**Abstract.** The article deals with the selection of potential customers using bankruptcy and credit-worthy models and the purpose is to create a tool for the minimization of the risk of a negative impact on the financial stability of a business establishment which might result in secondary insolvency.

**Keywords:** controlling, creditworthy and bankruptcy models, index of creditworthiness, Altman analysis; Taffler index

## 1. Introduction

The goal of business establishments is to increase their value or to generate profits. To achieve the set goal, they must either provide services or sell goods. The business process differs in individual business undertakings. In some of them payment or part payment proceeds in advance prior to the delivery of the goods (this is typical of B2C transactions). Nevertheless, the B2B variant when the goods are delivered and the invoice with a due date is issued afterwards is used more frequently. In such a case there is a risk that the business establishment supplies the goods but fails to get the money due to the fact that the other party has financial problems and goes bankrupt. Bankruptcy and credit-worthy models can help select the customer and minimize the risk of a negative impact on financial stability.

## 2. Information and Retrieval

### 2.1. Bankruptcy and credit-worthy models and their informative value

The purpose of testing the customer's creditworthiness with every purchase order is to eliminate any non-recoverable claims and a uselessly high number of customers with overdue payments, which may inflict crisis situations in the supplier's management [1]. There are several methods which can be used for the verification of the customers' stability. Among the most frequently used ones are financial analyses, pyramidal decomposition and bankruptcy models. Each of them has its pros and cons.

In the case of a financial analysis and pyramidal decompositions, the main drawback is the difficult interpretability of the resulting data. On the other hand, the method provides an integrated view of the business establishment and if the analysis is performed by a professional, the method's reliability is very high.

Unfortunately, the bankruptcy and credit-worthy models do not allow a comprehensive assessment of the business establishment, but the result is easily understandable even to a non-specialist in the respective field of activity.

Business establishments for B2B transactions can be selected using both the aforementioned methods. However, the first method is time consuming and depends on whether the business

establishment has a real specialist in the field at its disposal. Considering this fact, we will assess the selection of customers on the basis of bankruptcy and credit-worthy models.

### 2.1.1. Index of creditworthiness

The index of creditworthiness is one of the most frequently used credit-worthy models in German-speaking countries [6]. This index was created based on the multiple discriminant analysis and consists of six ratio-type indices.
The formula of the index of creditworthiness:

$$IoC = 1{,}5 \cdot \frac{Cash\ flow}{Liabilities} + 0{,}08 \cdot \frac{Assets}{Liabilities} + 10 \cdot \frac{Profit}{Assets} + 5 \cdot \frac{Profit}{Revenues} + 0{,}3 \cdot \frac{Profit}{Revenues} + \\ +0{,}3 \cdot \frac{Inventories}{Revenues} + 0{,}1 \cdot \frac{Revenues}{Assets} \tag{1}$$

The result of the respective index is whether the business establishment is creditworthy or if its bankruptcy is imminent. The negative values of the index of creditworthiness indicate business establishments on the edge of bankruptcy. On the other hand, positive values are typical of creditworthy customers. The following table shows these categories more specifically.

| **Result** | **Evaluation** | **Business establishment** |
|---|---|---|
| IoC € (-∞ ; -2) | Extremely bad economic situation | Bankruptcy |
| IoC € <-2 ; -1) | Very bad economic situation | Bankruptcy |
| IoC € < -1 ; 0) | Bad economic situation | Bankruptcy |
| IoC € < 0 ; 1) | Difficult economic situation | Creditworthy |
| IoC € < 1 ; 2) | Good economic situation | Creditworthy |
| IoC € < 2 ; 3) | Very good economic situation | Creditworthy |
| IoC € < 3 ; ∞) | Extremely good economic situation | Creditworthy |

**Tab. 1.** Evaluation by the index of creditworthiness [4]

### 2.1.2. Altman model

The Altman model or the Altman analysis. References provide four variants of this analysis [6]:

- a variant for joint-stock companies with publicly traded shares (a so-called Z Score),
- a variant for companies not traded on financial markets (a so-called Z‘ Score or ZETA),
- a variant for non-productive companies (a so-called Z‘‘ Score),
- a variant for Czech companies.

The Altman model's formula: [3; 4; 6]

$$Z' = 3{,}107 \cdot \frac{Profit}{Assets} + 0{,}998 \cdot \frac{Revenues\ from\ sales}{Assets} + 0{,}42 \cdot \frac{Book\ value\ of\ shares}{Total\ payables} + \\ +0{,}847 \cdot \frac{Retained\ profit}{Assets} + 0{,}717 \cdot \frac{Net\ working\ capital}{Assets} \tag{2}$$

The resulting values of the Altman model classify business establishments into three basic categories:

| Result | Evaluation |
|---|---|
| Z € < 2.99 ; ∞) | Creditworthy business establishment |
| Z € ( 1.81 ; 2.99) | Grey zone |
| Z € ( - ∞ ; 1.81 > | Bankruptcy business establishment |

**Tab. 2.** The resulting values of the Altman model [4]

Altman says that the resulting analysis will predict the business establishment's bankruptcy in 91 % and only in 3 % of cases the business establishment is classified as prosperous although it goes bankrupt in near future [6].

### 2.1.3. IN index

This is the first index created for the local market of the Czech Republic which should therefore show a high reliability in the local environment. This index has developed gradually from the IN95 variant (the number 95 indicates the year of origin), through the IN99 and IN01 variants up to the IN05 variant. The IN95 variant was the bankruptcy model. The IN99 variant was the credit-worthy model monitoring whether the business establishment generates value. In the case of the IN01 and IN05 variants the procedure has been unified and both approaches are followed [2].

The last known index for the time being is the IN05 index which is an up-to-date version of the IN01 index.

The formula of the IN05 index:

$$IN05 = 0{,}13 \cdot \frac{Assets}{Liabilities} + 0{,}04 \cdot \frac{EBIT}{Interest\ expenses} + 3{,}97 \cdot \frac{EBIT}{Assets} + 0{,}21 \cdot \frac{Total\ revenues}{Assets} + 0{,}09 \cdot \frac{Current\ assets}{Short-term\ payables + short-term\ bank\ loans} \quad (3)$$

| Result | Evaluation |
|---|---|
| IN05 € < 1.6 ; ∞) | Creditworthy business establishment |
| IN05 € (0.9 ; 1.6 ) | Grey zone |
| IN05 € ( - ∞ ; 0.9 > | Bankruptcy business establishment |

**Tab. 3.** Evaluation by the IN05 index [2]

### 2.1.4. Taffler index

In 1977, Taffler and Tisshaw, British economists, chose four key ratio-type indices to which they assigned weights and thus enabled the calculation of a so-called Taffler index. For the selection of the used four indices, a set of 90 original ratio-type indices was used [6].

The Taffler index has two variants - the original variant and a modified variant.

$$T2 = 0{,}53 \cdot \frac{Profit}{Short-term\ payables} + 0{,}13 \cdot \frac{Current\ assets}{Liabilities} + 0{,}18 \cdot \frac{Short-term\ payables}{Assets} + 0{,}16 \cdot \frac{Revenues\ from\ sales}{Assets} \quad (4)$$

| **Result** | **Evaluation** |
|---|---|
| T2 € (0.3 ; ∞) | Creditworthy business establishment |
| T2 € < 0.2 ; 0.3 > | Grey zone |
| T2 € ( - ∞ ; 0.2 ) | Bankruptcy business establishment |

**Tab. 4.** Evaluation based on the modified Taffler index [4]

The result is further categorized within the limits 0.9 and 1.6 (Figure 1). If the business establishment is below the lower limit 0.9, the probability of its bankruptcy is 97 %. If the index is within the grey zone (between 0.9 and 1.6), the probability of bankruptcy is 50 %. If the index exceeds 1.6, the probability that the companies will not go bankrupt amounts to 95 %. This informative value has been measured in 1,526 industrial establishments [2].

## 2.2. Drawbacks of the bankruptcy modules

Regardless of the aforementioned informative value of individual models and the easy interpretability of results, there is a number of problem areas. However, the purpose of the article is not to provide the solution of individual problem areas and therefore the article offers the reader an overview accentuating the fact that currently it is not possible to absolutely rely on the models and that a number of other parameters must be taken into account. Such other parameters in practice often refer to non-financial and informal indicators, such a small talk with a dealer of the other party where the dealer complaints about defaults in payment of their remuneration, etc.
Among the main problems related to bankruptcy models are the following ones [6]:

- Bipolar dependent variables - The models work with simplifications that cannot be reached in reality. Even in the case of a simple definition of the business establishment's failure there are various views which may result in different calculations and interpretability of the result.
- Input data set - A majority of models work with a non-random sample, which implies that if the model is applied to a real case, the result will differ from the result on the basis of which the model was created.
- Stationarity and instability - The models are usually created based on a reverse analysis. If a forecast is created using these models, a different dependency between dependent and independent variables develop, which affects the result of the model.
- Choice of independent variables - In a majority of models, popular and frequently used indicators are chosen. However, these indicators are often subject to “window dressing” (fraudulent conduct aimed at improving the respective indicator in accounting records).
- Annual financial statements - These financial statements are used for the calculation although individual countries employ different methodologies for their drawing up and also in this case a great deal of data necessary for the correct calculation is missing.
- Time dimension - The standard models ignore the fact that companies develop in time. Due to this fact, the calculation is always independent of time, which is conflict with reality.

## 2.3. Credit framework

Regardless of the aforementioned drawbacks, the bankruptcy and credit-worthy models can be used for the selection of suitable business partners and the definition of rules for approval of invoice-based transactions. For this purpose, a credit framework can be used in several ways.

## 2.4. Segmentation based on categories

One of the methods of the credit framework application is defining individual segments of customers according to own needs and the business establishment can determine the total credit limits based on the segments. It is very important that the financial limits and segments correspond with the needs of the business establishment. If this is not the case, the limits are determined by the business establishment with high demand, not being able to meet the demand with its offer. In this case it is very likely that the business establishment will not conduct trade with companies subject to a risk of bankruptcy. The situation will be completely different in the case of a company having difficulties with establishing in trade. Such a company will likely take a greater risk to sell its goods. This different approach may not apply to the company as a whole but individual products. The following table provides an example of the determination of limits.

| Category | Creditworthy | Uncertain | Risky |
|---|---|---|---|
| Product A | 100 thousand | 25 thousand | 30 % of the deposit and a max. of 10 thousand |
| Product B | 200 thousand | 50 thousand | 100 % of the deposit |
| Product C | 200 thousand | 100 thousand | 50 thousand |

**Tab. 5.** Possible segment categories, own work

Table 1 shows that in the case of product B, the demand for the goods produced by the company is high, which means that the company can afford not to trade with risky business establishments at all or to request a 100% deposit for the goods concerned. In the case of product C the situation is completely different.

## 2.5. Choice of model for the definition of segments

No matter whether the business establishment determines individual segments for credit frameworks in the standard way or deals with frequent collections on the basis of a matrix, it is necessary to implement a procedure for the classification of individual business establishments into segments. As indicated above, it is possible to use a number of approaches, starting with the standard financial analysis, though pyramidal decompositions up to bankruptcy models. For the sake of easy interpretability and a relatively good informative value of results, I recommend all business establishments to preferentially use for this purpose bankruptcy and credit-worthy models, unless the business establishment has a specialist (financial analyst) at its disposal.

If the business establishment decides to define a segment for the classification of companies based on the bankruptcy and credit-worthy business establishment criteria, it remains to decide which of these models will be used as there is number of them available. Some of the models are used on a global basis, such as the aforementioned Index of creditworthiness or Altman analysis. In other cases, local models would be more appropriate, such as the IN index by Mr. and Mrs. Neumaier. Considering the fact that a local design of the bankruptcy models is able to take into account various regional specifics, which may not be respected by the globally utilized models, I recommend employing such locally applicable models provided that there are convincing studies attesting their informative value.

## 3. Conclusion

Systematic controlling implemented in the business establishment reduces the risk of secondary insolvency due to a business partner bankruptcy. For this purpose, the trader should create records on customers based on the probability of their bankruptcy, or, where applicable, their inability to meet financial obligations. Due to high-quality results and easy use, it is advisable to employ bankruptcy and credit-worthy models.

When defining controlling, it is very important to take into account the goals of the business establishment and regard the results as source materials for decision-making, not as a decision itself. In other words, if the calculation for the business partner results in a negative value, this does not mean that cooperation with the business establishment concerned should be terminated immediately. On the other hand, it should be kept in mind that there is an increased risk involved in continuing cooperation with such a business partner.

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# Sustainable development, solidarity and pension entitlements of the privileged groups in Poland

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**Abstract:** The objective of this article is to present the pension entitlements of privileged groups in the context of sustainable development and solidarity. Social security is one of the fundamental rights of citizens, however, specific solutions in this area should be based on numerous principles resulting not only from the current or past political power of specific social groups, but also from the principles of solidarity and of sustainable development. Solidarity in this regard refers to the impact of a group on the community. Sustainable development, in turn, through sustainable finance refers to the impact of specific solutions resulting from the functioning of the privileged pension systems on the situation of future generations.

**Keywords:** Sustainable finance, solidarity, sustainable development, pension, Poland

## 1. Introduction

Social security is a fundamental right under the current legal order in most (if not all) countries in the world. This statement, similar to the reference concerning the need to base the country's development on the principles of sustainable development, appears in the constitutions of many countries - solidarity (in France, Germany, Poland, Italy, Mexico, Egypt, and Switzerland), sustainable development (in Poland, Montenegro, Egypt, and Switzerland)[1].

Currently, both politicians and numerous social groups appeal to solidarity in the context of the pension security of selected social groups. However, to address their rights appropriately, it is necessary to determine precisely what solidarity and sustainable development are. The latter in one of their pillars refers to the economic aspect which can be understood here as balanced finances. Meanwhile, this preference stems from the specific characteristics of the Polish system of representation of interests. It must be noted that narrow occupational categories closely tied in terms of ownership or organizationally with the state are exceptionally well-represented within this system [3] and the pension rights are the product traded in exchange for political support [10].

The purpose of the study is to present the entitlements of the privileged social groups in Poland in relation to solidarity and sustainable development.

## 2. The essence of solidarity and sustainable development

Solidarity has been based on the responsibility of the individual for the community and of the community for the individual, that is on the activities undertaken in common interest. Solidarity can occur between members of a small community, of the whole society, as well as between regions or

[1] In the Constitution of Poland both terms have been used (the Preamble to the Constitution says 'the obligation of solidarity with others'; article 20: 'solidarity, dialogue and cooperation between social partners, shall be the basis of the economic system of the Republic of Poland' and article 5: 'The Republic of Poland shall safeguard the independence and integrity of its territory and ensure the freedoms and rights of persons and citizens, the security of the citizens, safeguard the national heritage and shall ensure the protection of the natural environment pursuant to the principles of sustainable development').

countries. However, each of these entities should be required to ensure a decent life for future generations - in accordance with the principle of sustainable development. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs [11].

Both solidarity and sustainable development are interrelated. The need for global solidarity, which is the sense of belonging to the same community for whose welfare one is held responsible, is mentioned in the Strategy for Sustainable Development of the European Union approved in May 2001 by the European Council meeting in Gothenburg, and then renewed in June 2006 [6].

Sustainable development in many of its aspects (economic and social) refers to the issues that also regard solidarity - solidarity in economic relations, or solidarity in social relations [2]. Solidaristic behaviours also exert a positive impact on the environment, and the formulation of environmental solidarity is generally used by various institutions of the European Union [7;9]. Solidarity is inextricably linked with the community within which it is going to apply. The appropriate perception of solidarity from the point of view of the individual and community as well as the concern for ensuring the development prospects of future generations (sustainable development) are essential for the community to function properly [12]. Such coexistence of the two rules can be referred to as 'sustainable society', 'sustainable solidarity', 'environmental solidarity' or 'community of responsibility' [13].

Actions resulting from both solidarity and sustainable development are compatible with the Theory of Exchange, which points out that people while offering items to others (actions arising from solidarity and sustainability) pay more attention to how in this exchange process they compare with others than to how the relationship of their own benefits and costs is being shaped within this exchange - nobody wants to be treated worse than others [8]. The exchange of these measures is based on both the rights deriving from pure social exchange (feeling of personal commitment, gratitude and trust) and on the economic exchange related to economic calculations [1]. Moreover, the exchange resulting from solidarity and sustainable development is probably based on the institutional exchange rather than on the individual exchange, in which decisions are taken by the individual. Indeed within the institutional exchange the actual exchange is realised by individuals (taxes, benefits), however, they are not real decision-makers. Under a democratic system individuals can make decisions which are limited only to the choice of their representatives in legislation bodies.

## 3. Privileged pension systems in Poland

Currently, Poland has numerous privileged pension systems. The general system covers about 16 million people insured in accordance with the general principles. Firstly, under this system also miners benefit from the pension privileges involving the possibility of early retirement. Contributions to social security paid by clergymen come from the Church Fund financed by the state budget. Secondly, some people belonging to the tax-transfer-system – o non-contributory – (including uniformed services, judges and prosecutors[2]) do not pay social security contributions, however, their benefits – after meeting some requirements, are be financed by the general budget, *i.e.*, from taxes. And thirdly, Polish farmers have a separate social security system.

A feature shared by all of these professional groups are far better pension conditions (more in 5). All these groups use their preferences on a different basis and in a different manner. Miners like those belonging to the tax-transfer-system are not obliged to work until they are 67 years old (a military person can retire after 15 years of work, which means that practically a person can be retired even at the age of 33) and farmers pay lower social security contributions than those belonging to the general pension system.

[2] Judges and prosecutors at the end of their professional activity do not receive a pension, but when they retire they receive an allowance (which differs from pensions mainly in name).

When determining the costs related to financing the social security[3] of the privileged groups, it should be noted that in 2012 [5; 12]:

1. expenditure on miners' pensions amounted to 8.8 billion PLN,
2. expenditure on the tax-transfer-system (non-contributory) amounted to over 10 billion PLN
3. subsidy to farmers' social security amounted to 15.6 billion PLN (the value of contributions made amounted to 1.5 billion).

It should be noted, however, that in recent years in Poland a number of reforms have been implemented and they only emphasize that the changes are not only possible (in the case of pension security, acquired rights do not apply) but are necessary. These changes included raising the retirement age to 67 and including teachers into the system of general regulations (by the end of 2008 the most important condition for receiving a pension by teachers was to have 30 years of seniority, so teachers could retire even at the age of 49, at present their retirement age is - ultimately - 67 years).

Obviously the privileged groups presented above may maintain the existing systems due to their relatively small size. These small and homogeneous group through political representation and lobbying tend to redistribute a part of the national income in their favour. Maintaining such a variety of industry pension systems would not be possible without the involvement in the process of trade unions that defend the privileges of its members. These groups - mostly farmers - also benefit from hidden and more complex forms of support, for instance, from intervention buying of agricultural products [3]

To sum up, the annual expenditure on the privileged pension systems in Poland amounts to a minimum of 35 billion PLN. With the revenue of the entire state budget at the level of 287 billion and the deficit of 30 billion PLN (data for 2012), the expenditure is a significant burden to the public finance system and may affect the prospects for the development of our country [4].

## 4. The privileged pension systems in the context of solidarity and balanced finances

The efficient functioning of social solidarity depends on many factors. These factors include altruism (community), egoism (unit), reciprocity, or vindictiveness. It is important to base the system on all of these conditions. Currently, the privileged pension systems base majorly on selfishness, that is on the right of the individual to the acquired pension rights - thinking about an individual. Unfortunately, we look at the efficient functioning of the entire community or reciprocity too rarely (*i.e.*, the answers to the questions why my group deserves these entitlements, whether other professional groups deserve such entitlements, and what I can offer in return for my rights). However, very often we refer to the vindictiveness (within the scope of the discussion of the privileged ones) by demanding the maintenance of certain privileges, by strike, or by criticizing other professional groups for falling within these privileges (Figure 1).

[3] The term 'pension security' should be used and not 'pension insurance' as the word 'insurance' is associated with contributions and the financing of benefits covered from contributions made by members of the so-called risk community, which in the case of the pensions of the privileged groups undoubtedly does not happen.

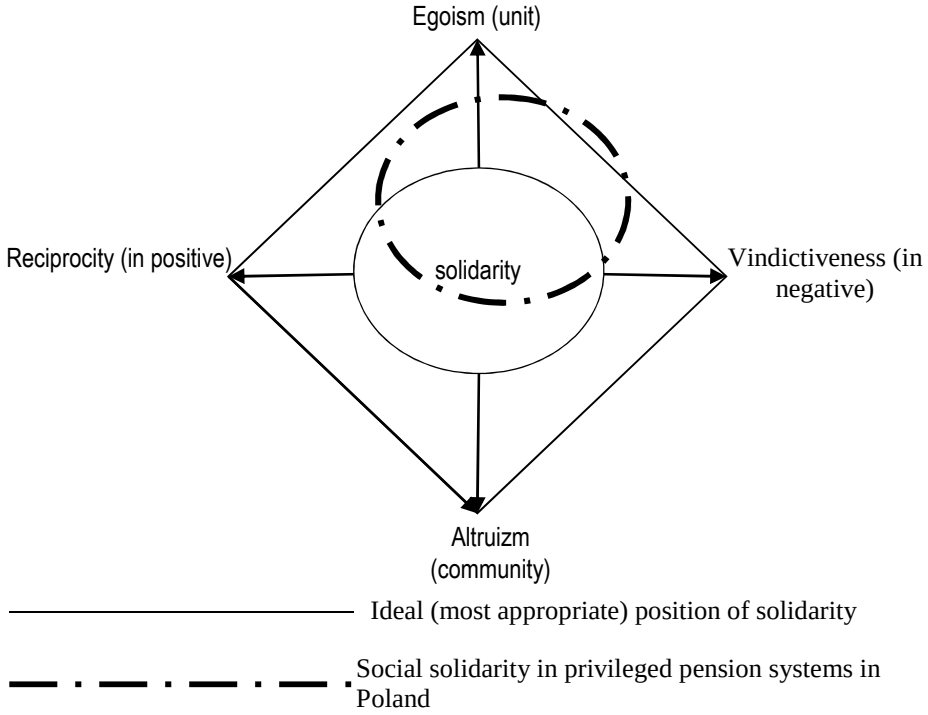


**Fig. 1.** The concept of ideological factors determining solidarity. Source: Own study based on [12; 13]

As already mentioned, solidarity is based on the responsibility of the community for the individual and of the individual for the community. Therefore, none of the privileges can impact the community negatively. On the other hand, however, the community needs to provide the individual with a decent pension security, but at a level appropriate to its financial capacity and to the contribution made by the individual to the community.

Sustainable development refers to ensuring a decent life for future generations. In this respect balanced finances are important. Unfortunately, under the current scope the privileged pension systems make it impossible to balance the finances. The excessive privileges annually generate several-billion spending and on a many-year scale these are billions that hinder, for instance, financing the development of infrastructure or supporting innovation in the Polish economy.

The Constitutional Court emphasizes that 'the benefits derived from the implementation of the principle of solidarity (...) are a way to favour and thus are hedged around with additional responsibilities on the part of the potential beneficiary, which allows it (in this case, the pension) to keep the nature of a special benefit'. This judgment corresponds to the above principles of solidarity, which, in the context of the privileged pension arrangements should be considered as a whole. Particular attention should be paid to the nature of the entitlement, and not to the historical (the rights acquired in the times of communist Poland) or political (political survivor) background [15]. The Supreme Court, in turn, emphasised that 'no provision of the (...) does not give primacy (to the rules specified by the Court of Appeal in the contested judgment) over the principles of solidarity of the insured and the public interest', which only underlines the role of a holistic view of the presented case [14].

## 5. Conclusion

Privileged pension systems are not the result of solidarity, they are frequently ordinary annuity awarded for political support given (which has happened in Poland many times), for instance, for withdrawing from the planned strikes, which could reduce the quotations of the ruling parties. At the same time granting pension benefits with the present budget deficit may lead to weakening of the budgetary situation and to the deterioration of living conditions of future generations. Such

changes in the conditions of life, also in the deterioration of the pension system covering the whole of the future society, is in contradiction with the principle of sustainable development.

It can be stated that the privileged pension systems do not result from the principles of solidarity and sustainability. Therefore, the regulations concerning the solutions presented require changes that could adapt the solutions presented to the rules also referred to by the Constitution of the Republic of Poland.

Starting debates on implementing changes in the pension systems of the privileged groups (some changes in the uniformed services pensions were introduced in the early 2013) is necessary. If we want our society to function in compliance with the constitutional principle of solidarity, or provide a decent life for future generations, we must discuss the possible changes, which in economic and social dimensions will adapt the systems in effect to the principles of solidarity and sustainable development.

The principle of solidarity applied in a democratic state of law cannot breach the interests of some members of a community, or of the entire community, with costs borne. The principle of sustainable development, in turn, cannot limit the development of future generations.

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# Determination the value of internally generated goodwill by using residual income valuation

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**Abstract.** This paper presents issue of internally generated goodwill. Internally generated goodwill is a company's property. For this type of goodwill is typical his intangible nature. But in general it has impact on the value of the company's equity. This paper tries to measure the value of internally generated goodwill and then the total value of company by using residual income valuation method. The first part of the presented paper is trying to capture theoretical aspects of internally generated goodwill. On the other hand, the second part of the presented paper it is practical part which consists a model example of residual income valuation. This model example shows how we can use it for measuring the value of internally generated goodwill.

**Keywords:** internally generated goodwill, the value of goodwill, residual income method

## 1. Introduction

Over the last 100 years accounting literature has confirmed that it is impossible charge of internally generated goodwill in accounting. Because it is in conflict with historical rules of cost accounting concept. For these reasons any internally generated goodwill cannot be recognized despite of fact it has the own value. [3] Goodwill is a common term which in generality does not have due importance from companies or economic public. Goodwill is like a health - unappreciated property which everybody want to have, but only pieces of them are willing to make efforts to preserve it. [1], [2]

In general, we may say that goodwill is an economic term. The corporate finance theory, explains it as an intangible asset which reflects for example customer connections, business reputation and other similar factors. Goodwill shows the value of enterprise's reputation. It is important to understand what this English word means and not to confuse it with other term. Especially with terms about company activity in the market such as rating, credit score, or the credibility of the company. Goodwill conception is mainly interesting because it is something abstract, intangible but something which has more and more importance in nowadays. When a company has brand with certain reputation and certain status in the market area, these aspects can be measured and then they have lesser or greater value. [4],[5]

## 2. Theoretical aspects of internally generated goodwill

In the simplest sense we can find two types of goodwill in the literature. The recognized and the unrecognized goodwill. Recognized goodwill can only arise from mergers and acquisitions according to accounting standards. That goodwill is defined as the difference between the purchase price of the target, and the fair value of its assets. This type of goodwill is capture in the balance sheet in the side of intangible assets. In this sense, recognized goodwill is essentially a "plug" that

keeps the accounting balanced, as is often cited by researchers. This type of goodwill is also known as secondary goodwill. [1]

On the other side unrecognized goodwill is the same term as internally generated goodwill. For the internally generated goodwill is considered such goodwill that is created enterprises, on the basis of their activities, that is not the subject of the exchange transaction. In the literature we can find many other examples for internally generated goodwill. For example it can be the employee qualification, selected marketing activities, customer loyalty, other positive relationships with financial institutions, suppliers, customers, the tax Office, top management qualification, positive contact in political environment and economic environment, ecological and social enterprise policy. Unrecognized goodwill also includes events which have a positive effect on the company like comparative advantages. Also there are other aspects of enterprise prosperity such business location, geological, meteorological and demographic conditions or tradition in the industry and so on. Above mentioned conditions are not dependent on the will of the company, because they are already available. [4]

Issue of internally generated goodwill has one unpleasant problem. It is the problem with the amount of literature. In the almost all literatures we can find only recognized goodwill and so goodwill which is created from mergers and acquisitions. But despite of these problems we can find there some relevant information which we can use. It is the difficulty to exactly define or objectively evaluate internally generated goodwill. One of these difficulties is uncertainty which is linked to his future material effects. Then this is reason why it is difficult to find it in accounting standards books. Even if it were possible to exactly define and objectively evaluate the amount of internally generated goodwill, this valuation only can be done by its future expected impact to the enterprise's future performance. Especially uncertain future benefits cannot be capture in the assets, according by accounting standards. Because then it will be impaired the one of accounting conditions which is determined for intangible assets identification. The differences between accounting methods which are used for internally generated goodwill and for purchased goodwill demonstrating these facts. Of course internally generated goodwill does not represent the total amount of company intangible assets which are included in the market value of company. But it is only the amount of unidentified parts. Despite of fact that accounting does not recognized this type of goodwill, it is still more and more relevant for many users. [1], [2]

Due to above mentioned circumstances we can state there are two methodologies which were created in the literature for evaluate the internally generated goodwill. The direct method, which consists of computing the present value of expected abnormal earnings. This method relies on the residual income formula which was created by Ohlson. And the indirect method which is consists of the difference between fair value of company assets and company value in the case of business combination. [1]

## 3. Illustrative example of residual income valuation method for determination the value of internally generated goodwill

In this method is the total value of the company composed of the value of substance and the value of company. In this case is the value of company understood as a difference between the yield value and the value of substance. The characteristic feature of the value of company is the fact that it isn't in material form. It also expressed values as a customer loyalty, efficient management and so on. It is clear that this is just another label of the known concept of goodwill. We will assume that we can calculate the value of company directly in the method of net residual income. This method is based on capitalized net residual incomes. The term net residual income is understood as the difference between the total net income of company (NI) and net income which we should get from the normal interest rate ($i_k$) of invested capital. This "normal return" of capital is usually calculated by interest rate. Interest rate which determined the cost of capital. This rate usually represents

capital appreciation with regard to the risk associated with this investment. Our calculated interest rate is stipulated at the level of equity costs because we work with net income for owner and outcome of evaluation will be direct evaluation of equity. Invested capital expresses substance value which is based on the replacement price, in this case the value of substance netto ($S_n$). [4], [6]
*The process and logic of calculation is follows:*

- normal net annual income = $I_k \times S_n$,
- residual net annual income = $NI - i_k \times S_n$,

It is the difference between the company's net income and the usual normal net income. Normal net income which investor requires from the equity for compensate his risk. When the company achieves higher profit than capital costs it is the residual income and it is the source of goodwill.

- the value of company´s equity (EV) which is achieved during permanently residual income:

$$EV = S_n + \frac{NI - i_k \times S_n}{i_{k2}} \qquad (1)$$

Where:
EV the value of equity
Sn the value of substance netto
NI net annual income
$i_k$ normal interest rate
$i_{k2}$ higher interest rate

Residual net income is usually associated with considerable risks. Therefore there is usually calculated with higher interest rate ($i_{k2}$). In other words, is supposed that the risk associated with residual net income which is calculated in the cost of equity is for investor higher than risk associated with recovery of invested capital. In both of cases there are costs of equity but with different level of the risk premium.

| | | | |
|---|---|---|---|
| The value of substance netto | 3 000 000 € | | |
| Calculated interest: | | | |
| interest rate $i_k$ | 9% | | |
| interest rate $i_{k2}$ | 11% | | |
| Permanently expected net income | 500 000 € | | |
| a) normal net income | 9 % z 3 000 000 | | 270 000 € |
| b) residual net income | 500 000 - 270 000 | | 230 000 € |
| c) the value of "company" | residual net income | 230 000 | 2 090 909 € |
| | $i_{k2}$ | 0,11 | |
| d) the value of company: | The value of substance | | 3 000 000 € |
| | The value of "company" | | 2 090 909 € |
| **Total** | | | **5 090 909 €** |

**Tab. 1.** Illustrative example of residual income valuation method for determination the value of internally generated goodwill own processing according [6]

The basic formula is based on the fact that the residual income will be achieved permanently. Thus the value of "company" is calculated as the present value of perpetuity. However, it is easily to dispute this because in the normal life is residual income only transitory phenomenon. The lenght of

duration is essentially determined by the time that we are able to maintain a certain competitive advantage (n years). In the real time of residual income then represents only 2 to 5 years.
Then the value of company for a limited duration residual net income is follows:

$$EV = S_n + \sum_{t=1}^{n} \frac{NI_t - i_k \times S_n}{(1 + i_{k2})^t} \tag{2}$$

Where:
EV the value of equity
Sn the value of substance netto
NI net annual income
$i_k$ normal interest rate
$i_{k2}$ higher interest rate
t time

We based on consideration from previous request. However, the lenght of duration residual net income be reduced to 3 years:

$$EV = 3\,000\,000 + \frac{230\,000}{1{,}11} + \frac{230\,000}{1{,}11^2} + \frac{230\,000}{1{,}11^3}$$
$$EV = 3\,000\,000 + 207\,207 + 186\,673 + 168\,174 \tag{3}$$
$$EV = 3\,562\,054$$

Where:
EV the value of equity

It is obvious that the value of "company" (goodwill) will be considerably lower in this case.

Now we have to stop near issue of method residual net income. It is supposed there may exist a certain state of equilibrium where it is invested to company as many equity ($S_n$) how much should be. Then this capital provides the normal rate of return which is expressed by the calculated interest rate $i_k$ in certain period of time and in degree of risk. Then the net income (NI) of the invested capital will be (assuming a long-term stable income) follows:

$$NI = i_k \times S_n \quad or \quad S_n = \frac{NI}{i_k} = the\ value\ of\ net\ income \tag{4}$$

Where:
NI net annual income
$S_n$ the value of substance netto
$i_k$ normal interest rate

In the state of equilibrium is the value of income equal to valuation which is based on replacement prices. However, company can achieve economic results which are higher or lower than "normal income" which is equal to $i_k \times S_n$. If is the real income higher $i_k \times S_n$ then company achieves residual income (residual net income). In general, the source of this residual income is competitive advantage. It is supposed that the company achieves positive residual net income and thus some values of goodwill until the company maintains its competitive advantages. Competitors usually sooner or later balance competitive advantages. Then in most cases it is necessary assume that residual net income will be achieve in limited time.

Of course weak company can achieve lower income than it is normal. In this situation arises badwill. Then residual net income method can help understanding how to approach to the companies which have lower income which we can often find in our practice. Weak companies are often appreciated directly by substance value based on the replacement prices but it is not correct. Better approach would be to reduce the value of substance by estimated the value of badwill. [6]

## 4. Conclusion

Residual net income method has one problem, this problem is often in that it is used incomplete the value of substance. Incomplete the value of substance does not include all of costs which is associated with establishment of the enterprise mainly its intangible assets. But then the result is not quite correct calculation of the value of company which then does not includes only the net value of goodwill but also the value of certain other intangible assets. Although this combined method does not used often in practice but unlike the method mean value which valuers like to use has a theoretical reasoning and therefore its use should be preferable.

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# Ability and factors of value creation of portfolio companies by venture capital funds

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**Abstract.** Venture capital (VC) funds has emerged as the dominant source of finance for entrepreneurial and early stage businesses. Academic literature reveals that venture capital funded companies show superior performance to non venture capital funded companies. Many of the successful businesses that we know today such as Cisco, eBay, Apple, Microsoft and Google received venture capital funding at one point or the other. Venture capital backed firms contribute to the economy through the creation of jobs, an exceptional growth rate, their high level of investments, and their global experience and expansion. The proportion of companies that receive venture capital funding, however, is very small. Despite that, there has been a growth in the availability of VC over the years in the different branches and economies. Evidence indicates that VC funded companies perform better than comparative companies that are not VC funded. Research has indicated that significant variance in performance between them can be attributed to the VC investor. This then led to the subsequent question—what capabilities of VCs contribute to the performance variation. There has been high number of research evidence to indicate that managerial and value addition capabilities of venture capital dominate the selection capabilities in explaining the performance variation. This paper provides an academic perspective on how venture capitalists contribute to the portfolio companies that they have invested in.

**Keywords:** venture capita, value creation.

## 1. Introduction

The introduction of a venture capital fund is only the beginning of the road for business executives who must learn to work towards a systematic increase in goodwill. Understanding the expectations of investors and managers to agree with them common to enterprise objectives is of paramount importance for the efficiency of management. Makes it possible to move to the planning process, for example to identify the driving forces and their sensitivity to growth. Extensive experience gained in the course of carrying out further investments in the formulation of product and marketing strategies are particularly useful for portfolio companies in the development and construction of values. The range of counseling and support often includes a number of solutions of a system including but not limited tools to control and measure the value of the different levels of the company.

## 2. Overview of venture capital investment

Venture capital funds invest in small, young and promising companies that are associated with high risk. They expect their value to grow faster than average non-venture capital entities. VC funds use their competence, skills, and experience for efficient deployment of funds with the objective of maximising returns for their investor. The money that VC bring to the table is often called "*smart money"* (to differentiate it from what one would term as "*dumb money"*) because in addition to the monetary capital that VC bring to the table, they also bring intellectual capital and relationship capital. In a sense they actively create an eco-system through building and leveraging a network of investors, industry forums, business and thought leaders, investment banks, audit and legal firms, to the advantage of the fund managers (general partners), investors (limited partners) and the portfolio

companies. At the beginning of the relationship between the VC and a portfolio company, the notion of value addition is nebulous or abstract. As the relationship builds the perceived needs of the enterprise and the potential ability of the investor to contribute take a more distinct form and shape. There are many areas where VCs can potentially add value to an enterprise. VCs contribute to the senior management pool – they are able to identify, interview, negotiate and recruit senior management talent for the portfolio company. VCs also help to attract other co-investors to the firm. A most critical value add from a VC is in enabling a liquidity event such as an Initial Public Offering (IPO) or Strategic Merger/Acquisition (trade sale). Large VC investors have a network and in depth understanding of the capital markets. So, if the company wants to list in an IPO, it becomes critical to have the right merchant banker and the ability to value the company correctly. VC funds also help in building momentum and managing capital markets during the IPO process[1]. Value addition by the VC is not to be seen as charity work. Such value addition directly contributes to the valuation multiple at exit. In sum, VCs do not wave a magic wand and cast a spell on the enterprise. They can provide specific value adds which they understand and can deliver to meet the relevant needs articulated by an enterprise. Small companies are inherently more risky than large companies and they need adequate capital to manage those risks appropriately. Second, they need expertise. Unlike large companies, small companies do not have substantial functional expertise. Apart from the founders and a couple of other senior members, there would be few others within the organisation who would have significant functional expertise. Therefore, they are compelled to get this expertise from outside. The best people to provide such expertise would be the investors in the company. While others can act as mentors, or even become board members, it is the investor who is well positioned to provide such expertise because the performance of the company is intertwined with the financial returns to the investor. Many VC investors have prior industry experience and are therefore well equipped to advise the companies in different functional areas. They are also well networked and well informed because of their active participation in various industry forums. Many of them are not able to decide whether they want to grow or be content with the existing level of operations. Even when they want to grow, they sometimes do not make the right decisions that would help them to grow. It is here that a VC investment helps. Because of their own exit pressures, VCs bring in a sense of urgency and positive pressure on achieving performance and growth. In sum, VCs add a lot of value to their portfolio companies. VC funded companies should have disproportionate success as compared to companies that are completely funded by promoters. The VC investment cycle consists of four phases, namely, fund raising, selection and investment, monitoring, and exit. In the fund raising phase, VC firms (commonly known as general partners or GPs) raise capital from various investors (commonly known as limited partners or LPs) such as financial institutions, corporations, university endowments, family offices, and wealthy individuals. Generally, the VC funds have a close ended structure and have a fund life of around 10–12 years. During the fund raising process, the VC firms clearly state the investment objectives and other features of the fund structure such as the fund life, fund management fees, etc. The funds can have a sector focus (technology, biotechnology, etc.) or stage focus (growth stage, late stage, etc.) or both. Established VC firms usually have more than one fund under their management at any time. Staged financing is an important part of how VCs actually bring value addition and it is one of the levers they use in the value addition process. Some of the other levers that VCs use to create value include board representation in the portfolio company, use of covenants, and engagement with the portfolio companies at the operational level. During the selection and investment phase, the VC firms evaluate various investment opportunities to deploy the funds raised. The monitoring phase is the time interval between date of investment and exit of the VC investor. During this phase, the VC works closely with the investee firm. During the exit phase, the VC firms realize returns on their investments in the portfolio company, and return the capital to the investors in the fund. Since VC funds are generally structured as close ended funds, the VCs have to liquidate their investments after a certain period and cannot hold on to them forever. The common routes of exit are the IPO or an acquisition.

## 3. Value creation and performance of venture capital portfolio companies

Value addition is an important concept in practice, as venture capitalists often position their post financing involvement as a strategic differentiator from competing funds. While academic literature often tends to look at value creation universally across funds, in reality styles of VC involvement vary across funds and the stage of evolution of the portfolio company[1]. Value addition also varies between angel investors, VCs and private equity investors. Venture capital is not only about money. The activity of the venture capital fund as an investor in the company portfolio can be seen especially in his involvement in the formulation of medium and long-term development strategy. Active participation of the fund in this area allows for precise determination of the strategic objectives of the company, the measurement and evaluation of the implementation and adjustment to adapt to changing market conditions. When cooperating with the fund company gains a partner who has the experience, contacts, and thinks in terms of long-term. Employees of the fund are usually extensive contacts with financial institutions, consulting firms know and lawyers. So they can serve a really useful aid, and - what is more - much larger company augment credibility. Besides monitor the activities of the company, particularly in financial terms, allowing you to identify possible problems in advance and find common solutions. It is the combination of money, experience and long-term commitment to the company determines the attractiveness of the VC[2].

VC backed IPOs are associated with higher underwriter prestige, higher institutional holdings, and lower levels of underpricing than non VC backed IPOs. The presence of VC in the issuing firm lowers the total costs of going public and maximizes the net proceeds to the issuing firm[3]. VC backed firms show superior post IPO operating performance than non VC backed companies. Brav and Gompers find that VC backed firms have higher long term returns[4]. On the other hand venture capital investments are conducted in unlisted companies so financial returns may not always present a reasonable picture of efficiency. Therefore, many have looked at the operational efficiency of portfolio companies. One of the problems in looking at operational efficiency is in measurement. For example, it becomes difficult to measure the inputs that constitute the so called value addition process. VC investment happens in a highly unregulated setting, and there are no reporting or disclosure requirements. A lot of the inputs that venture capitalists provide are never documented either by the fund or the company. These happen in private conversations for a variety of reasons. Another issue with value creation is what can be called the “post hoc, ergo propter hoc” problem. Many believe that returns follow inputs of value addition and therefore when returns occur they are construed as the outcome of value addition. But it is difficult to prove the cause and effect relationship. Most often, the returns might have happened in spite of value addition. Most of the existing academic literature on value addition dates back to the late 80s or early 90s [4]. From my understanding of the industry, the value addition practices have changed a lot since then. Therefore it becomes important to study the subject of value addition with some of the current practices in the industry.

## 4. Explaining the performance differential

Research on the comparative performance of VC and non VC funded companies indicates that by and large VC funded companies have shown superior performance[5]. The two major activities of VCs are screening and selection of the companies to invest in and contributing to the management of the companies post investment. If this is the case, can the superior performance of VC funded companies be attributed to the superior ability of VC firms to identify promising investments. That is, are VCs able to identify, before investment, the firms that would be able to achieve superior performance? Or, can the superior performance be attributed to the value addition and managerial inputs that VCs provide to their portfolio companies after investment? That is, the subsequent superior performance stems not from the ability to pick winners, but by the ability to

ensure that the firm is managed well post investment. Value addition to the portfolio companies is an important feature of VC investment and one which distinguishes it from other sources of funds. The characteristics that attract VC funding such as alliances, intellectual and human capital (top management) are also associated with future performance after the investment. The results indicate that alliances and intellectual property have a similar effect on attracting VC investment and subsequent firm performance. However, human capital or top management characteristics of the firm that was associated with VC investment had little effect on subsequent firm performance. This suggests a combination of both the selection and value addition roles in influencing portfolio company performance. VCs are able to select companies that have strong technology and relationships, but those that are at an increased risk of short term failure. They then provide management inputs that enhance the long term survival of the firm and contribute to superior performance[6]. Similarly, different VCs have different skills and information and the value addition improves if investors with complementary capabilities can add value to the portfolio company. Since syndication involves sharing of benefits among different investors, VCs would engage in syndication only when benefit cost ratio of syndication is favorable. If the value addition hypothesis dominates then the returns should be higher for syndicated investments. Using the data collected from Canadian VC investments, Brander et al. indicated that syndicated investments have significantly higher returns than non-syndicated investments. Therefore they infer that the value addition hypothesis drives the rationale for syndication over the selection hypothesis and suggest that management rather than selection contributes to the success of VC investments[7].

More recently Chemmanur use the Longitudinal Research Database of the US Census Bureau to study questions related to efficiency gains in VC investment[7]. They use Total Factor Productivity (TFP), i.e., the residual growth in output after accounting for changes in production factors as a measure to analyses the efficiency of portfolio firms. They find that the efficiency of VC backed firms prior to receiving VC funding is higher than that of non VC backed firms. Further, the growth in efficiency after receiving VC financing is greater for VC backed firms as compared to the growth of non VC backed firms. This indicates the evidence for both screening/selection and the value addition role for VCs in improving firm efficiency. They however find that the contribution due to monitoring and value addition accounts for a higher proportion of the increases in profits in VC funded companies (21% of the increases in profits are due to screening effects and 35% of the increases in profits are due to monitoring effects). Fitza, Matusik, and Mosakowski try and address the same question in a governance context, by modelling the relationship between the VC and portfolio companies analogous to that of the relationship between a corporation and its business units. They study the impact of owners (VCs) and the contribution of VCs to variation in firm performance. They find that while portfolio company specific effects accounted for 26.3% of the variation, VC effects accounted for the next highest percentage of variation (11.2%). They also find that the VC investor is not a statistically significant predictor of the variance in portfolio company performance during the first round of investment and performance variance attributable to VCs appeared to occur after the initial round of VC investing and not before. Some VCs provided a high value added (estimated at 19% over at least 10 investments), while others appeared to destroy value (estimated at −18% over at least 10 investments). This suggests that VCs may be similar to each other when it comes to choosing investments, but differ in terms of their ability to add value after they have made the investment[9]. On the other hand, Sorensen provides a contrary finding to the studies stated earlier. He finds that the effect of selection exceeds that of management. However, the limitation of this finding is that his study was based on identifying only one lead investor per portfolio company investment without considering the significance of multiple investors, some of whom are in a better position to select rather than manage their portfolio companies[10]. In order to explain these obvious discrepancies in performance and risk we need to look at the differences between the investment approach of a venture capital investor such and public equity investors or non-venture capital supported business. Three main systematic advantages could be inherent to venture capital model: 1.The selection process is based on operational performance of a company

and in-depth information provided in a due diligence process (legal insiders), 2. The investor's long term orientations enables sustainable value creation strategies beyond short-term results, 3. Corporate governance structures allow venture capital investors to actively engage in a portfolio company's management and implement operational improvements.

As the capability to execute operational improvements at the portfolio company's level differentiates successful venture capital investor from their peers, they should focus on pure operational improvements in their value creation plan:

- Most value creation is generated by direct operational improvements within portfolio companies. Revenue growth is to weight most in this process and venture capital investors focus on growth opportunities and provide financial and operational support for achieving sustainable, long-term growth. EBITDA margin improvement is recognized as another very important factor in value creation. VC investors continuously look to improve the cost structures of their portfolio companies. Direct involvement in the operational management by the venture capital investor is essential for driving these processes.
- Other factor that improves value in the portfolio companies is to be derived from levers that are indirectly influenced by operational improvement measures. Multiple expansions are one of them. Value creation through relative valuation differences can be driven by current market sentiment. Multiple valuations are also driven by the relative positioning of a company in its market. A clear, focused strategy driven by a long-term oriented venture capital investor enables a company to achieve a superior positioning, commanding higher multiple exit. Value creation from cash flow is indirectly linked to the operating performance of the portfolio company. In venture capital investments, cash flow is used to improve capital structure, manage working capital and capex spending without directly impacting the profit and loss statement. Working capital is thereby in the centre as this lever is often neglected by common management approaches. Working capital management does not impact any profitability but helps accelerate company's deleveraging.

## 5. Reported performance of the venture capital across main global markets

In the USA venture capital funds performance continues to be strong across most time horizons as of September 30, 2014, according to the National Venture Capital Association's (NVCA) Performance Benchmark, the Cambridge Associates LLC U.S. venture Capital Index. Although returns were down for the third quarter as well as the 1-year horizon, returns were greater in the 3- and 5-year horizons.

| For the periods ending September 30, 2013 | Qtr. | Year To Date | 1 Year | 3 Years | 5 Years | 10 Years | 15 Years | 20 Years | 25 Years |
|---|---|---|---|---|---|---|---|---|---|
| **USPE** | 5.1 | 13.3 | 17.2 | 15.7 | 11.0 | 14.2 | 12.0 | 13.5 | 13.4 |
| **USVC** | 6.5 | 14.0 | 15.1 | 14.4 | 7.5 | 8.6 | 26.1 | 30.0 | 20.2 |
| **Other Indices** | | | | | | | | | |
| **DJIA** | 2.1 | 17.6 | 15.6 | 14.9 | 9.9 | 7.7 | 6.9 | 10.0 | 11.0 |
| **NASDAQ Composite*** | 10.8 | 24.9 | 21.0 | 16.8 | 12.5 | 7.8 | 5.5 | 8.3 | 9.5 |
| **Russell 2000 Composite** | 10.2 | 27.7 | 30.1 | 18.3 | 11.2 | 9.6 | 8.9 | 9.0 | 9.8 |
| **S&P 500** | 5.2 | 19.8 | 19.3 | 16.3 | 10.0 | 7.6 | 5.3 | 8.8 | 10.0 |

**Tab 1**. Rate of returns of venture capital in USA

Looking at longer time horizons, returns for the 10- and 15-year horizons were down from the previous quarter and the 20-year horizon was up slightly from the second quarter of 2014.

Compared to other benchmarks, venture capital outperformed the DJIA, NASDAQ Composite and S&P 500 during the third quarter of 2014 as well as the 1-year horizon. While all three major

stock indices tied or outperformed venture during the 3- and 5-year horizon, venture capital outperformed the DJIA, NASDAQ Composite and S&P 500 during the 10-, 15- and 20-year horizons.

## 6. Conclusion

Data on VC efficiency shows that the overall efficiency of VC-backed firms is higher than that of non-VC-backed firms at every point in time. This efficiency advantage of VC-backed firms arises from both screening and monitoring. The efficiency of VC-backed firms prior to receiving financing is higher than that of non-VC-backed firms, and further, the growth in efficiency subsequent to VC financing is greater for such firms. The above increases in efficiency of VC-backed firms are spread over the first two rounds of VC financing after which the TFP of such firms remains constant until exit. Overall efficiency gains generated by VC backing arise primarily from improvements in sales, the efficiency gains of high-reputation VC-backed firms arise also from lower increases in production costs. Finally, we show that VC backing and the associated efficiency gains positively affect the probability of a successful exit.

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# Technologies Supporting Business Logistics Processes for Productivity Increase

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**Abstract.** This paper is focused on technologies which are used to support logistics processes in warehouses for productivity increase. Companies pay attention not only to growing efficiency of manufacturing processes but to supporting processes as logistics, too. In the first part of paper are described automatic logistics systems represented by AGV system. These systems can help to reduce labour costs and reduce work-in-process. The second part is focused on some technologies used by picking orders or materials in warehouses. These technologies improve picking productivity and accuracy and they have rapid return on investments. It is important to company consider different categories of items in warehouse to choose right technology or combination of technologies which company will purchase.

**Keywords:** Automated Guided Vehicle, Pick-to-Light, Put-to-Light, Pick-by-Voice, Intelligent Glasses.

## 1. Introduction

Enterprises are constantly looking for ways to increase efficiency and productivity of their processes. One of these methods is the use of various technologies to simplify and accelerate the work. Recently the trend in industry is mainly automation. Technologies which support logistics processes are influenced by this trend, too. In warehouses and in distribution of material in the production are used a lot of technologies which increase productivity and efficiency of these activities.

Manufacturing companies increasingly apply various automated logistics systems, for example AGV (Automated guided vehicle) systems. Furthermore there are technologies which help in warehouses by order and material picking.

Despite automation and deployment of information technologies in the field of material flow is still the first step towards the correct logistics human factor - the design of logistics solutions. Initial analysis of the future of logistics and defining optimal logistics chain are a "compass" to efficient logistics systems.

## 2. Automatic Logistics Systems

For automatic distribution of material in logistics process of manufacturing enterprise are used automatic logistics systems. They increase automation and productivity of logistics and contribute to reducing business costs. AGV system automates pulling wagons with material by a predefined path with the help of logistics trucks in industrial halls (Fig. 1.). System as a whole improves efficiency of logistics processes while decrease logistics costs.

Automated Guided Vehicles are recommended for applications wherein long-distance horizontal transport of materials is required from or to multiple destination points and/or the requirements for material transport include repetitive/predictable and/or dangerous tasks. AGVs also have several advantages inherent to their design, such as the reduction of product damage from removal of human error, the ability to travel into hazardous areas without concern for operator

safety, the ability to automatically track and record product movement, the reduction of labour, and the flexibility and adaptability especially prevalent in laser guided systems.

**Fig. 1.** AGV (Automated guided vehicle) system [1], [2].

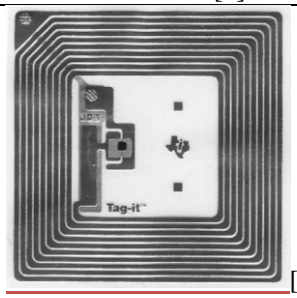
One of the main benefits of the AGV is reducing costs by reducing work-in-process, as well as cost savings for employees who are required to operate the truck by manual logistics.

Calculations from a case study of employees of Zilina University show that the total annual costs of manual logistics are 182 160,00 € while total annual costs of implementation AGV are 89 456,05 €. The case study was conducted in conditions of subcontractors for the automotive industry, where for supplying was used three forklifts operated by employees [4].

## 3. Warehouse Technologies

Besides various types of manipulation equipment in warehouses are used technologies which help by preparation of orders or materials. There are systems like put-to-light, pick-to-light intelligent glasses, RFID codes and picking by the voice. These technologies can increase productivity of workers by tens of per cent. They are clearly described in Tab. 1.

| | |
|---|---|
| **Put-to-light**<br>Light displays guide the operator to put stock in an order. In Put-to-Light systems light displays instruct the operator where and how to allocate stock to orders, allowing efficient picking from bulk stock. The operator scans each product and flashing light displays at each location indicate which containers require that product and how many items to put. Confirmed put results are updated to the system in real time for host system updates [5]. |  [6] |
| **Pick-to-light**<br>Light displays direct operators to specific stock locations. Pick-to-Light systems use light displays to direct operators to specific stock locations. Each product location can have an individual numeric or alphanumeric display with a light, an acknowledgement button, and a digital readout for indicating quantity. Other configurations allow fewer or more simplified displays to reduce the total cost [5]. |  [7] |

| | |
|---|---|
| **Pick-by-voice, Voice recognition system**<br>Pick-to-Voice relies on voice instructions through headphones and a microphone [10].<br>Without the need to handle wireless data terminals and paper lists eliminated, the order picker can focus entirely on retrieving the required items. The operation is streamlined – and productivity increases (by 10% to 20%) [5]. |  <br>[7] |
| **Intelligent glasses**<br>Revolutionary paperless picking technology that functions with augmented reality: Virtual information and images coalesce with the real environment. This technology is already being used in the auto industry.<br>The employee wears a special picking headset with a see-through display on which all the relevant information for the picking process is precisely superimposed. Both of the employee's hands are free for picking [8]. |  <br>[8] |
| **RFID (Radio Frequency Identification)**<br>RF handhelds have been in widespread use in warehouses since the early 1980´s when radio transmitters and bar code scanners were integrated into portable handheld units to enable real time data collection when operators perform tasks in the warehouse.<br>RF devices remain the most flexible technology because they can be used across all functional warehouse operations (not limited to order picking) [9]. |  <br>[9] |

**Tab. 1.** Warehouse technologies for productivity increase.

Tab. 2. shows which technologies are suitable for certain volume of picked pieces of material. The last row shows which handling system is used in these cases. For example, pick-to-light technology is mostly used by picking 200 to 400 items per man-hour and usually is applied in flow racks. Classification of SKU into A, B, C and D category is based on SKU turnaround time. To the A category belong units with the fastest velocity.

<table>
<tr><td colspan="15">Velocity in Order Lines Selected per Paid Man Hour</td></tr>
<tr><td rowspan="11">Movement category</td><td>SKU Velocity Category</td><td>0</td><td>100</td><td>200</td><td>300</td><td>400</td><td>500</td><td>600</td><td>700</td><td>800</td><td>900</td><td>1000</td><td>1100</td><td>1200</td></tr>
<tr><td>A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="8">Automated / Semi-Automated Picking Technologies (e.g. A-Frame, KIVA…)</td></tr>
<tr><td>A</td><td></td><td></td><td></td><td colspan="5">Horizontal Carousel</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A&B</td><td></td><td></td><td colspan="3">Pick-to-light</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A&B&C</td><td></td><td colspan="3">Pick-by-voice</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A&B&C</td><td></td><td colspan="2">Visual picking</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>C&D</td><td colspan="2">RF Picking</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>C&D</td><td colspan="2">Paper Picking</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="3">Racks and Static Shelving</td><td colspan="3">Pick to Belt Carton & Pallet Flow</td><td colspan="7">Carousels & Semi-Automated Systems</td></tr>
</table>

**Tab. 2.** Using of different technologies in warehouse depending on number of picked items [9].

Using these technologies brings a lot of benefits, for example:

- hands-free and in some cases eyes-free picking,
- up to a 35% improvement in picking productivity [5],
- up to 99,9% picking accuracy [5],
- reduced operator training time,
- direct interface to most WMS,
- rapid return on investment,
- shorter throughput times,
- cost savings,
- increased customer satisfaction,
- faster ability to supply,
- process transparency.

## 4. Conclusion

Production does not do without transport of material from warehouse to the production lines and without transport of finished goods from production line to the warehouse of finished goods. Therefore the plant has to choose technologies which will be used in warehouse and for transport of items, create suitable routes for handling vehicles and define specific volumes of transported items. Technological development is in recent in fast progress and therefore companies have to think about which technologies to include to their strategies and how they will reach their defined goals in area of material flows. Technological developments is related to devices that are used to create an efficient material flow, such as AGV systems, Pick-to-Light, Put-to-Light, smart glasses, Pick-by-Voice, RFID readers. As any company has products that fall in the different categories, a combination of technologies is often needed for greater efficiency. There are some items which are picked once a day or even once a week. Companies will have to take a good hard look at the order profile to decide which is best suited for their operation.

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