EDITORIAL BOARD

NICULESCU Publishing House

Marian Năpristoc – Editorial Director
Șerban-Alexandru Popină – DTP

ISSN 2344-4088
ISSN-L 2344-4088

Address: 6D Regiei Blvd.
060204 – București, România
Tel: (+40)21-312.97.82
Fax: (+40)21-312.97.83
E-mail: editura@niculescu.ro
Internet: www.niculescu.ro

FAIMA Business & Management Journal is indexed in international databases: ProQuest, ERIH PLUS, Index Copernicus and Google Scholar.

CONTENTS

The Future Begins Today 3
Gheorghe Militaru

The MPS.BR Model 5
Ticiane de Andrade Silva, Marciano Furukava

The QC-STORY Method 17
Nadia Belu, Gina Mihaela Sicoe, Iuliana Grecu

Ways to Improve the Performance of the Company 26
Dana Beļakova, Inese Ziemele

Predictive Decisions Based on Mimetic Models 35
Mihai-Vladimir Pascadi, Cezar Scarlat, Cristian Niculescu

Effective Business Informatics Management 45
Alena Buchalcevova, Jan Pour

The Impact of Software Mass Customization 54
Larisa Gavrilă, Sorin Ionescu, Bogdan Țigănoaia,
Gheorghe Militaru, Antonín Pavlicek

The Principle of Diversity in Management 65
Cristina Elena Bîgioi, Adrian Doru Bîgioi

The Future Begins Today

The field of management asks managers to do more with less and to see change rather than stability as a rule. Managers work at different levels in the hierarchy and perform different tasks for achieving high performance. Many managers need to understand where their companies are, where they need to go, and how to get there. Today, companies do not have to compete only with costs or prices they have to insist on creativity, innovation, and creating value for customers so that they are willing to pay. For example, integration of customer support process is vital for any organization.

Many of the key trends focus around technology because management is a rapidly evolving field and the pace of change is influenced of technological advancement. Technology is the key driver behind the business development. Technology advances re-shape value chains and create a better experience for customers because of digital tools rich customer experiences. Social business applications rely on robust search functionality increase productivity and minimizing variability in business processes. Thus, management trends favor agile, interactive processes that stimulate the innovation, and social impact.

As organizations become more digital and need to adapt more quickly, they need to develop digital capabilities in which a company's culture and activities are aligned toward organizational goals. Technological innovation is happening at a faster rate than ever before. In addition, technology changes faster than organizations can adopt it. Thus, managers face with respect to digital disruption. In this case, the big problem is the uneven rates of assimilation of the technologies into different levels of organizations.

Digital transformation is focused on cooperation and collaboration and the use of new digital technologies such as mobile analytics or social media and creating new business models. Digital has transformed operational processes, and business models, customer experience and how organizations create business value and establish a competitive advantage. Deploying digital technologies and capabilities to improve processes, attract and engage the best talent, and drive new value-generating business models can transform organizations into flexible and agile entities that can rapidly respond to changes and improve their performance and competitiveness. Talented employees are the strategic assets of a competitive advantage. A heavy emphasis is placed on

the hiring remote workers especially in the field of services.

Digital transformation is based on cooperation and collaboration. Advances in machine learning have improved business performance because the organization can learn about consumer behavior and preferences. Digital technologies are changing the rules of competition by using tools to support operations activities and increase the efficiency and reduce costs. Thus, big data offers the possibility to translate the knowledge into improved decisions making and performance. The use of big data has the potential to transform traditional businesses and offer greater opportunities for competitive advantage. The manager can make better predictions and smarter decisions. They can extract the intelligence from data and translate that into business advantage and improve business performance. Its focuses on using data to understand every part of a business operation because data in real-time makes possible for a company to be much agiler than its competitors.

A leader can also infuse stability and certainty in uncertain context and leadership is crucial for improving human behavior. Weak leadership can be one of the big barriers that limit the high performance of organizations. A trend in this area is the neuroscience-based leadership. This kind of leadership focuses on neural patterns to unleash the brain agility, and creativity emotions and cultural diversity, collaboration change facilitation improve the effectiveness of human interactions using the cognitive sciences to improve personal and leadership performance in organizations using concepts and techniques deriving from brain research and psychology that can improve individual or team leadership performance.

Gheorghe Militaru
Deputy Chief Editor

„The best preparation for tomorrow is doing your best today."
H. Jackson Brown, Jr
(American author)

The MPS.BR Model

Ticiane de Andrade Silva, Marciano Furukava
Universidade Federal do Rio Grande do Norte, Natal, Brazil

Abstract

This study was carried out to describe and analyze how the process of implementation of a quality model in a small software industry in Brazil improved its level of development production. Based on the literature review of quality models and the needs of the company, the most suitable model was chosen and applied to the situation – the Brazilian Software Process Improvement (MPS.Br). The process was presented and then applied in the industry, in which the scenario was described and the before and after situations were compared. Among other factors, the rate of performance was improved, showing the success of the quality model. The present research considers the applicability of a quality model in the process of software development which is still limited in the literature. The study concentrates on the quality model that suits the needs of the company, improving the development processes and showing what was necessary to implement in order to get the desired results. It also aims to contribute with future references for the companies and enthusiasts who desire to know more about this model.

Keywords: quality, certification, process, MPS.BR model, implementation

Introduction

The technology area, especially the development of software, demands constant learning and recycling of the professionals, in view of the demands from new technology introduced daily on the market. In this scenario of constant innovation, it is necessary the search for new methods of obtaining efficient results.

The everyday life inside the software development area is known for the big pressure regarding deadlines, the cost of

* Correspondence to: ticianea3@gmail.com

operations and the quality of the products/services. Regardless of the size of the team, many organizations have difficulties dealing with those activities. In this scenario, many quality models were developed, offering the companies efficient methods for the development and maintenance of software.

With the constant search for quality, the organizations have been recurring to the certified software quality models, providing the client with the guarantee that their processes follow a standard to assure a satisfactory result. These certifications can be defined as a series of regulations that guide the implementation of a quality system and are certified by a third party.

This study will describe and discuss the process of implementing and certifying the Brazilian Software Process Improvement (MPS.Br) in a small technology company in Brazil expecting to gain improvement in the productivity levels, as well as getting to insights in the process of software development.

Literature Review

According to Ambrozewicz (2003), the process of quality achievement goes beyond delivering a product or providing a service within the pre-assigned characteristics; it covers the process starting with the resources used, passing through the controlling of the process and the professional qualification, to the customer service.

Crosby (1990) defines quality as a system that prevents flaws. As for Deming (1986), quality means accordance, prevention, and continuous improvement. Quality acquires different meanings depending on the clients' needs and demands; as the necessities change, the concept of quality changes as well. Therefore, quality is not an absolute measurement, but a goal to be reached, a goal which changes constantly at the same pace as the clients' necessities (Starke *et al,* 2012). As for software quality, it contemplates a complex combination of factors that vary according to the different applications and clients who require the software (Pressman, 2005).

According to Rouiller *et al.* (2003), many models and software quality standards have been proposed throughout the years. In the following sections, the most used quality models are presented.

The most recognized models, such as ***ISO 9001***, became known for the quality of the product, closer to the client perspective. According to Côrtes and Chiossi (2001), the technological revolution, between other reasons, has elevated the clients' minimal expectations. The ISO standards have their disadvantage the applicability: the process of implementation is complex and confusing for newcomers and the certification is bureaucratic, making the fulfillment of the requirements harder, since the software industry is very dynamic and virtual.

The Capability Maturity Model Integration (CMMI), is an international model for quality in software development created by the Software Engineering Institute (SEI). According to SEI (2010), organizations from different areas including the aerospace industry, financial, software, hardware, cars, and telecommunications industries use CMMI for development processes.

The model contains practices that cover management projects and processes, system and software engineering, as well as other supporting processes of development and maintenance. It uses professional judgment as well as common sense. As described in the Technical Report released by the SEI, the CMMI model is divided into six capacity levels (Figure 1):

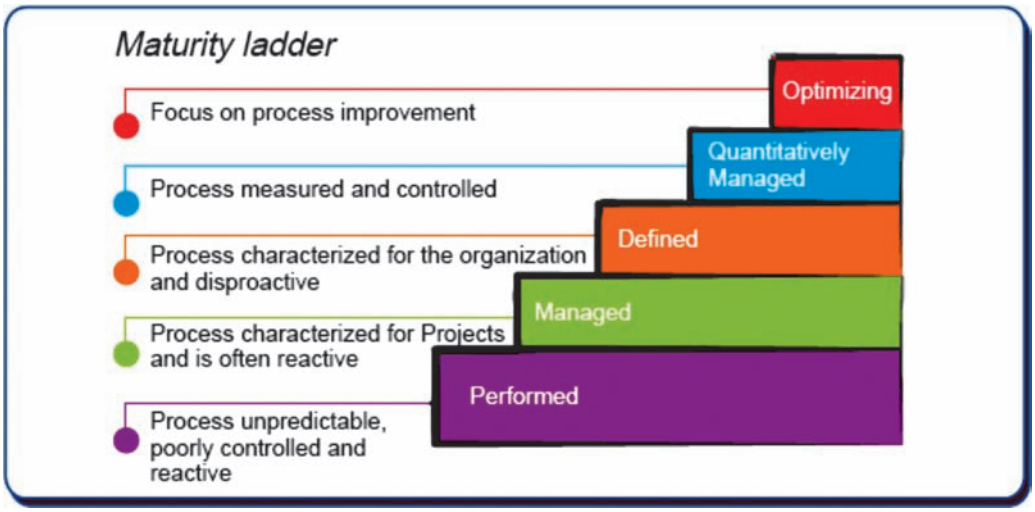


Figure 1 – *Maturity Ladder of the CMMI model*
(Source: http://www.qaiglobalservices.com)

In order to reach each individual level, the organization must satisfy all given goals associated with each process areas. According to Sutherland (2008), even with all the benefits that CMMI can offer to a company, there are a few negative points that must be considered: Significant costs and time invested in the implementation (high maturity levels) – counter interacts with the Brazilian reality; Respects the process, but ignores the people; Does not focus on internal problems; Is not business-oriented; Ignores the technical and organizational structure; Focuses on the internal efficiency and ignores external competitiveness.

The MPS.BR Model

According to the data shown by the Federal Association of Brazilian Informational Technology Industries, the number of Brazilian software companies who carried any type of quality certification was only 11,8% in 2014. As for ISO 9000 certification, the percent was 3,9%; for the CMMI, only 3% of the companies, mostly multinational companies (Figure 2).

As claimed by Sommerville (2004), throughout the past years, the organizations' interest in process improvement has grown. With the development of technologies in Brazil, the knowledge about standards and process improvement began

Figure 2 – *Brazilian software companies certified in 2014*
(Source: Assepro, 2014)

to reach all companies, but the certifications available were difficult to become a reality, either from a financial or a methodical point of view.

In this context, the Brazilian market developed the MPS.BR model. Created in 2003 by SOFTEX to improve the capacity of software development in Brazil, it was based on two international models for quality: the CMMI (Capability Maturity Model Integration) and the ISO (International Organization for Standardization), as well as software engineering practices and the necessities of the Brazilian market.

The MPS.BR represented an economically viable way for the small industries to reach the benefits of the improving their software processes in a reasonable period of time. It brought a benefit in competition to the Brazilian industries.

The MPS.BR is an improved model which proposes requirements, as well as a software evaluation process that must be met by the companies. It makes it more accessible for small and medium companies to be certified and acquire a quality standard, thus attending to the needs of nationwide businesses.

In this model, the requirements that must be implemented are all listed in guidelines for implementation. The model has different levels of maturity, marking the level of process improvement in which objectives are attended (ISO/IEC 15504-1, 2004). Each level of maturity is composed of specific areas with specific requirements that must be met. For each superior level, all requirements of the previous levels must be met. All seven levels of maturity in the model are shown in Figure 3:

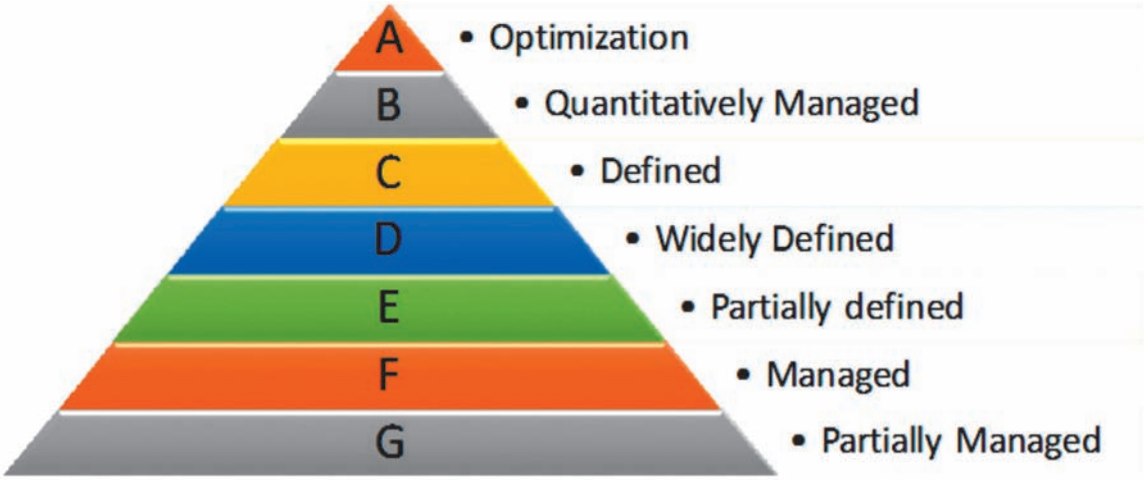


Figure 3 – *MPS.BR Maturity Levels*
(Adapted from: http://www.fumsoft.org.br)

The first level is the G level; the more mature one is the A level. Each level shows different control rates in the process and the quality that can be expected from the organization. A small company usually faces a great difficulty to achieve the first level of maturity, since the environment is usually chaotic. Taking control and having production records can be very complex; therefore, nowadays there are numerous tools available to help to make the implementation process simpler.

The first maturity level is ***G (Partially managed)***, which covers two areas: Requirement management and Project management. This level is composed of the most critical processes in management. Intending to improve project control, the organization must implement supporting processes for software development, which can be found in the next level (F – Managed).

Within level G, planning, execution and process control must be observed, establishing a commitment to fulfill the processes and maintain their visibility to the managers. The two areas defined in this level are Project Management – GPR (having as purpose the identification, coordination and control of tasks and resources, providing information about the project, and Requirement Management – GRE (having as purpose the management of the clients' requirements by breaking them into smaller tasks to be coded, the identification of inconsistencies of the products and the project.

The second maturity level is the ***F (Managed)***. As shown in Figure 4, this level is composed of the level G areas added with new areas.

The areas introduced by level F are:

Quality Assurance (GQA) – has the purpose to assure that products and processes are following the standards stated in the documentation. This supporting area is responsible for maintaining the control of the productive process and its accordance with the documents analysis. It is a critical area for the MPS.BR.

Measurement (MED) – has the purpose to collect, store, analyze and report all data from the development process and the projects. Using measurements, it is possible to establish indicators and goals for each individual project.

Configuration Management (GCO) – has the purpose to establish and maintain the integrity of all products and projects, this area is responsible to for the security of the archive, giving access to the files, and to track every change in the source-code, the core of the product.

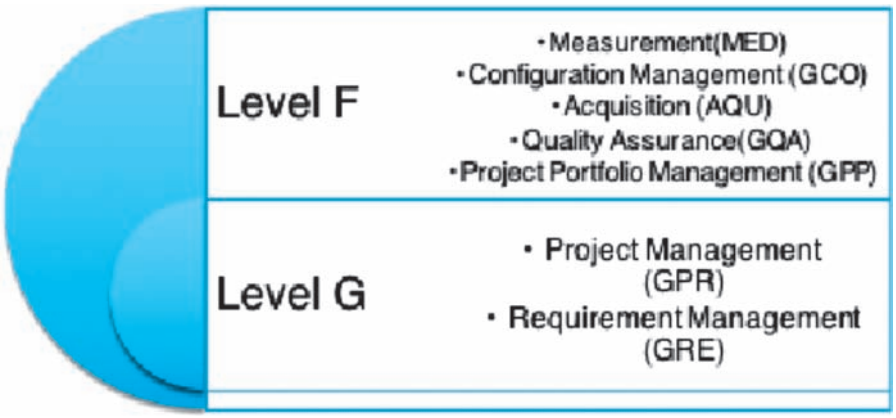


Figure 4 – *Level F areas of the MPS.BR model*

Project Portfolio Management (GPP) – has the purpose to initiate necessary projects in order to meet the strategic objectives of the organization. This area is not necessary for companies who do not work with new projects and only maintain existing products.

Acquisition (AQU) – has the purpose to manage the acquisition of products that satisfy the needs of the company. This area is necessary for industries who buy part of the systems from other suppliers.

Case Study

This study took place in a small software company in Brazil that acts in the areas of software development (developing efficient software solutions) and technical support, providing technical support for the developed products. The company has 42 employees in several domains: 15 people in the software development area, divided into three teams with 4 developers per team, each one responsible for different products; there is also the requirement analyst, who writes all the requirements and work tasks, the development director, who acts as the product owner bringing the clients' needs, and the quality analyst (the author of this study), responsible for the documentation and auditing of the processes.

The scenario of the study. In 2010, the company was certified according to MPS.BR at level G development, having the two initial areas of a process implemented: Requirement Management and Project Management. The company had its processes documented, therefore they were outdated since the previous certification; also, there was no control over the development process. The improvement and need of change were within the culture of the company and its staff; however, there were some changes in the staff, and some newcomers did not know how a quality model works. The firm had the responsibilities and roles defined and documented, but they were still tangled together.

The development area of the company had a low productivity rate, causing a lot

of effort to go wasted trying to fix older bugs in the system. Therefore, the directors of the firm decided to invest in the process improvement using the MPS.BR model. This model was chosen because of its viability since it is implemented gradually and easily applicable in small companies. Its implementation is also subsidized by SEBRAE of Brazil, reducing the implementation costs.

To the intention of planning the activities towards software improvement relating to level F requirements, a diagnosis was made with the help of employees who had the technical, managerial and administrative knowledge, as well as with the help of an external consultant. The diagnosis showed the necessary changes to achieve level F. Taking into account the situation of the company, the implementation process took nine months, is then followed by the certification.

Methodology. The implementation happened with the aid of an outside consultant, which was responsible to prepare an action plan with every requirement necessary to obtain the certification, as well as to achieve the envisaged improvements in the development process, e.g. an increase in productivity. Inside the company, this process was managed by the development director and by the quality analyst, the author of this study. This process took place in 2014, from January to September.

Results. Implementation – the company obtained a situational diagnosis, showing what needed to be done in order to obtain the MPS.BR F level certification, then the implementation started. to achieve the F level, it was necessary to evaluate and implement the needed areas out of the required ones. the required areas were: measurement (MED), configuration management (GCO), quality assurance (GQA), acquisition (AQU), project portfolio management (GPP), requirements management (GRE) and project management (GPR). The last two areas only needed improvement.

After all the required items were implemented, the certification was scheduled and it was conducted with qualified

representatives licensed by SOFTEX (the organization responsible for the MPS.BR model). For the implementation of the certification, the documentation improved and was renewed, the responsibilities were outlined. Following the implementation, each team's performance registered an improvement that could be measured; the improvement results are shown as follows.

Requirements Management. This area had been evaluated before, during the level G certification of the company from 2010, but the project management software has changed since then and the new standards were not registered, although a pattern was followed. The responsible for all the inputs in the system was only one person – the requirement analyst. In this area it was only necessary to document the process done by the analyst in the management system, making the standards available for every company member. There was no necessary change the standards or in the source code.

Project Management. This area had been certified during the previous certification, but it was registered in the obsolete system, since then the management system changed and all projects' documentation was now being registered in a new tool called TFS (Team Foundation Server). The use of this new system made the project management easier, giving access only to the interested people. Each person involved in the project had a profile where the access was limited. These processes were not documented and had no standardization; each member of the team registered information in an unstandardized way, so it was necessary to establish standards and document them.

Configuration Management. This area is important to the development process because it tracks every change made to the product, the time when it was made, who made it and the possibility to change it back to the previous state if necessary. This area is extremely important when a bug is reported. It was then necessary to introduce this area to the organization, to define standards regarding the names of the files, where alterations should be made and how the folders that should be used etc. The requirement analyst had the responsibility to verify the products folders and files, as well as the source code to make sure that every alteration had a responsible person. This process assured the integrity of the products and made it possible to track the responsible persons for bugs in the system.

Quality Assurance. The Quality Assurance was implemented by first hiring a quality analyst. The next step was to identify all the processes related to quality, which was then documented. Initially, a checklist was created by the development director and was then improved and divided by each instance of the project (planning, execution, and closure), and by process area. It was then possible to measure

each area and work on the ones with the worst performance.

Measurement. The measurement started by improving the measures with the help of the team members. They had to learn how to record the hours spent on each task in a standardized way. This area required the listing of all data regarding the work tasks, such as how many tasks were done by each team member, the complexity of the tasks, how many hours were spent for each task, how many bugs were corrected, how many nonconformities there were in the project etc. With the data, it was possible to create reliable indicators and acceptable levels for them.

Acquisition. The acquisition area is not necessary for companies who develop the entire system, it is demanded only for the ones who buy systems or modules developed by third parties. Since the organization in this study develops all of its products, this area was not implemented.

Project Portfolio Management. This area is necessary only for companies who develop new products for each client. The studied company does not develop unique products, it has three products that are maintained and upgraded, and therefore this area was not implemented.

Certification. The certification process started with the training of the company's representative, the quality analyst, who went through the Introduction to MPS-Software course, which was a mandatory part of the certification process. The certification needed the presence of the evaluators certified by the competent organization – SOFTEX. As the date of the evaluation approached, all the documents were compiled, including all the company information, the confidentiality agreements to assure that all information collected during the documentation analysis and interviews are confidential and a general view about the evaluation days with all the schedules.

The evaluation lasted two days. In the first one, all evidence was studied by the two evaluators with the assistance of the company representative, the quality analyst. Since there were no nonconformities, only improvement suggestions, the evaluation was able to proceed in the next day; if any nonconformity was found, the process would continue after the nonconformity was fixed. The second day of evaluation started with the interviews, where all the employees involved in the projects were asked questions in order to confirm what was described in the certification documents. After completing all the interviews, a meeting with the directors took place, in order to inform the top management that the F level in development was achieved. All documents were signed and then the certification was socialized with all the other members of the company. The news could only be disclosed to the general public after its official publication by SOFTEX.

Improvements in the company. With the implementation of the MPS.BR model, it was possible to observe improvements in the access to the companies' documents where all processes were registered. The newcomers were able to read them and get familiarized with the development processes. Besides that, it was possible to observe an improvement in the individual performance levels as shown in the following figures. The indicator line represents the relation between times spent for development (in minutes), the number of points (complexity of the task) and the number of tasks completed (development work).

The first graph (Figure 5) shows the performance levels of one team before the complete implementation process:

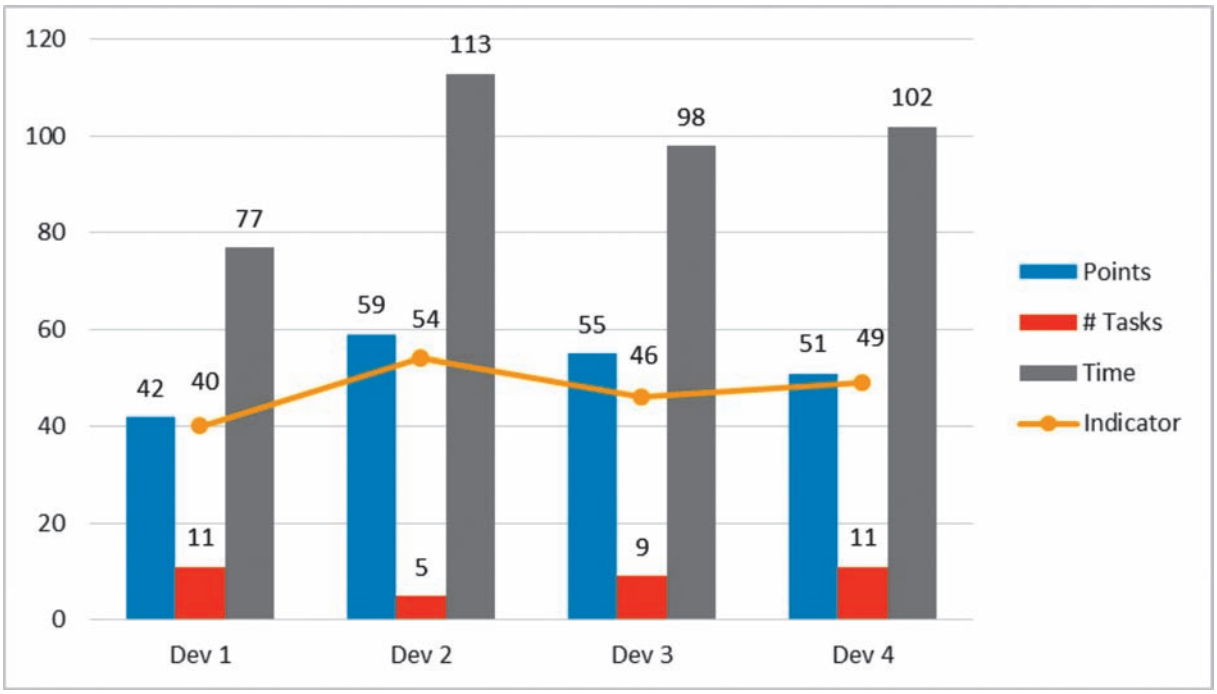


Figure 5 – *Individual Performance levels – February*

The second graph (Figure 6) shows the performance of the same team after the certification of the model, where is possible to observe an improvement in the performance rate of all developers; besides, the team was able to maintain a balanced level:

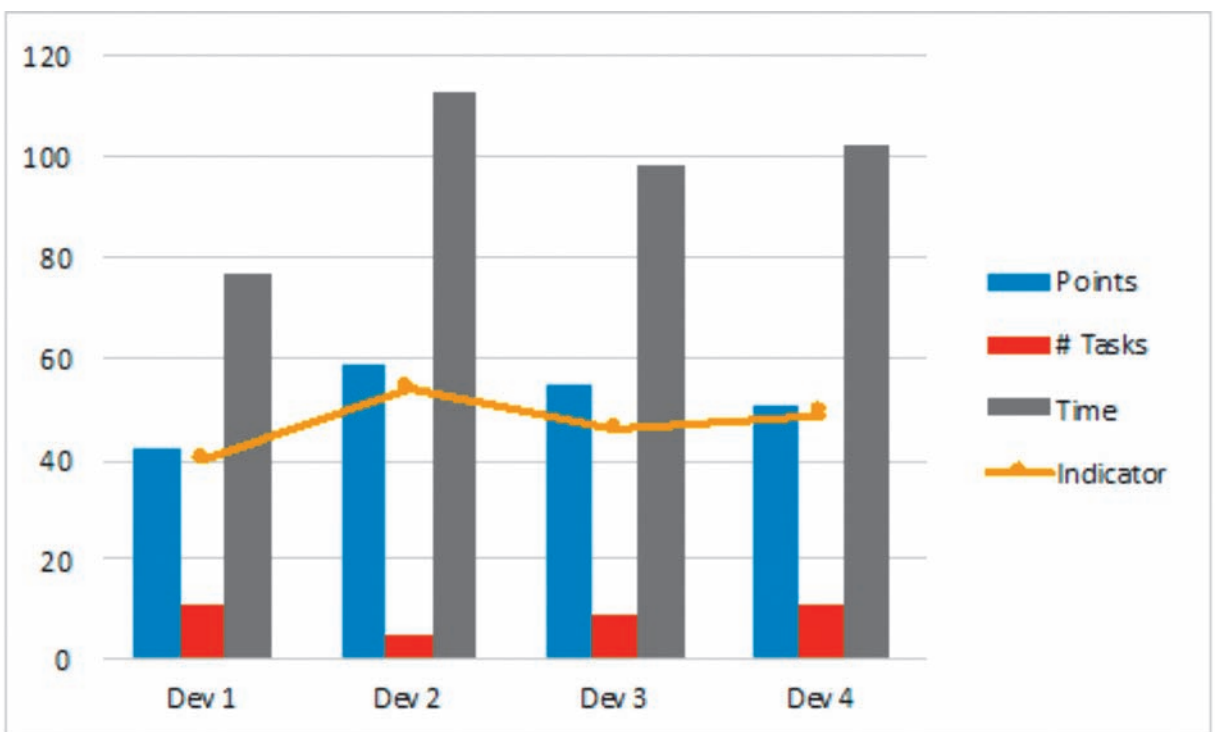


Figure 6 – *Individual Performance levels – November*

After each project was finished, all indicators were presented to the teams. In this way, it could be provided important improvement information such as the developers who had a lower level of performance, the causes for it – if it was a problem in understanding the requirements if the task was too complex if it was a personal reason etc. Also, each member wanted to know their own performance and to know if it improved as compared with previous results.

The quality became deeply embedded in the organization culture, making sure that all established and standardized process and patterns were followed. There was also an improvement in the relationships between team members, creating a sharing environment and defined responsibilities, with every task being done in the best way.

With the help of the measurement area, all the decisions of the managers were backed by numbers, being able to create goals and ranges for each indicator. Besides all the internal benefits, the certification also brought significant external benefits such as the higher credibility of the company in the market, since the certified company generally offers a feeling of security. The certification was also used for marketing purposes and for the possibility to attend governmental organizations that require a certification.

Conclusions

The initial diagnoses of the company addressed in this study showed that it needed adjustments and improvement in its processes development area. The MPS.BR model was chosen for certification, as this model needed a gradual implementation and is fit for a small company with little

resources. Consequently, the processes of implementation and certification of the MPS.BR model's level F was approached and presented in this paper.

The implementation of the model provided an improvement in the process, allowing a better management in the requirement area, lowered the projects nonconformities, implemented indicators, audits, and standards. There was an increase in the performance levels and the process organization, there was also an improvement in the organization's culture, creating a bond and better relationships between the employees.

The main difficulties during the implementation were: the lack of communication between workers, the poor knowledge of the systems used internally, such as TFS, the lack of agreement on establishing the best way to perform a process (standards) and the concentration of power by the high management.

The objective of the study was met, leading to an improvement in the team members' performance levels. Since the development area was such a success, the company has now moved on to implement the quality program in the support area, looking to achieve a performance just as high. This study is an experience report that is intended to help other software companies going through the certification process.

REFERENCES

1. ABNT NBR ISO 15504-1:2008 (2008) *Tecnologia da informação – Avaliação de processo. Parte 1: Conceitos e vocabulário* (In English: *Information technology – Process evaluation. Part 1: Concepts and vocabulary).*
2. Ambrozewicz, P.H.L. (2003) *Qualidade na prática, conceitos e ferramentas* (In English: *uality in practice, concepts and tools).* Brasilia: SENAI.
3. Côrtes, M.L., Chiossi, T.C. (2001) *Modelos de Qualidade de Software* (In English: *Software Quality Models).* 2nd ed. Campinas: Unicamp.
4. Crosby, P.B. (1990) *Let's talk quality.* New York: McGraw-Hill.
5. Deming, W.E. (1986) *Out of the Crisis.* Cambridge: Massachusetts Institute of Technology Center for Advanced Engineering Study.
6. Federação das Associações das Empresas Brasileiras de Tecnologia da Informação (ASSEPRO). (2014) *2014 – Censo ALETI do setor de TI* (In English: *2014 – ALETI census of the IT sector).* [Online] Available from: http://assespro.org.br/biblioteca/dados-mercado/2014-censo-aleti-do-setor-de-ti-2014-resultados/. [Accessed: 9th November 2015].
7. International Standardization Organization (2015) *ABNT NBR ISO 9000:2015. Sistemas de gestão da qualidade – Fundamentos e vocabulário* (In English: *Quality management systems – Fundamentals and vocabulary).*
8. Ionescu, S.C. (2014) Economy of Quality. *FAIMA Business & Management Journal.* 2(1). p. 16-27.
9. Pressman, R.S. (2005) Software Engineering*: A Practioner's Approach.* 6th ed. McGraw-Hill.
10. Rouiller, A.C., Vasconcelos, A.M.L. & Maciel, T.M. de M. (2004) *Engenharia de Software* (In English: *Software Engineering.* Lavras: UFLA/FAEPE.
11. SEI (2010) *Improving processes for developing better products and services.* CMU/SEI-2010-TR-033. Carnegie Mellon University.
12. SOFTEX (2012) MPS.BR – *Guia Geral MPS de Software (MPS.BR – General MPS Software Guide).* [Online] Available from: http://www.softex.br/wp-content/uploads/2013/07/MPS.BR_Guia_Geral_Software_2012.pdf [Accessed: 28th August 2016].
13. SOFTEX (2015) *Tecnologia da Informação Brasileira* (In English: *Brazilian Information Technology).* [Online] Available from: http://www.softex.br/mpsbr/mps/mps-br-em-numeros/ [Accessed: 27th August 2016].
14. Sommerville, I. (2004) *Software engineering.* 7th ed. Boston: Pearson Education.
15. Starke, F. et al. (2012) Impact of ISO 9000 certification on firm performance: evidence from Brazil. *Management Research Review.* 35 (10). pp. 974-997.
16. Sutherland, J., Jakobsen, C. & Johnson, K. (2008) *Scrum and CMMI Level 5. The Magic Potion for Code Warriors. Proceedings: Hawaii International Conference on System Sciences.* Hawaii. January 7-10.

„I don't know the key to success, but the key to failure is trying to please everybody."
Bill Cosby

The QC-Story Method

Nadia Belu (1), Gina Mihaela Sicoe (1), Iuliana Grecu (2)

(1) University of Pitești, Romania, (2) University POLITEHNICA of Bucharest, Romania

Abstract

The Quality Control Story (QC Story) method represents, for the automotive industry companies, a problem-solving method based on considering the facts and data, without speculation, for a problem caused by several factors. QC Story method is applicable not only to quality problems, but also to problems of productivity, costs, logistics, and energy. This paper presents the improvement in the customer complaints process achieved by an effective use of the QC Story methodology. It is presented the QC Story methodology and its performance in influencing the customer complaints management process throughout a case study in the automotive industry.

Keywords: QC Story, IATF 16949, customer complaints, problem-solving, quality improvement

Introduction

The global auto industry is a key sector of the economy for every major country in the world. The companies in the field must maintain product quality, deliver on time and at a competitive price in order to achieve customer satisfaction. Therefore, the subsequent product realization process results from the awareness of entrepreneurs and their serious approach to the quality planning (Misztal, S. & Bachorz I., 2014). Failures reduce products' quality, leading to production delay due to the rework or additional production that leads to additional costs (Banduka N., Veža, I., Bilić B., 2016).

There are many tools that can be used to help the companies to determine the

„Effective leaders help others to understand the necessity of change and to accept a common vision of the desired outcome."
John Kotter

* Correspondence to Nadia Belu: nadia.belu@gmail.com

root causes of problems and to solve them, to reduce the overall costs of quality and to improve customer satisfaction. These are known as problem-solving methods. In the automotive industry, one of these methods, is known as Quality Control Story (QC Story). Previous practical applications of the QC Story lack powerful tools or techniques to effectively solve problems and develop innovative solutions to problems (Sha, D.Y., Hsu S.-Y., Chen, H.-Y., 2016; Hsu, S.-Y., 2014). The QC Story originated in the Seisakusho Li Tianjin plant, which is located in Komatsu, Ishikawa in Japan. To improve the performance of the quality control circle – QCC, a structural process for the activity of the QCC is presented. The output of the QCC can be arranged and presented based on the process, namely, the QC story (Sugiura, Z., Shantian, J., 2003). The QC story is a structural process for the presentation of QCC activities. It is frequently used in practical problem-solving procedures and methods (Hsu, S.-Y., 2014; Yang, P.J., 2004).

QC Story method is a tool of IATF 16949. In October 2016, the IATF published a revised automotive industry standard, and the first edition was referred to as „IATF 16949." According to IATF 10.2.3 Problem solving: *„The organization shall have a documented process(es) for problem-solving: c) root cause analysis, the methodology used, analysis, and results. Where the customer has specific prescribed processes, tools, or systems for problem-solving, the organization shall use those processes, tools, or systems unless otherwise approved by the customer"* (IATF, 2016). In this paper, we present the solution of a quality problem by applying the QC Story method.

QC Story in the Automotive Industry

QC Story is a problem-solving method based on considering the facts and data, without speculation, for a problem caused by several factors. QC Story method is applicable not only to quality problems but also to problems of productivity, costs, logistics, energy, security etc. (Bidault, F., 2001). Therefore, using a different standard process and different tools, QC Story is applicable to different kinds of problems. The approach used by QC Story is appropriate for solving problems both as a group and as individuals. Sometimes using the format is not essential, but may be necessary at the beginning or to communicate the results.

The QC Story method can be used by any employee from worker to manager in all areas of a company (manufacturing, design, logistics etc.) when the causes and action plan for solving a problem are not obvious. The method is applied using nine steps and basic principles of quality by taking into account tools and techniques from various approaches based on the principle of PDCA (Plan – Do – Check – Act) cycle (Figure 1):

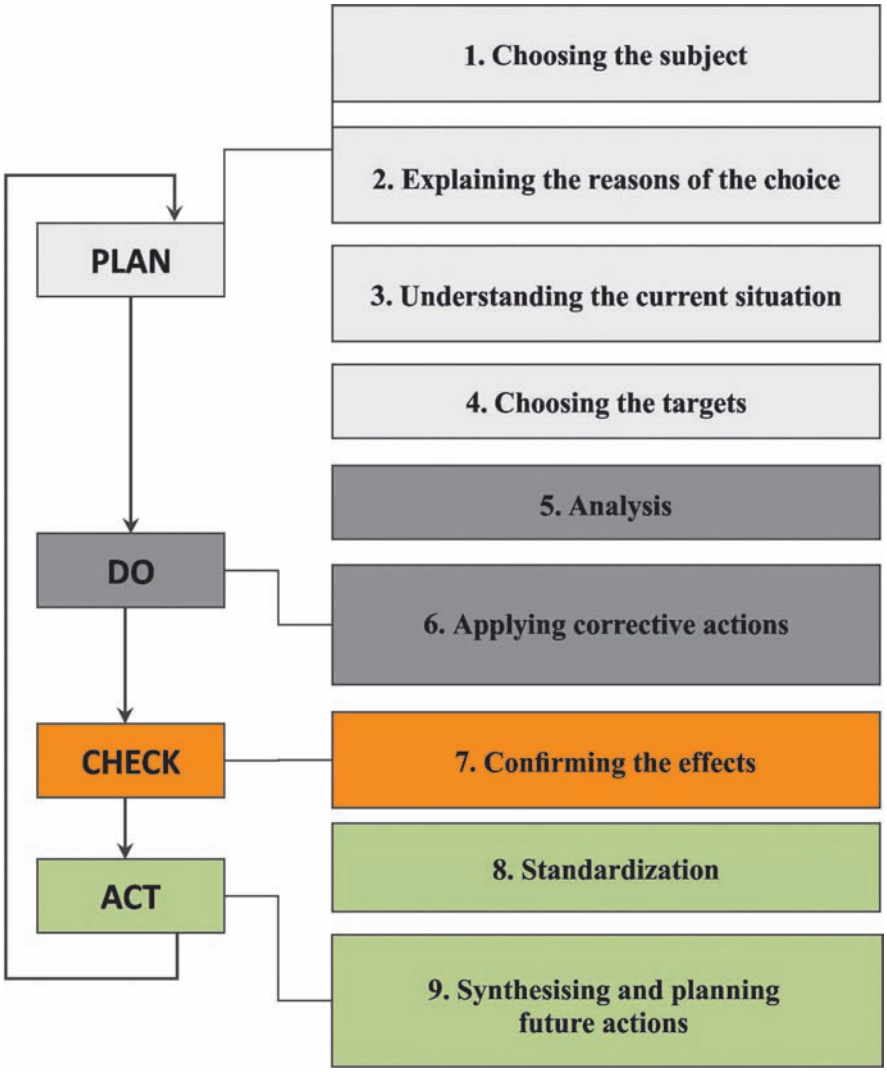
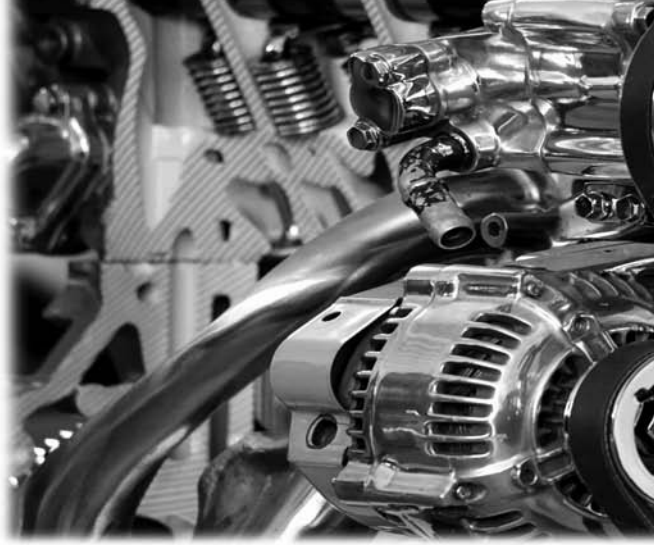


Figure 1 – *QC Story Method steps*

Step 1. Choosing the subject. The first step in solving a problem is to discover the problem and give it a name, allowing anyone to easily understand its nature. It is recommended to use a verb of action such as eliminate, reduce, diminish etc. The choice of the subject means to identify the strategy problems or complaints received from customers. The problem is selected according to priority.

Step 2. Explaining the reasons for the choice. The second step consists in establishing the importance, urgency and impact of the problem, gathering all possible data based on facts. Pareto diagrams are generally used to present the problem and the reasons for the choice; in a general manner, we have to demonstrate the interest of the subject through visual elements (graphs, charts etc.).

Step 3. Understanding the current situation. This step is essential in the assembly of QC Story and is crucial for obtaining the final result. The analysis step (step 5) depends on the quality of this step. To successfully fulfill the requirements of this step, a precise observation of the problem must be performed, and the



necessary data on the field during production must be identified and collected. Data are ranked in order to highlight their relevance through simultaneous graphics, which clearly show the differences between the current situation and the reference situation (standard) (Bidault, F., 2001).

Step 4. Choosing the targets (objectives). This stage is determined by a compromise between the ideal situation and constraints such as time, manpower and money that may be invested in the project. For this, it is easier to set targets for improvement if the situation in Step 3 is well presented. In case of an identified problem, the employees must take action for the return to at least a „normal" situation. For a better choice of the target, the following conditions have to be met: to produce benefits that outweigh the costs and efforts required to achieve them, to be quite important to create motivation, to be achievable (not to discourage), to have the possibility to verify whether the results will be achieved or not, all participants must accept and believe in the objectives, and their relationship to the general policy of the company and the other departments should be carefully analyzed.

Step 5. Analysis. Precise identification of the true causes indicates what needs to be done in the next step: finding and implementing corrective actions. If the causes are not clearly identified, the team risks losing time and money trying various inefficient solutions. To analyze the causes means finding the main factors which create problems and whose emergence affects the results of the process. When identifying the causes, it is important to establish whether the causes identified are actually the true underlying causes. For the identification of the causes and effects, the Ishikawa diagram, WWWWH (Who? What? Where? When? How?) and „5 Whys?" methods can be used (Myszewski, J.M., 2013).

Step 6. Applying corrective actions. This step is directly related to the previous step: this link should be visible in the QC Story form by using such numbers corresponding with the causes identified and the actions set. Before the implementation of corrective actions, they must be approved by management. Then, the team needs to conduct tests and check the effect on other processes or other factors. If the results are good, then the plan can be put into practice. Particularly, it must be verified whether the actions taken do not create a failure elsewhere. Sometimes, the implementation of actions one by one and checking their effect may seem slow, but no costs are allowed for the implementation of actions which are not efficient.

Step 7. Confirming the effects. In order to achieve this step, the current situation is compared with the initial conditions (step 3), using graphs. If the effects can be converted into gains (money) it is even better and both the direct and indirect effect (repercussions) and intangible effects should be considered. Also, the situation before and after the corrective actions should be presented using the same graphs as those from step 4, and if possible the effect of every action on the final result should be shown.

Step 8: Standardization. In this stage, the corrective action should be standardized to avoid further failures by taking the following steps: revising or establishing the work „standard", training the operator for the new standard if the problem comes from the operational mode, revising the time cycle, standard stocks, standard conditions of equipment etc.

Step 9. Synthesizing and planning future actions. In this stage, after the target has been reached, the progress and results should be presented. We can also have aspects that have not been solved yet by applying the QC Story method. This stage allows us to note them for the future. Thus, to close the PDCA cycle, each user must end his/her QC Story approach by making a review of the manner in which he practiced. This balance should prompt a reflection on improving the skills needed to achieve a QC Story even better, especially as regards the means of analysis. The management's task is to help QC Story practitioners to highlight the points to be improved.

Case Study

In this case study, we present the solution of a quality problem found on the crown wheel of a vehicle gearbox using the QC Story method.

Step 1. Choosing the subject. The quality department of a company in the automotive industry received a complaint from a customer regarding the emergence of an „engine noise at start" of a vehicle. The case was registered in week 927, due to customers' complaints. After the expertise conducted at an authorized workshop, it was found that the noise came from the welded crown wheel.

Step 2. Explaining the reasons for the choice. Given the company's quality policy, the application of the QC Story method it is aimed to:

1. Eliminate the risk of the emergence of this failure at other customers;
2. Treat the problem quickly; deadline to solve the problem Week 930;
3. Reduce the costs generated by solving the quality problems.

Step 3. Understanding the current situation. The manufacturing process of the part involves the following operations: OP 110 – facing, OP 120 – stamping, OP 130 – toothing, OP 140 – hardening, OP 170 – adjustment (Figure 2):

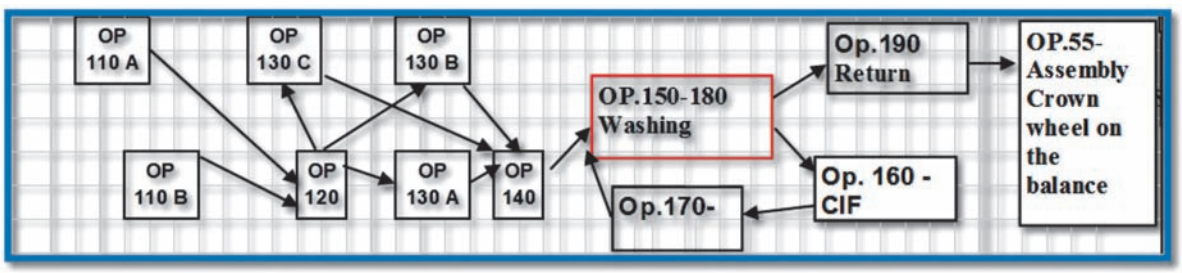


Figure 2 – *The manufacturing process of the crown wheel*

For understanding the current situation, data collected is presented in Table 1:

Table 1 – *Workstation data*

Workstation data	OK	NOK	Observations
1. OPERATOR			
The operator has the level L		X	Not all operators have the level L
The operator respects the operational mode		X	The „Punctual lesson" is not respected
The operator knows the key points and reasons	X		There is not a key point concerning the failure
Instruction sheet is respected	X		Lack of failure characteristic
2. EANS			
Use of specific tools	X		Wear unidentified elements
The tools are in good working order		X	Plate and inductor wear
The parameters to respect are in instruction sheet	X		Lack of conditions to verify the plate
3. METHODS			
There is a standard in the Standard Operations Sheet	X		The failure is not specified
There is a key point concerning the failure		X	Lack of verification point „welded tooth"
There is a standard in the Standard Operations Sheet	X		There is no verification „welded tooth" in instruction sheet
There is an instruction sheet	X		Lack of instruction sheet „Cross inductor"
There are actions to verify the plate beats		X	There is no verification „plate beat"

Step 4. Choosing the targets (objectives). Given the company's quality policy, it was established that the goal of solving the problem would be Week 930, presented graphically in Figure 3:

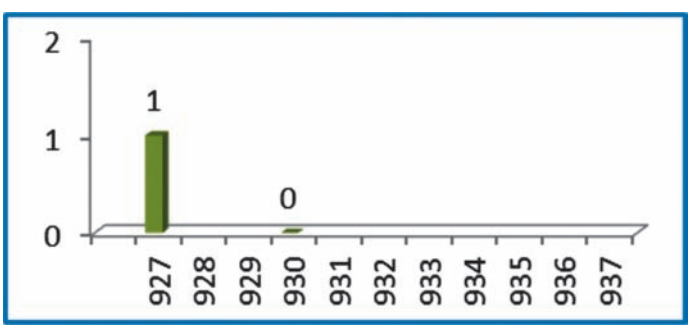


Figure 3 – *Graphical representation of the target problem solving*

Table 2 presents the action plan to apply the QC Story method.

Table 2 – *Action plan*
P – planned; R – realized

Actions	S927		S928		S929		S930		S931		S935		S936	
	P	R	P	R	P	R	P	R	P	R	P	R	P	R
Step 1-4	X	X												
Step 5-7			X	X										
Step 8-9							X	X						

Step 5. Analysis. The Ishikawa diagram has been used in order to establish the precise causes that led to the nonconformity (Figure 4):

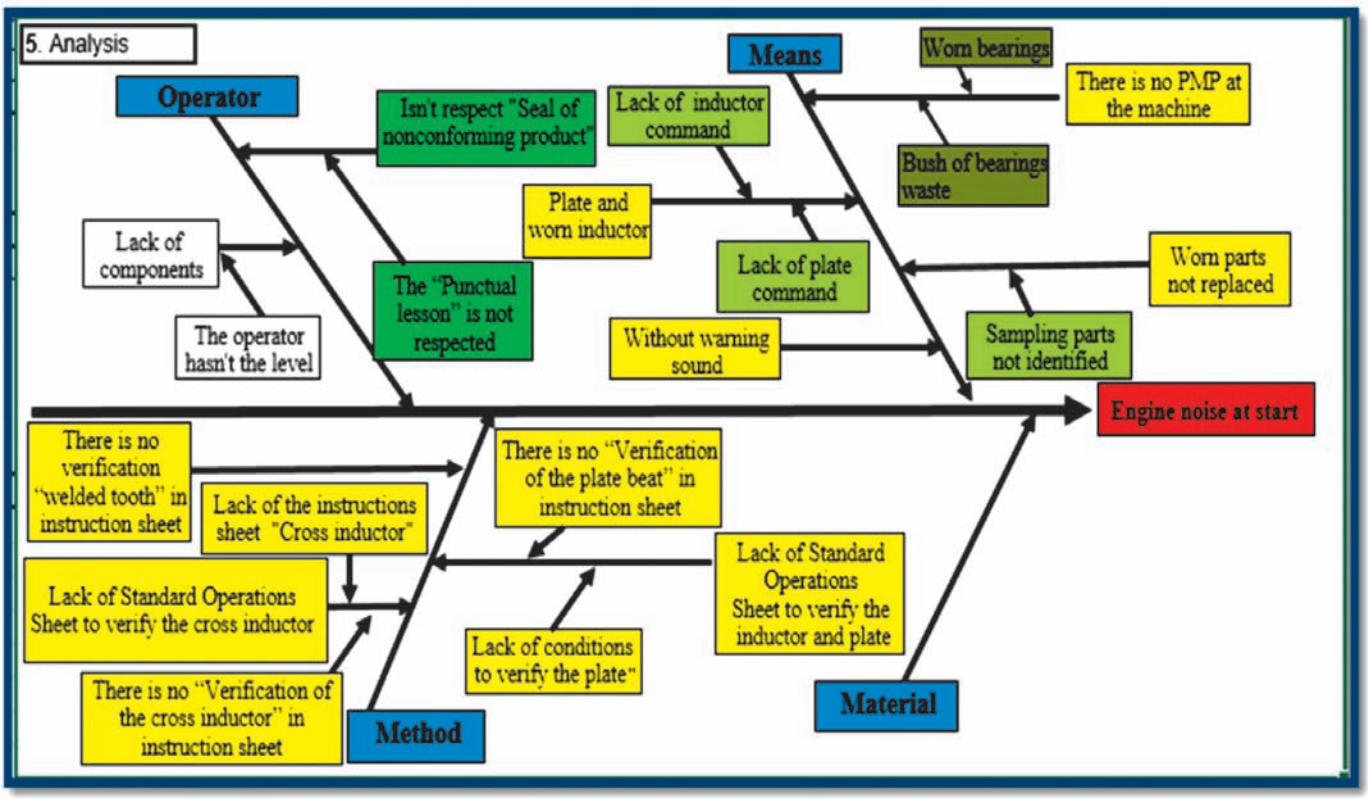


Figure 4 – *Ishikawa diagram for „engine noise at start" failure*

Step 6. Applying the corrective actions. The immediate actions are:

1. Selecting the parts: 1945 engines / 2200 flywheels / –0 575 crowns nonconformities;
2. Replacement of plate bearings and knurl housing to reduce plate the beat.

The responsible of corrective action are presented in Table 3.

Step 7. Confirming the effects. In order to achieve this step, the current situation is compared with the initial conditions, using graphs (Figure 5):

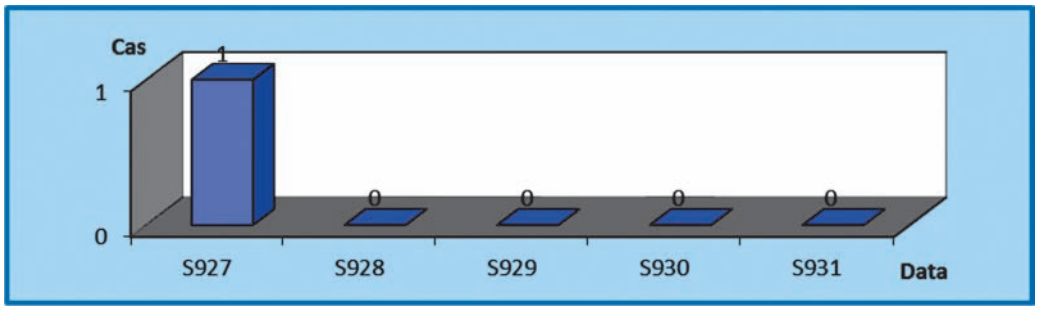


Figure 5 – *The number of cases occurred in workstation*

Step 8. Standardization. To avoid other similar cases, the following standardizing actions were established:

- Achieving Standard Operations Sheet: Verifying plate beat / Verifying cross inductor;
- Instruction sheet introduction: Verifying plate beat / Verifying cross inductor;
- Update MQA – Quality Assurance Matrix;
- Standard Operations Sheet Update.

Table 3 – *Corrective actions*

Cause	Action	Efficiency				P	Resp.	Term	
		Q	C	D	T			Planned	Realised
„Non-conforming product circuit" is not respected	Training operators „Circuit of non-conforming product"	6	3	3	54	1	Resp.1	S27	100%
„Punctual lesson" is not respected	Retraining operators „Punctual lesson"	6	9	6	324	2	Resp.2	S27	100%
Plate and worn inductor – No spare parts	Command plate and inductor	6	9	6	324	3	Resp.3	S27	100%
There are no instruction-conditions to verify the plate beat	Establishing the conditions to verify plate beat	6	3	6	108	4	Resp.4	S29	100%
There is no Standard Operations Sheet to verify the plate beat	Achieving Standard Operations Sheet „Verification plate beat"	6	3	3	54	5	Resp.5	S29	100%
There is no „Verification of the plate beat"	Introduction in instruction sheet „Verification plate beat"	3	3	3	27	6	Resp.6	S29	100%
There is no planning at the machine	Achieving planning	3	3	3	27	7	Resp.7	S30	100%
There is no Standard Operations Sheet to verify the cross inductor	Achieving Standard Operations Sheet „Verification cross inductor"	6	3	3	54	8	Resp.8	S29	100%
There is no „Verification of the cross inductor" in instruction sheet	„Introduction in instruction sheet" – „Verification cross inductor"	3	3	3	27	9	Resp.9	S29	100%
Spare parts worn unidentified gear plate	Equipment intervention to identify wear parts	3	6	6	108	10	Resp.10	S29	100%
	Identifying / sampling spare parts	3	3	3	27	11	Resp.11	S29	100%
	Replacing worn spare parts	3	3	6	54	12	Resp.12	S31	100%
There is no instruction – verifying cross inductor	Achieving reinstruction „Verification cross inductor" (with hold)	9	3	6	162	13	Resp.13	S29	100%
Not mentioned in the checklist „Verifying welded teeth"	Introduction in instruction sheet „100% verification teeth aspect"	6	3	6	108	14	Resp.14	S29	100%

Step 9. Synthesizing and planning future actions. As a preventive measure, it was established to create a warning system when touching the inductor part.

Conclusions

By applying the QC Story method, there have been identified a number of non-conformities that could generate complaints concerning the engine noise at the start,

there was established a preventive action to avoid the future emergence of similar cases and there have been standardized corrective actions (documentation) to avoid further failures.

Of all the aspects of QC story, the fundamental principles remain the following: QC Story is a way of thinking problems, not a method or means, QC Story can be used for different types of activities where a problem has to be solved or something has to be improved, and QC story must be practiced again and again to prove its efficiency.

REFERENCES

1. Banduka N., Veža, I., Bilić B. (2016) An integrated lean approach to Process Failure Mode and Effect Analysis (PFMEA): A case study from the automotive industry. *Advances in Production Engineering & Management.* 11(4). pp. 355-365.

2. Bidault, F. (2001) *QC story – Trainee Manual.* Version 1.1.

3. Hsu, S.-Y. (2014) A New Problem-Solving Procedure Based on TRIZ Methodology and QC Story. In: Qi E., Su Q., Shen J., Wu F., Dou R. (eds). *Proceedings: The 5th International Asia Conference on Industrial Engineering and Management Innovation (IEMI2014).* 1. Paris. pp. 289-293.

4. IATF (2016) IATF 16949 – *Automotive Quality Management Systems Standard – Quality management systems requirements for automotive production and relevant service parts organizations.*

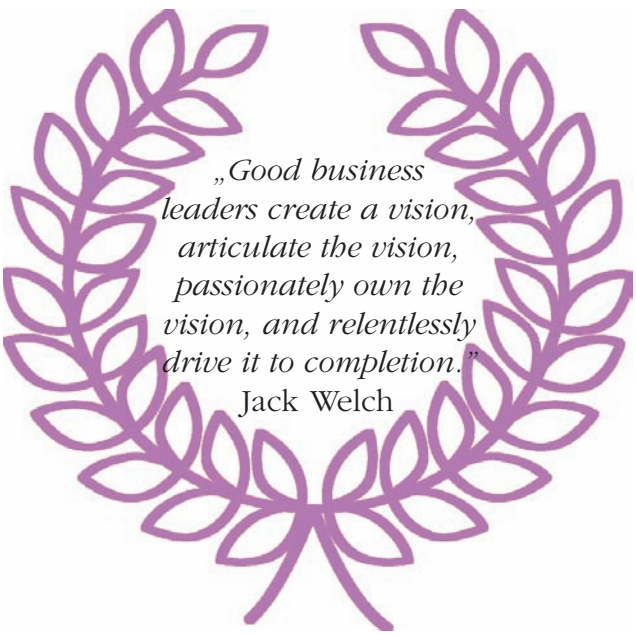
5. Misztal, S. & Bachorz I. (2014) Quality planning of parts machine production based on the housing of cylinder head milling machines. *Applied Mechanics and Materials.* 657. pp. 986-990.

6. Myszewski, J. M. (2013) On improvement story by 5 Whys. *The TQM Journal.* 25(4). pp. 371 -383.

7. Sha, D.Y., Hsu S.-Y., Chen, H.-Y. (2016) Creative Problem-Solving QC Story Based on Systematic Innovation TRIZ. *Journal of Quality.* 23(1). pp. 25-42.

8. Sugiura, Z., Shantian, J. (2003) *QC Story Utilization Method.* Taipei: Corporate Synergy Development Center Press.

9. Yang, P.J. (2004) *The Practical Manual on Enhancing the Problem Solving on Shop Floor: Problem-Solving QC-Story.* Taipei: Corporate Synergy Development Center Press.



Ways to Improve the Performance of the Company

Dana Beļakova, Inese Ziemele
Technical University Riga, Latvia

Abstract

The research objective was to show practical application of traditional work and time study methods to improve company's productivity. The paper describes a pilot project that was implemented at a furniture manufacturing company finding the causes of the problems and showing the ways of solving them.

Keywords: work measurement, methods and time study, human factor

Introduction

The study carried out in collaboration with DA Kompetentie Specialisti Ltd in the framework of the project financed by ESF „Practical application of labor relations and work normative safety acts in sectors and enterprises" implemented by the Employers' Confederation of Latvia (LDDK). During the project implementation, the work measurement adoption methodology was elaborated that can be used in any sector. In the framework of the project, two pilot projects have been implemented. The article is intended for practitioners and managers who are trying to find ways to improve the performance of their company.

The article reflects the original research carried out in the furniture manufacturing company to identify and prevent production loss, thereby saving time and costs. The research result shows that the company can reduce production loss, can increase the productivity and profitability by eliminating non-production activities.

Experimental and Methods Used

During research, the production area layout and location of equipment were analyzed drawing production area and

„Organization charts and fancy titles count for next to nothing."
Colin Powell

* Correspondence to Dana Beļakova: Dana.Belakova@rtu.lv

material flow in it (Kanawaty, 1992). Labour working methods were studied – workstations arrangement and sequence of labor movements during the working process (Freivalds, Niebel 2013), (Lawrence, 2000). The Gantt diagrams of process sequence and time were prepared; working time was measured using time study. Working sequence and time data were collected using video recorder.

Analysis of Production Area Layout and Location of Equipment. The research was done in a furniture production company's materials preparation area. Analysing material flow it was found out that it was sequential and moving lengthwise, work items were not moved back to previous workstations. However, semi-finished stocks between workstations sometimes blocked the transportation routes. In addition, raw material transport palettes were difficult to install, greatly complicating the work. Palettes are two separate, unconnected wooden frames that are unstable and may fall down without semi-finished products placed in. Every time, when executor starts new palette, frames must be connected promoting direct working time loss. It was suggested to use stable frames, which have to be only placed in the workstation.

Study of Executors Working Methods. Analysing the labor work at workstation specific work process study is applicable. There was analysed labor work sequence, workstation layout and executors movements in it. As a result, schema (figure 1) was drawn in order to determine whether workstation arranged rationally and labor movement take place without interference (no time loss). Moreover, such analysis allows understanding of working processes. Then a work sequence diagram was drawn up (table 1). Working period

– from the moment when the labor begins new palette development until the palette has been developed and transported – was selected to analyze the process. In addition, two different executors work, whose working methods and intensity are different, were analyzed. To facilitate the study process video recording of three shifts were performed.

Workstation layout and executors movements in it. Figure 1 shows the workstation where the executor is serving furniture parts preparation equipment (sawing of furniture parts). The furniture parts are moved to the workstation by vehicles (movable only by human muscle power) and are placed where the palette-1 must stay. Executor takes (1) furniture parts from palette-1 and performing the control of furniture parts (2), delivers them to the equipment, performs sawing and sorts processed parts (3). Follow sorted parts delivering to palette-2 according to the quality category, in or on the palette (for later delivering to another place). Parts that are placed on the palette-2 further deliver to the palette-3, which is placed on the other side of transportation path (6). The last operation is

carried out only in certain cases when the parts do not comply with the required category. Returns and continues to work.

The figure shows that the work in a sawing workstation passes sequentially. However, time loss occurs when executor must leave the working place to deliver furniture parts that do not meet the desired quality category. While the company has not developed a better system of those parts transportation from working place, these time loss must be considered as organisationally-technical and included in the operation time as unavoidable. In addition to the already listed, time loses of working place supplying with palettes and delivering of processed parts to the semi-finished storage site, that is the responsibility of executor in this company, must be mentioned.

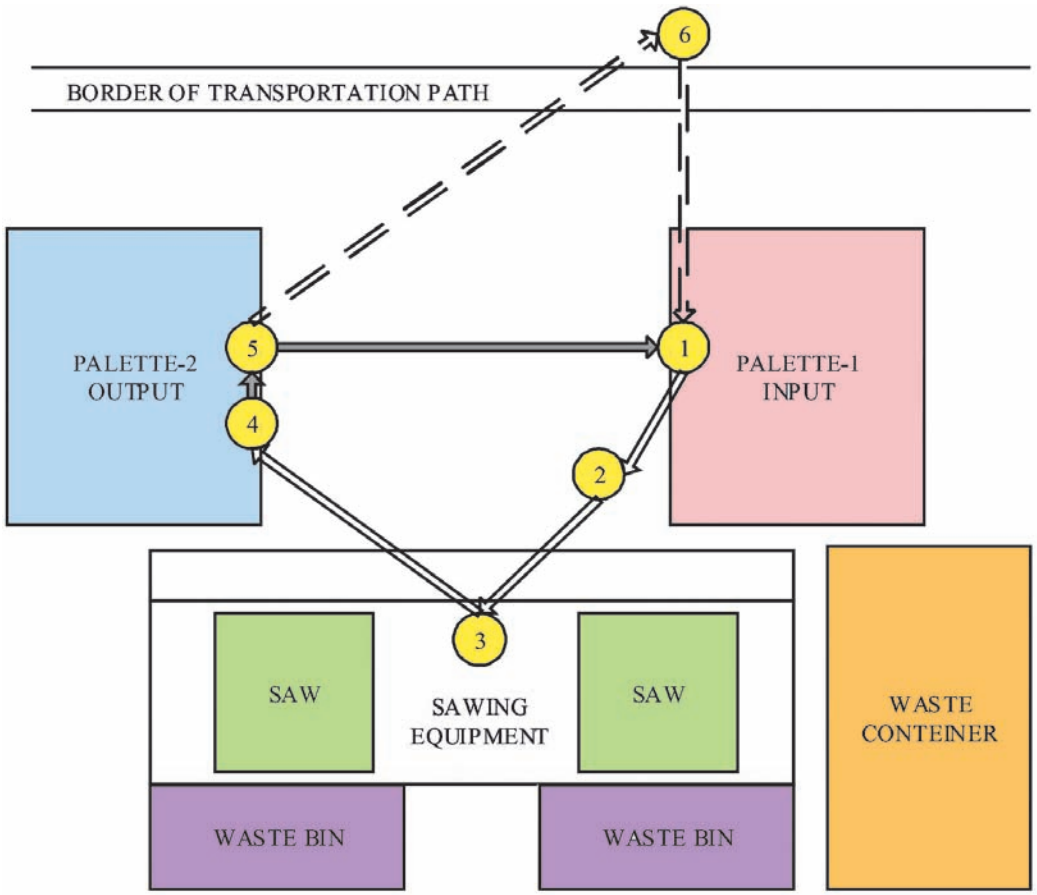
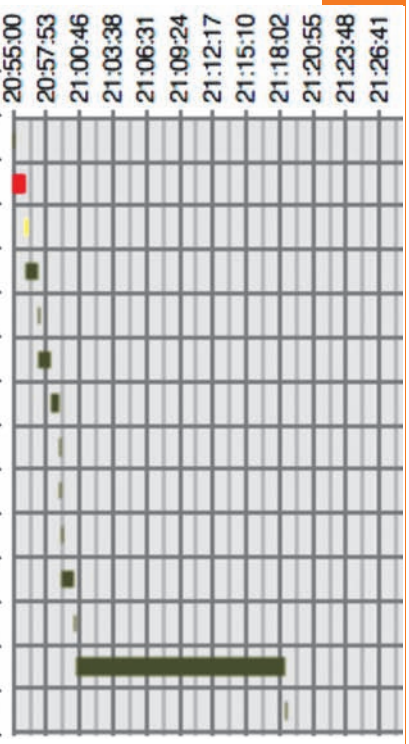


Figure 1 – *Workstation scheme and working sequence in it*

Diagrams of working process sequence and time. Diagrams of working process sequence and time allow evaluating of working, transportation, control and idle proportion to the total performance time. Applying each of process development components to the total length of time it is possible to find out the exact expedient (or inexpedient) working time expenditure assessment. To display diagram of time Gantt chart was used. In a Gantt chart, it is easy to read the length of each type of activity and its correlation to the whole process. Excerpt of the Gantt chart (table 1) shows what part of the process takes executors-1 leaving workstation.

Table 1 – *Executors-1 Gantt chart of working process (except)*

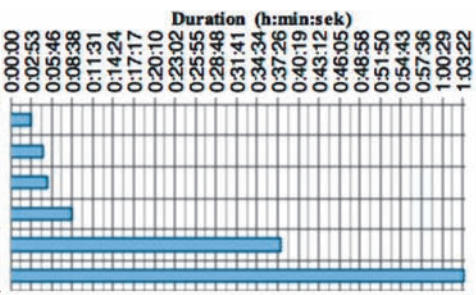
No	Activity	Beginning	Lenght (min)	End
1	Puts on glasees	20:55:00	0:00:01	20:55:01
2	Unbinds palette	20:55:01	0:01:01	20:56:02
3	Takes away band	20:56:02	0:00:05	20:56:07
4	Takes away lifting mechanism	20:56:08	0:01:00	20:57:08
5	Goes	20:57:08	0:00:01	20:57:09
6	Takes away empty palette	20:57:09	0:01:01	20:58:10
7	Goes	20:58:10	0:00:47	20:58:57
8	Switches on equipment	20:58:57	0:00:01	20:58:58
9	Stays	20:58:58	0:00:09	20:59:07
10	Cleans equipment	20:59:07	0:00:03	20:59:10
11	Sorts wooden parts	20:59:10	0:01:08	21:00:18
12	Takes away wooden parts	21:00:18	0:00:11	21:00:29
13	Goes away	21:00:29	0:17:57	21:18:26
14	Puts on glasees	21:18:26	0:00:09	21:18:35



Executors-1 working time sequence diagrams summary (table 2) demonstrates the executors work components and their proportion to one palette processing time.

Table 2 – *Executor's-1 components of working performance*

No	Activity	Duration	Actually %	Regulated %
1	Idle (contacts with colleagues)	02:52	2,33	
2	Workstation service	04:39	3,79	
3	Transportation - moving of parts around the workstation, 3-11 steps	05:11	4,22	
4	Work preparation and finalization	08:36	7,00	
5	Physiological needs and regulated breaks	37:54	30,85	12,50
6	Sawing operation (including sorting of quality categories)	1:03:38	51,81	
	Total:	2:02:50	100,00	



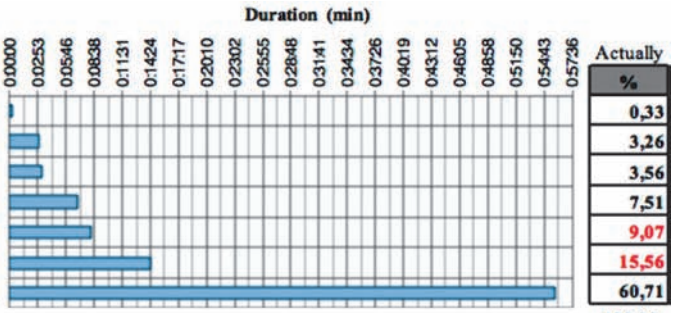
In the company's regulation, a time for the physiological needs and a regulated break is defined as 12,5% of the shift time. Executor-1 for this purpose used 30,35%. In addition, conversation with colleagues made idle standing 2,33% of one palette processing time. Workstation service time and time for work preparation and finalization take 3.79% and 7% of one palette processing time. It can be seen that the execution time takes only 51,81% of one palette processing time, or one palette processing time efficiency is only 0,52. Such a low efficiency is considerable to time loss that occurred mainly from the executor's fault – repeatedly discusses with the other executors and leaves the workstation outside regulated breaks.

There is also time loss related to the execution and organization of work – sorting of processed parts to several quality categories and transportation accordingly to quality categories; while executor works the palette becomes emptier, that makes executor bend and arise when reach and put furniture parts. This particular situation extends execution time by 6,8%. In this situation, it is recommended to place the palette on equipment that depending on the weight moves palette up or down. Consequently, the light/almost empty palette would be located in convenient height allowing the executor to do work in convenient position.

In the same way, the analysis of executors-2 working process was done (table 3). Analysing the other executor's work it was found that workstation service time and time for work preparation and finalization takes 0,33 and 3,56% of one palette processing time. Executor-2 part of the working time (26,3%) uses for conversation also and the operation time takes up to 60,71% of one palette processing time.

Table 3 – *Executor's-2 components of working performance*

No	Activity	Duration (min.)	Actually %
1	Workstation service	00:18	0,33
2	Idle (contacts with colleagues)	03:00	3,26
3	Work preparation and finalization	03:17	3,56
4	Transportation-moving parts around workstation (3-19 steps)	06:55	7,51
5	Transportation - (delivering parts) delivering out of workplace	08:21	9,07
6	Phisiological needs and regulated breaks	14:20	15,56
7	Sawing operation (including sorting of quality categories)	55:55	60,71
	Kopā:	1:32:06	100,00



Both executors for the regulated breaks and physiological needs use more time as it is defined in the company's regulation, spending in breaks 30,85% – executor-1 and 15,56% executor-2. In addition, both executors lose 2,3 to 3,3% of one palette processing time negotiating to colleagues. Executor-2 a lot of working time (16,58%) spends for carrying or transporting furniture parts, in addition 9,07% from one palette processing time devoted to carrying parts out of the workshop. Executor-1, 7% of working time uses for work preparation and finalization.

Time Standard Estimation of Sawing Operation. Executor's performance analysis showed that one of the executors works unduly slow – a lot of time losses, so for the time standard determination executors-2 working time analysis is used. Structure of sawing operation:

1. pick up parts from the palette to saw;
2. delivering parts to sawing equipment while controlling;
3. saw up and sort by quality category;
4. place sawed and sorted parts in or on a palette, according to the quality category;
5. return to the first position.

Time economy of one palette processing is presented in table 4.

Table 4 – *Executors-2 working time expenditure and possible time economy*

Position	Time (h, min, sec)
Observed one palette processing time	1:32:06
Working time loss due to discipline	0:05:49
One palette processing time without time loss due to discipline	1:26:17
Carrying furniture parts out of workshop during one palette processing time	0:08:21
One palette *theoretical* processing time if work organization and parts transportation is improved	1:17:56
Total *theoretical* time expenditure economy of one palette processing	0:14:10

Time study of sawing operation and time standard estimation. Using video record, working process time study was done and working time estimated (20 cycles) to be used in time standards estimation (table 5).

Table 5 – *Time study of sawing operation*

Operative time parts	Description	Time (h, min, sec)	
		Time of palette processing	One cycle
Basic working time	In that case, the machine-manual time – work executed by sawing equipment and wooden parts during operation run by a man – in a given situation takes a tiny part of the total execution time	0:01:08	0:00:03
	Sawing operation basic working time in a particular case includes sorting of wooden parts by quality category, which occupies a large part of execution time	0:41:28	0:02:04
Auxiliary time	Executor's hands and other body movements, which carried out immediately before and after sawing to deliver wooden parts from the palette to the sawing equipment, from the workstation, to arrange wooden parts in palettes.	0:20:43	0:01:02
Quality control time	Quality control of sawed wooden parts. In this case partly covered with parts transportation (auxiliary time) from the sawing equipment to sawed wooden parts palette.	0:08:06	0:00:24
	Total operative time	**1:11:25**	**0:03:34**

Wooden parts pallets transportation activity in the workshop and outside cannot be included in the sawing operation. That must be done by a person who controls the process providing executor possibility to do only a sawing operation (table 6).

Standard time is obtained by adding time allowances to the operative time (table 7).

1. Developed time standard *applies only to* the processing of certain pallets amount that contains fixed length, breadth and weight wooden parts;
2. Time standard must be modified according to the number of execution cycles included in the bigger or smaller palette;

3. If the wooden parts size and weight is changed, time standard must be calculated repeatedly.

Table 6 – *Allowances for sawing operation time standard*

Allowances	Description	Calculation	
Workstation service time and time for work preparation and finalization	Workstation service time and time for work preparation and finalization in particular case determined by the video records of all cases during the shift (in terms of time) and calculated by the formula:	where $a_{sp.apk.} = \frac{T_{fh} * 100}{T_m - (T_{fh} + T_{atf})}$ T_{fh} – workstation service time and time for work preparation and finalization during shift time; T_m – shift length; T_{atf} – time for brakes and physiological needs, depends on the discretion of the company and job safety	
	Workstation service time and time for work preparation and finalization in a company	$a_{sp.apk.} = \frac{36.25 * 100}{720 - (36.5 + 90)} = 6.1\%$	
Regulated breaks, time for relaxation and physiological needs		Stated in a company	12,5%

Table 7 – *Time standard estimation* (*10,08pcs of palettes in shift)

Time standard components	Time (h, min, sec)	
	For one operation	For one palette*
Operative time	0:03:34	1:11:25
Workstation service time and time for work preparation and finalization	0:00:13	0:04:21
Regulated breaks	0:00:27	0:08:56
TIME STANDARD	**0:04:14**	**1:24:42**

Experiment Results

Analysing executor's work it was estimated (table 8).

Time study was done using video recorder and time standard executed (table 9).

Knowing the working time loses due to reasons dependent and independent of executors, actual and standard time for physiological needs, relaxation and regulated breaks and the actual operating time, it was calculated the potential (theoretical) increase in productivity by the formula:

$$\Delta P = \frac{T_{stn} + T_{pd} + (T^f_{atf} - T^n_{atf})}{T^f_{op}} 100 \quad (1)$$

Where: T^f_{atf} and T^n_{atf} actual and standard time for physiological needs, relaxation

T_{pd} unregulated breaks due to reasons dependant of executors

T_{stn} unregulated breaks due to reasons independent of executors

T^f_{op} actual operating time

Table 8 – *Results of working time analysis*

Position	Executor-1	Executor-2
	%	
One palette development time loss due to discipline	20,18	6,32
Operation time of one palette development time	51,81	60,71
Transportation of pieces, including transportation outside the shop	4,22	16,58
Working time efficiency rate	0,52	0,61
	h. min. sec.	
Theoretical time expenditure economy of one palette development	0:25:24	0:14:10
Theoretical time expenditure economy in one shift (8 hours)	3:31:80	1:58:20

Table 9 – *Time standard estimation*

Parts of time standard	h. min. sec.	
Operating time	palette	1:11:25
	cycle	0:03:34
	%	
Time for physiological needs and regulated breaks	shift	12,5
Workstation service time and time for work preparation and finalization	shift	6,1
	h. min. sec.	
TIME STANDARD	cycle	0:04:14
	palette	1:24:42
	pieces	
Palettes	shift	10.08

Table 10 – *Potential (theoretical) increase in productivity*

Increase of productivity, avoiding time loss	Executor-1	Executor-2
if the sawed parts being taken out of the shop *is a time loss*	x	30,14%
if the sawed parts being taken out of the workshop *isn't time loss*	42,68%	16,25%

Conclusions

By introducing the new time standard, it is important to work with executors:

1. To agree with the executor on the working method change. Mostly executors resist changes, so the person who carries out the negotiations, have to find a special approach, bearing in mind that the production cannot exist without executor;
2. It must be explained to executor, why the changes are made and what are the executor's benefits (performing more work receives more pay; reaching time standard receives bonuses, etc.);

3. Training of executors must be performed to use certain movements and techniques. It does not always succeed immediately, but experience shows that the insistence of training always crowned with success;
4. Appropriate working conditions have to provide.

REFERENCES

1. Freivalds, A. & Niebel, B. (2013), *Niebel's Methods, Standards, & Work Design*, Edition 13th, McGraw-Hill Education.
2. Gantt Chart Software. Available from: http://www.smartsheet.com/gantt-chart-software. [Accessed 14th Jan 2014].
3. Kanawaty, G. (1992) *Introduction to working study*. International Labour Office, p. 524.
4. Lawrence, S. (2000) *Work measurement and methods improvement*. John Wiley & Sons, Inc., p. 452.

„What's measured improves."
Peter F. Drucker

Predictive Decisions Based on Mimetic Models

Mihai-Vladimir Pascadi (1), Cezar Scarlat (2), Cristian Niculescu (2)

(1) Avantera Bucharest Romania, (2) University POLITEHNICA of Bucharest, Romania

Abstract

„Management of tomorrow" will be characterized by higher quality decisions; then new models, methods and instruments should be continuously developed, under the signs of higher complexity; big and extremely dynamic data; information and communication technology support. On the background of a proposed decision typology – and in concert with several studies on time series analysis and their applications – this paper presents the results of a recent doctoral research work on mimetic modeling of industry sub-systems. The aim of the paper is to solve the problem of predictability in nonlinear dynamic systems by a new approach (mimetic modelling). Two practical case examples are presented. The results are important for both theorists (as academia, researchers' community) and practitioners (business people as well as strategists and decision makers at all levels – micro- and macro- levels alike). Equally conceptual and applicative, based on strong mathematics and IT-supported, the paper offers a novel managerial instrument – of high quality potential impact on the decision making process.

Keywords: nonlinear dynamic systems, mimetic models, prediction, predictive decisions, long-term versus short-term decisions, macro- versus micro- level decisions

Introduction

The current decision making processes, under such enduring time pressure – never met before, are characterized by visible trends as:

- Decision making models of higher complexity;
- Big data available to be processed;

* Correspondence to Mihai Vladimir Pascadi: mihai.pascadi@avantera.ro

- Higher rate of variability;
- A significant number of influencing factors (many unknown) – sources of risk or uncertainty.

Fortunately, the associated explosive development of computing and communication infrastructure capacity addresses and properly serves most of them. Yet – in spite of these positives – rarely the necessary information is certain and/or complete (while resources, in general, are scarcer and scarcer). Paradoxically, more capable we are, less happy are with the results we get...

In order to make quality decisions, new models, methods and instruments are continuously developed, on the same coordinates: higher complexity, big and extremely dynamic data, information and communication technology (ICT) support. To better understand the authors' standpoint and approach, a certain decision typology is proposed upfront.

There is a multitude of criteria to categorize the various types of decisions. And it is a commonplace to agree that minor decision objectives are associated with minor impact areas as well as short time horizons (short-term decisions, usually less than one year but exceptions are possible). And *vice versa* in case of ambitious, major objectives and longer time horizons (longer than five years and even more).

Trying to go deeper, extending the association of short-term decisions with micro-economic level and long-term-decision with macro-economic level is not only debatable, but also risky. This is why the authors propose a bi-dimensional matrix investigation model: (i) the decision making level, on one hand, and (ii) the previously complex dimension – size of the objective – time horizon – impact area (as depicted in *Table 1*).

Table 1 – *Decision types – a suggestion*

Decisions		*Related to the complex dimension of: size of decision objective, time horizon and impact area:*	
		relatively minor objective, short-term and minor area	major, ambitious objectives, long-term & large area
Decision level:	macro-level	**NW** *Decisions with mixed objectives, time horizon, and impact area*	**NE** Country (national) strategic decisions
	micro-level	**SW** Organization's current decisions	**SE** Organization's strategic decisions

To remark that finer, intermediary levels of analysis are realistic and possible.

As mentioned, the associations from SW and NE corners – respectively {decisions at the microeconomic level & relatively minor objectives} and {decisions at macroeconomic level & major objectives} are intuitive associations – as many examples demonstrate. To highlight just a couple of sound examples: the economic development of Singapore (Zhou, 2017: from $320 to $60,000 GDP/capita over a few decades) and the reform of the Finnish education system, which started in 70's, today one of the best worldwide (Välijärvi, 2012).
(To note that there are negative examples as well: just remember the multi-annual plans of the centrally planned economies of the former communist countries).

At the extreme NE, the *foresight* exercises are suitable: clear movement to longer term scenarios, the *strategic foresight* is equally a new area of activity for policy-makers as well as study area for researchers – as existence of several prestigious journals demonstrate: *Foresight – The journal of future studies, strategic thinking and policy* [since 1999]; *Foresight: The International Journal of Applied Forecasting* [since 2005].

The strategic decisions (Porter, 1980; Mintzberg *et al.*, 1998) made at the organization level (SE corner) show that „intuitive associations" are not the only possibilities.

The NW corner remains an interesting area to be explored – as many macro-level decisions aim at long-term effects but have also immediate, local impact (let's agree to call them *decisions with mixed objectives, time horizon, and impact area*). For example, the *decisions related to the exchange rate* are made at the macro-level, and the effects of the decisions made are to be seen in time; however, some effects might be of short-run (Scarlat, 2011).

Kantz & Schreiber have published their book on *Nonlinear time series analysis* two decades ago (1997). The large spectrum of effects of the decisions made related to the extremely variable currency exchange rate explain the interest of researchers in this respect, abroad (Schwartz & Yousefi, 2003; Chatterjee & Chakrabarti, 2006) and Romania as well (Cristescu *et al.*, 2009). Scarlat (2011), Cristescu *et al.* (2011) conducted studies aiming at identifying markers of economic turbulences and downturns (recessions and crises). As early as a decade ago, the process of macro-economic transition was studied by Scarlat & Scarlat (2007), Scarlat *et al.* (2007), by analysing time series. The particular aspect of management decentralization was also investigated by Scarlat & Scarlat (2010).

If the macro-level studies are rather numerous, the micro-level impact of the macro-level decisions related to the exchange rate is less investigated – in spite of the accepted importance of currency exchange rate prediction. This paper tries to contribute at covering this gap and *the mimetic modeling is an attempt to address this issue.*

Mimetic modeling: support for predictive decisions

One of the characteristics of complex, high-volume of data-based systems is the difficulty to develop a theoretic model. In such a complex system, relationships between systems' and external parameters may be quite difficult to figure out and shape into a set of formulas. An alternate approach may be to build a model based on the following assumptions (and data):

A1. The system to be modeled may be described as a nonlinear dynamic system.

A1. The system is or may be described (even if discrete) by continuous relationships.

A3. The observed parameters describe the system in a „sufficient" manner in order to be able to build a model that „imitates" the real system, based exclusively on the observed behavior (the vector of parameters in time – which is its trajectory).

In a nutshell, a black-box system is studied, and the system's behavior (trajectory) is observed via a set of parameters. A „mimetic" model is built based on the time-series of those parameters and it is expected that mimetic system to behave in a similar way (display approximatively the same time-series of parameters = trajectory, under the same initial conditions). Such mimetic model (the iterative version) has been proposed in Pascadi (2015). An improved „one-step" model has been presented in Pascadi (2017a) and Pascadi (2017b).

The following results have to be mentioned:

R1. The proposed model is indeed mimetic: the approximating trajectory is close (with a fair approximation error) to the real system's one.

R2. Reasonable predictions may be made regarding the observed to-be-modelled system, providing this way an instrument for predictive decisions.

The case of a company of the pharmaceutical industry

This example refers to a study conducted in a company active in the Romanian pharmaceutical industry, during spring 2017. The observed to-be-modelled system was the production process.

The parameters specific to pharmaceutical industry – pressure (P), temperature (T) and humidity (U) – highlighted a frequently to be expected situation. The system's trajectory was passing several times through exactly the same point (measured at 2-decimal-digits precision) displaying

yet a different „speed" vector. We may suppose that either:

a. the low measuring precision made the observer unable to distinguish between two actually different (even if close) points through which the system passed or

b. *the cause of the differentiated behavior was, in fact, an additional, unobserved parameter* i.e. a hidden(?) or an ignored(?) parameter.

Possibility **(a)** can be confidently rejected as all the three parameters were in fact controlled through automated control loops. Thus it is highly unlikely that small differences in the systems' position could generate significantly different trajectories (such as the ones in pseudo-chaotic systems) as long as the automation loops' purpose is to ensure stability regions around certain target values of the parameters.

Possibility **(b)** would actually suppose that the parameter space (PTU) should be extended with at least a fourth parameter, its value being different for each passage in order to justify a different behavior each time. Thus, when considering the equation describing the system:

$$\dot{x} = F(x)$$

it should switch from R^3

$$(\dot{P}, \dot{T}, \dot{U}) = F(P, T, U)$$

to (at least) R^4:

$$(\dot{P}, \dot{T}, \dot{U}, \dot{H}) = F(P, T, U, H)$$

where H symbolises the „hidden" parameter.

The method (Pascadi, 2017a) is „naturally" protected against data that describe trajectories that pass twice or more through the same point (the algorithm supposes the inversion of a matrix in which at least two rows would be equal term by term in such a case). The solution to still being able to build a mimetic model would be to insert in the model a „substitution" parameter S (to replace the real-life H parameter which is supposed to be unknown):

$$(\dot{P}, \dot{T}, \dot{U}, \dot{S}) = F(P, T, U, S)$$

The problem related to properly choosing S is to be further investigated and promises to hide some intellectual treasures; however, the minimal condition to get a functional mimetic model (from the algorithm's standpoint) is to make sure that the trajectory never passes twice through the same point in R^4. Figure 1 shows how, based on the above explained technique, the mimetic system is capable to work properly even if a hidden parameter is replaced through a substitution one. The trajectory shown in the figure is built by a one-month data set. The table on the left shows how small errors appear after a number of trajectory integration steps. *Legend*: brown: real system; blue (hidden behind the real system's trajectory): mimetic model's trajectory.

As initial conclusion, *the use of mimetic model shows that ignoring parameters, in our effort to control a given system, may result in: loss of control* or *ineffectiveness* or *inefficiency of the system.*

As far as existence of real parameters causing the differentiated behaviour of the industrial system, discussions with the system engineers in the pharmaceutical plant lead to the following possibilities: **(i)** pressure and humidity in the closed production rooms may vary once an access gate is being opened for material inputs or outputs; **(ii)** temperature of the closed production rooms may vary once input materials have a different temperature than the standard one. The expected effect was the higher consumption of energy in stabilizing the target values of PTU which is an inefficiency of the system. Different solutions are at hand in order to eliminate such inefficiencies.

	Real System		Mimetic System	
	P	U	P	U
	1	3	Modeled	Modeled
1	45.2	21.8	45.2	21.8
2	45.3	21.8	45.3	21.8
3	45.3	21.7	45.3	21.7
4	45.3	21.8	45.3	21.8
5	45.4	21.7	45.4	21.7
6	45.4	21.8	45.4	21.8
7	45.3	21.8	45.3	21.8
8	45.3	21.7	45.3	21.7
9	45.3	21.7	45.3	21.7
10	45.2	21.7	45.2	21.7
11	45.3	21.7	45.3	21.7
12	45.2	21.7	45.2	21.7
13	45.2	21.7	45.2	21.7
14	45.2	21.7	45.2	21.7
15	45.2	21.7	45.2	21.7
16	45.2	21.7	45.2	21.7
17	45.2	21.7	45.2	21.7
18	45.2	21.7	45.2	21.7
19	45.2	21.7	45.2	21.7
20	45.1	21.7	45.1	21.7
21	45.1	21.7	45.1	21.7
22	45.1	21.7	45.1	21.7
23	45.2	21.7	45.2	21.7
24	45.1	21.7	45.1	21.7
25	45.2	21.7	45.2000001	21.7
26	45.1	21.6	45.1000007	21.5999994
27	45.2	21.6	45.2000023	21.5999994
28	45.1	21.7	45.1000016	21.7000056
29	45.1	21.6	45.10003	21.599997

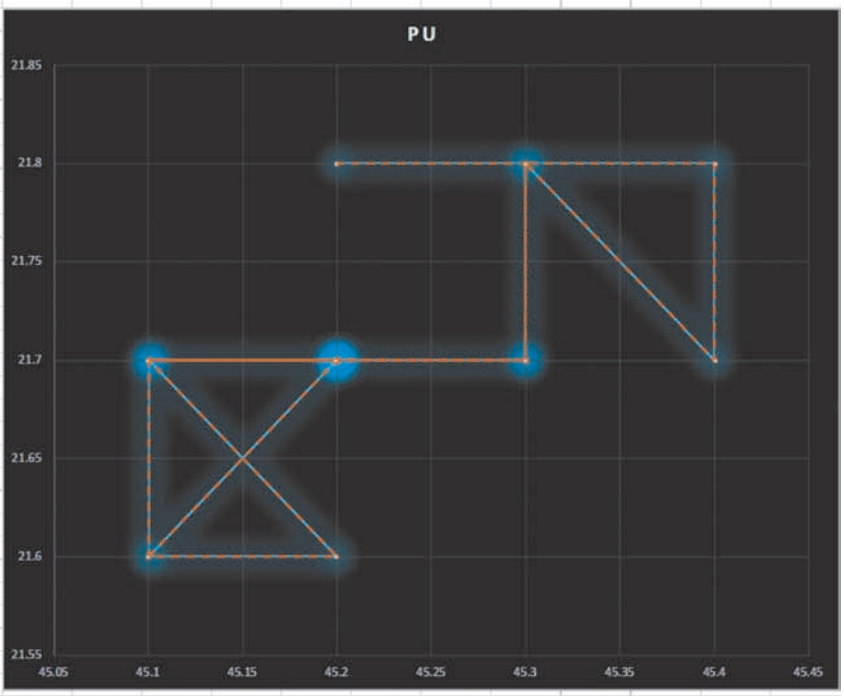


Figure 1 – *A one-month trajectory projection in the (PU) sub-space*

Case of transaction days

In this case, related to the exchange rate dynamics, the data (official exchange rate for 30 currencies) were available by the official site of the National Bank of Romania (www.bnr.ro). A history of 1500 transaction days (over a five years period) was analysed.

The trajectory of this system provides insufficient data in order to be able to precisely predict evolution through mimetic modeling; it is obvious that this system's dynamics depends on other factors besides the actual exchange rates. Among the known causes of the exchange rate (sometimes sudden) changes we may list: political decisions that generate uncertainty (sudden) changes in raw material prices (such as oil, natural gas, etc.), stock exchange evolutions, natural disasters

(likely to impact the local economy), military conflicts, etc.

The analysis showed that exchange rate predictions are possible to some extent even if only based on the time series of the 30 exchange rates. Moreover, the mimetic behavior of the system was fully preserved as for initial conditions belonging to the real trajectory, the mimetic model behaves exactly as the real system *for all the points included in the mimetic system's „experience"* as exemplified in Figure 2. The brown color indicates the real exchange rate, the blue – a mimetic system. The two trajectories actually coincide.

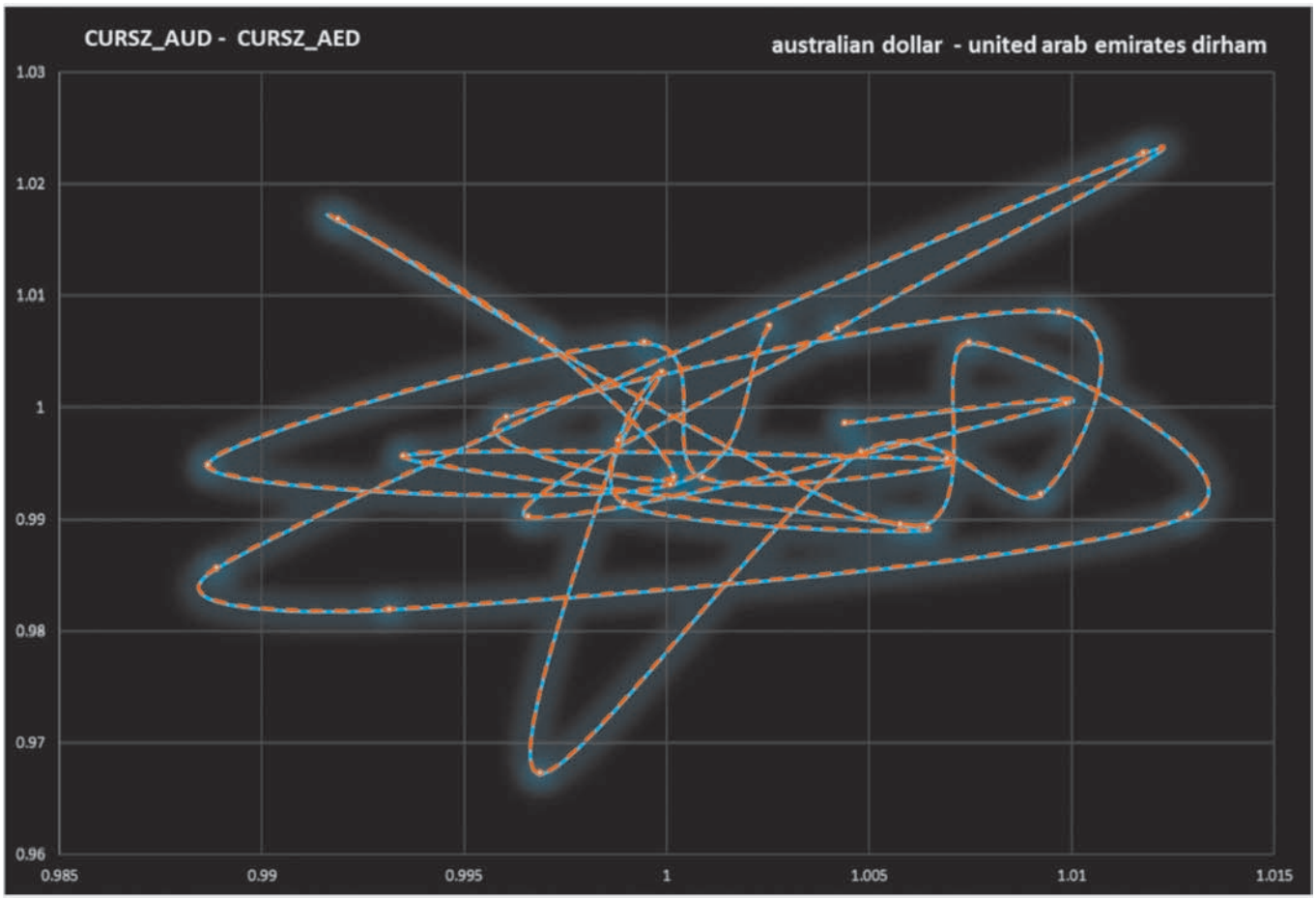


Figure 2 – *Australian dollar against UAE dirham*

Figure 3 displays the distribution of the „next day" prediction error (for points that were not included in the mimetic system's experience). The overall average error 1.33%; excluding errors over 3%, the average becomes 0.89%. Even if this looks like a reasonably low average error, in order to predict the exchange rate, it still is too high.

In fact, the relevant criterion is the error regarding the increase/decrease prediction. From this perspective, the analysis showed that across 30 currencies, a sub-set of 5 currencies were reasonably predictable (between 55% and 60%), for the entire period. For shorter periods of time (hundreds of days) the predictability of a group of 6 currencies is as high as 68%.

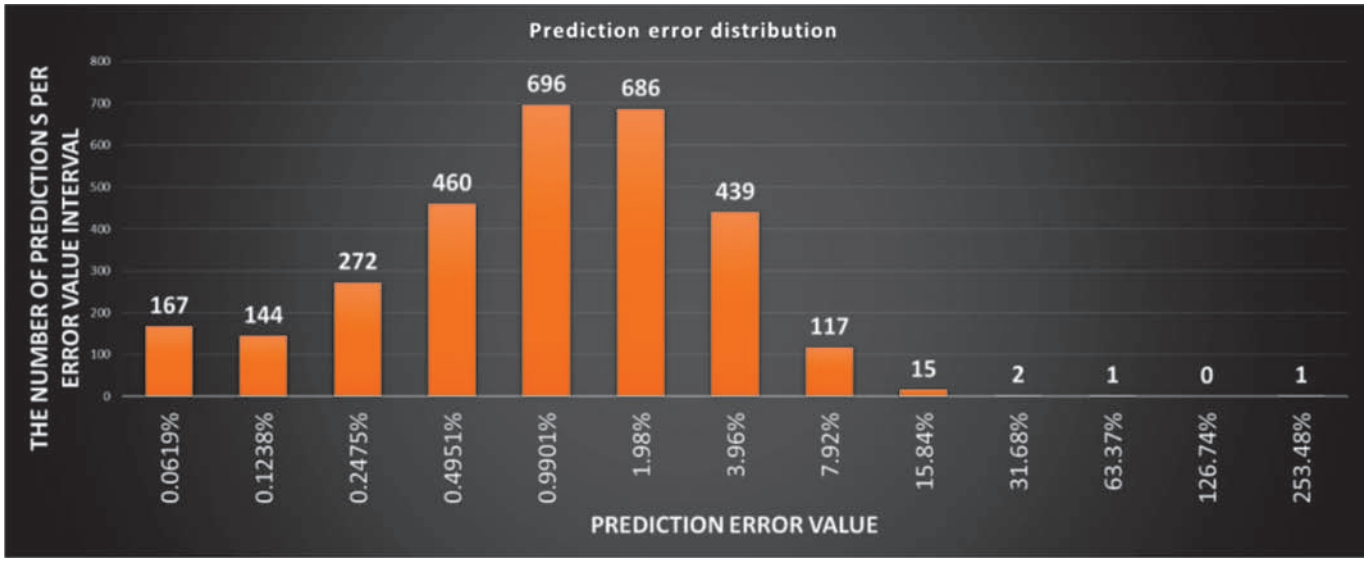


Figure 3 – *The distribution of the next day prediction error*

As consequences:

- *The use of this method (with improvement potential in the predictability rate by including additional unobserved parameters) can generate significant benefits to companies and markets* as commented in the conclusions of this paper.
- *The inability (in this case) of the mimetic model to predict at a higher precision rate is an indication of the presence and influence of unobserved (not included in the model) parameters.*

The next research steps – in this case – include an extended list of observable parameters (ignored in this analysis) related to identifiable parameters from the list mentioned earlier.

Conclusions

C1. The mimetic modeling is a viable approach to develop real-system models when „traditional" modeling is not possible.

C2. The mimetic modeling approach allows identifying the *possible existence* of unobserved parameters (either ignored or hidden) based on two signs:

(i) the system 'behaves' in different ways in the same point of the observed parameter space;

(ii) the system's predictability based on this method is low.

C3. This way,

(i) in the attempt to use the mimetic approach,

- it is possible to understand that there are still unobserved parameters;
- it is possible to use substitution parameters in order to simulate the influence of the unobserved parameters.

(ii) in the attempt to develop a „traditional" model, it is possible to identify the parameters that could be part of that model's formula.

There are several possible applications of predictive decisions based on mimetic modeling.

A. Better *control of production process* – as seen in the c*ase 1*; the identification of the unobserved parameters and the evolution forecast could lead to a higher causal control on the production

process, higher effectiveness and efficiency.

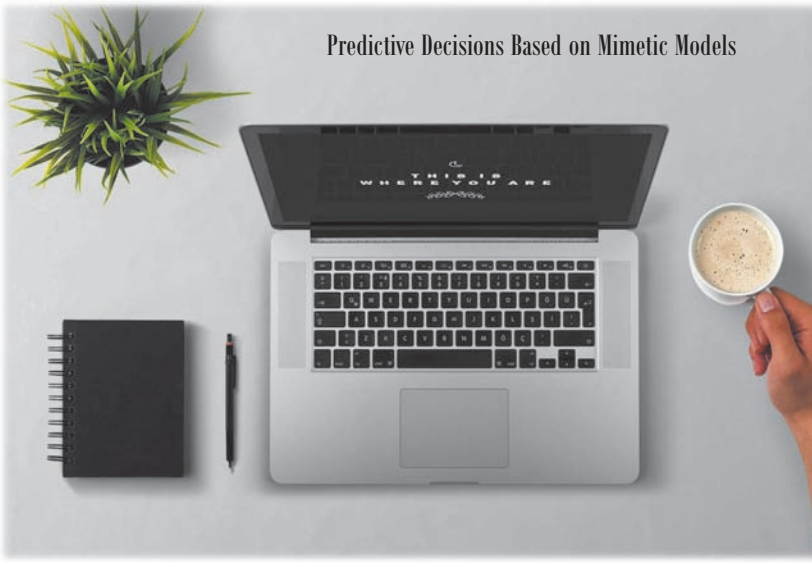
B. Higher *forecast precision* under given causal circumstances – as well as part of a company's evolution control. If the predicted results are not the desired ones, the causal circumstances may be adjusted to lead to better results.

C. Increased *market evolution predictability* – in many respects:

(i) better currency exchange rate risk management (for hedging purposes, export-import risk management);

(ii) new product adoption curve monitoring (by learning the correlation between the sales growth and marketing spending) in order to indicate the need for additional marketing / optimized campaigns for supporting the sales growth;

(iii) the anticipation of macro-economic evolution / policies effects; changes in macro-economic conditions may have better forecasted effects.



The next steps in analysing and developing the mimetic modeling approach include:

- extended testing on real systems modeling;
- definition and selection of the possible substitution parameters algorithms;
- development of a commercial application (service based) on the mimetic modeling method.

REFERENCES

1. Chatterjee, A., Chakrabarti, B.K. (2006) *Econophysics of Stock and other Markets*. Proceedings of the ECONOPHYS-KOLKATA II. (eds.) Econophysics of Stock Markets and Minority Games. 14-17 February 2006. Milan. Springer Verlag.
2. Cristescu, C.P., Stan, C., Minea, T. (2011) Exchange rate time series as universal fractals; correlations and signs of an emerging crisis. In: Scarlat, E.I. (ed.) *Predictability in Nonlinear Dynamic Systems: The Economic Crises*. Bucharest. Editura Politehnica Press. pp. 86-96.
3. Cristescu, C.P., Stan, C. & Scarlat, E.I. (2009) Dynamics of exchange rate time series and The Chaos Game. *Physica A: Statistical Mechanics and its Applications*. 388(23). pp. 484-485.
4. Kantz, H., Schreiber, T. (1997) *Nonlinear time series analysis*. Cambridge. Cambridge University Press.
5. Mintzberg, H., Ahlstrand, B. & Lampel, J. (1998) *Strategy Safari. A guided tour through the wilds of strategic management*. New York. The Free Press.

6. Pascadi, M.V. (2015) A Model for Nonlinear Dynamic Systems with Application Potential in Management. *Proceedings: The role of engineering/technology and business education in an uncertain future.* Sibiu. 1-4 November. pp. 331-341.
7. Pascadi, M.V. (2017a) Implementarea modelării mimetice a sistemelor neliniare într-un modul informatic cu aplicații în managementul organizațiilor industriale. *Proceeding: PhD Research Report no.* Bucharest. 5th July.
8. Pascadi, M.V. (2017b) Prediction capability analysis for a particular type of mimetic models of nonlinear dynamic systems. *Proceedings: Management International Conference (MIC).* Monastier di Treviso. May 24-27.
9. Porter, M.E. (1980) *Competitive Strategy. Techniques for Analyzing Industries and Competitors.* New York. The Free Press.
10. Scarlat, E.I. (2011) Short run correlations: A protection against the recession? In: Scarlat, E.I. (ed.) *Predictability in Nonlinear Dynamic Systems: The Economic Crises.* Bucharest. Romania: Editura Politehnica Press.
11. Scarlat, C., Scarlat, E.I. (2007) Theoretical aspects of the economic transition: The case of Romania. *Managing Global Transitions, International Research Journal* 5(4). pp. 307-331.
12. Scarlat, C., Scarlat, E.I. (2010) Theory of Chaos approach to assess the management decentralization. *UPB Scientific Bulletin, A Series.* 72(3). pp. 185-199.
13. Scarlat, E.I., Stan, C. & Cristescu, C.P. (2007) Self-similar characteristics of the currency exchange rate in an economy in transition. *Physica A: Statistical Mechanics and its Application.,* 379(1). pp. 188-198.
14. Schwartz, B., Yousefi, S. (2003) On complex behavior and exchange rate dynamics. *Chaos, Solitons and Fractals,* 18(3). pp. 503-523.
15. Välijärvi, J. (2012) The history and present of the Finnish education system. *Sino-Finnish PISA Seminar on education system* [Online] 31st May. Available from: http://cice.shnu.edu.cn/ [Accessed: 9th July 2017].
16. Zhou, P. (2017) History of Singapore's Economic Development. *Singapore's Economic Development* [Online] 3th March. Available from: https://www.thoughtco.com/singapores-economic-development-1434565 [Accessed: 9th July 2017]

„Technology makes more technology possible."
Alvin Toffler

Effective Business Informatics Management

Alena Buchalcevova, Jan Pour
University of Economics, Prague, Czech Republic

Abstract

The aim of this article is to present the Management of Business Informatics (MBI) model that assists enterprises in managing their business informatics. First, current issues in business informatics management are outlined as well as the results of several surveys conducted worldwide and in the Czech Republic. Then, the motivation behind the MBI model development is presented followed by the MBI model architecture and content description. For the purpose of an effective MBI model demonstration, evaluation and usage, the MBI model was implemented as a web application is free of charge.

Keywords: Business Informatics, Management, Governance, Evaluation, Management of Business Informatics Model

Introduction

Information systems and information technologies have become key elements in business development across all market segments being the means to a successful business operation, innovation and growth. These issues are driving management initiatives, such as IT governance and business – IT alignment that have become an important matter in both academic research and organizational practice. We see these initiatives as a part of business informatics management. Business informatics discipline combines various aspects of business management, information technology, and informatics (Heinrich & Riedl, 2013).

Although numerous methods have been developed for business informatics

„Learn from yesterday, live for today, hope for tomorrow."
Albert Einstein

* Correspondence to Alena Buchalcevova: alena.buchalcevova@vse.cz

management so far, the results of several surveys conducted in the Czech Republic (Pour, 2012; Pour et al., 2013) demonstrate a low level of their usage for management of business informatics. This fact together with limited customization possibilities of these well-known methods has led our team to develop a Management of Business Informatics (MBI) model that aims to assist enterprises (including SMEs) in managing their business informatics.

The aim of this article is to present the Management of Business Informatics (MBI) model and its contribution to solving business informatics management problems. This article is organized as follows. Following the introduction, section 2 explores a current status of the business informatics management domain through a detailed literature review. Section 3 then outlines the motivation behind the development of the Management of Business Informatics model and its objectives. The architecture and the content of the MBI model are then presented in section 4. Lastly, the conclusions are discussed.

Current Issues in Business Informatics Management

Over the past few years, a corporate IT departments' emphasis has shifted from technical to managerial issues (Buchwald, Urbach & Ahlemann, 2014). Resulting from this increasing business orientation and management complexity of corporate IT departments, IT governance has become an important matter in both academic research and organizational practice (Brown and Grant, 2005). The IT Governance Institute holds a leading role in this area. From an academic perspective, research on IT governance is emerging as an important area of inquiry (Huang et al., 2010; Schwarz & Hirschheim, 2003).

According to Weill & Ross (2004), IT governance specifies decision rights and accountability framework to encourage a desirable behavior in the use of IT. This behavior relates to the form of leadership, and organizational structures and processes that ensure an organization's IT sustains and extends organization's strategies and objectives (ITGI, 2009). Van Grembergen & De Haes (2009) stress the business-IT alignment facet of IT governance that enables the creation of a business value from IT-enabled business investments. A deep literature review relevant to IT governance was performed by Wilkin & Chenhall (2010).

IT governance and IT service management inherited much from corporate governance and operational IT management, but have developed into a discrete discipline. We try to combine IT governance, IT management and business-IT alignment concepts into one term, business informatics management, as shown in Figure 1.

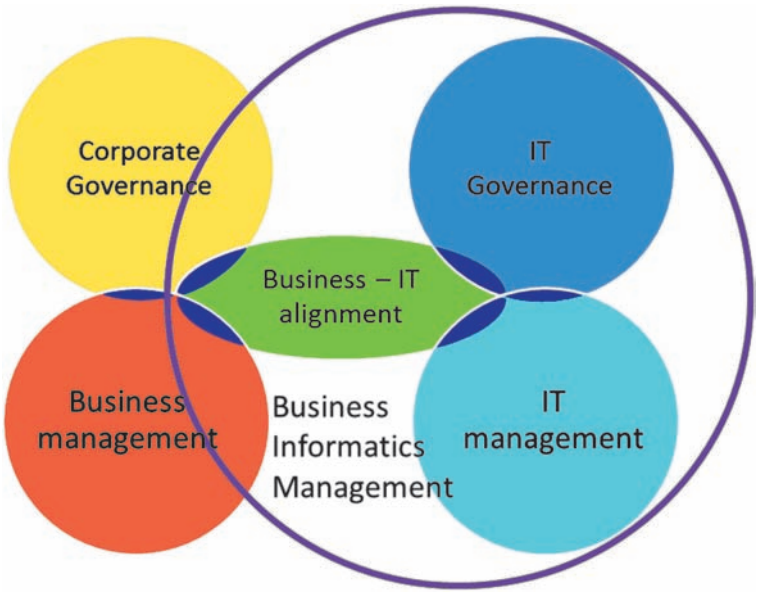


Figure 1 – *Business Informatics Management definition*

In recent years, standards, frameworks, and best practices addressing different aspects of business informatics management have emerged and matured. Among these, the most quoted are: ITIL (TSO, 2007) and ISO/IEC 20000 (ISO/IEC 20000, 2011) which address IT service management. Whereas, the Control Objectives for Information and Related Technology (COBIT) is an approach that aims to standardize proper information technology security and control practices. (ISACA, 2012). TOGAF, the Open Group Architecture Framework, has become a standard for EA development. (Open Group, 2009).

The usage of these standards and frameworks has increased in order to improve IT internal processes, quality, productivity, efficiency and communication with business areas, as well as explore possibilities for innovation (Scheeren, Fontes-Filho & Tavares, 2013). However, several surveys indicate particular challenges linked to the usage of these standards and frameworks. Studies conducted by the IT Governance Institute in 2008 (ITGI, 2009) and 2010 (ITGI, 2011) show that the vast majority (92%) of respondents are aware of the issues resulting from the application of these standards and frameworks. While security and compliance are mentioned as important elements, it is people who represent the most critical issue. 58% of respondents consider the number of IT people in their organizations insufficient, which represents the main issue brought up. The second issue, reflected by 48%, refers to the incidents related to the provision of services. Further, 38% of the respondents consider a lack of IT staff skills as another problem. In addition, it was found that communication between IT staff and users is improving, but at a slow pace and the alignment between IT and corporate strategy is bad or very bad (Lorences & Ávila, 2013).

These challenges are especially pronounced in the SMB market. Micro, small and medium-sized enterprises (SME) play an important role in today's society and economy, since they represent 99 % of all enterprises in the European Union (EU) (Küller et al., 2012). There are significant

differences in terms of resources and expertise available between small and medium enterprises and large organizations. Therefore, business informatics management practices used in large organizations cannot be linearly extrapolated to SMEs. As the results of a survey conducted in 160 SMEs in six Central European countries (Austria, Czech Republic, Germany, Hungary, Poland, and Slovakia) show, there is still an extensive difference between knowledge of ITSM frameworks and their application within companies (Küller et al., 2012). One of the reasons behind this fact is a complexity of existing frameworks. A number of IT department leaders mention that frameworks like ITIL or COBIT are too complex for them; they fear that such frameworks are administrative overhead (Küller et al., 2012).

MBI Model Objectives

As stated in the previous section, although numerous standards and frameworks aimed at business informatics management exist, they do not adequately solve practical issues and are not sufficiently applied in practice, especially in SMEs. As Küller et al. (2012) state, the ITSM frameworks are too complex and there are no guidelines for their implementation.

With the aim to identify the status of business informatics management in the Czech Republic, our team at the Department of Information Technologies at the Prague University of Economics conducted a nationwide survey during 2010 and a subsequent survey in 2012 (Pour, 2012). According to these surveys, to the most important reasons causing the low utilization of existing methodologies and standards belong their complexity, time consuming implementation and high costs. Moreover,

existing frameworks do not sufficiently take into account various factors that influence management of business informatics, e.g. sector of the economy, company size, importance of IT for strategic goals, etc. Furthermore, the implementation of such methodologies requires an extensive documentation and high knowledge and skills even in the case of a small enterprise with a simple information system. Consequently, such methodologies are used almost exclusively by larger companies with a significant IT budget (Pour et al., 2013). The results of these surveys have led our team to a development of our own tool for business informatics management.

The objective of the MBI model is to provide a support for business informatics management activities in companies that figure as the users of ICT services. The model aims to help enterprises (including SMEs) to:

- Document and analyse an existing business informatics management system,
- Design and implement a new (improved) business informatics management system,
- Obtain an advice and best practice solutions for specific IT management issues such as: How to develop an information strategy? How to prepare IT budget? What is a concrete structure and content

of SLA for application services delivered in the form of Software as a Service?

The MBI model aims to provide a solution that suits to specific characteristics of a company which determines the effectiveness of IT governance that cannot be generalized to all types of firms or industries. The MBI model strives to help organizations to improve the performance of enterprise IT systems, more specifically the quality, availability, security and effectiveness of IT services, and indirectly the overall business performance. To address these objectives, the following key principles (A to I) of the MBI model were defined:

Agility – The model rapidly responds to changing needs of business informatics, its content and functionality are easily extendable and upgradable.

Business Strategy Support – The model supports an organization's business strategy in defining strategic applications of business informatics as well as in monitoring IT investment profitability.

Competency – The model puts all responsibilities and authorities within an organization in the context of business informatics (Weill & Ross, 2004).

Deployment – The model is effectively deployable in organizations of a different size and operating in different industry sectors. The model implementation respects specific conditions under which an organization operates including its financial and human resources allowing a successful application of the model in SMEs that typically have limited financial and human resources.

Experience – An integral part of the model contains recommendations summarizing relevant practical experience.

Flexibility – The application of the MBI model in practice offers a high flexibility. The implementation of individual model components (tasks) is supported without having to implement the entire model. Considering a significant effort involved in a comprehensive business informatics system implementation, it is often more effective to address only those areas identified as the most problematic, or with the highest impact on an enterprise performance and its success.

Granularity – The model provides various levels of management tasks and metrics granularity that correspond to the requirements of different organization types.

High performance – Business informatics management is based on a coherent system of metrics that evaluate all important IT services, IT processes and IT resources (Vorisek, Pour et al., 2012).

Impact of Features – The model allows a control of all key business informatics features, e.g. functionality, availability, timeliness, accuracy, compliance with legislation, reliability, user-friendliness, security, flexibility, openness, integrity, standardization, performance, effectiveness, etc.

MBI Model Architecture

The MBI model was defined based on an extensive literature review, analysis of existing standards, methods and frameworks as well as generalized knowledge gained from numerous consulting projects across a wide spectrum of organizations.

The architecture of the MBI model is defined in the UML 2.0 class diagram notation in Figure 2.

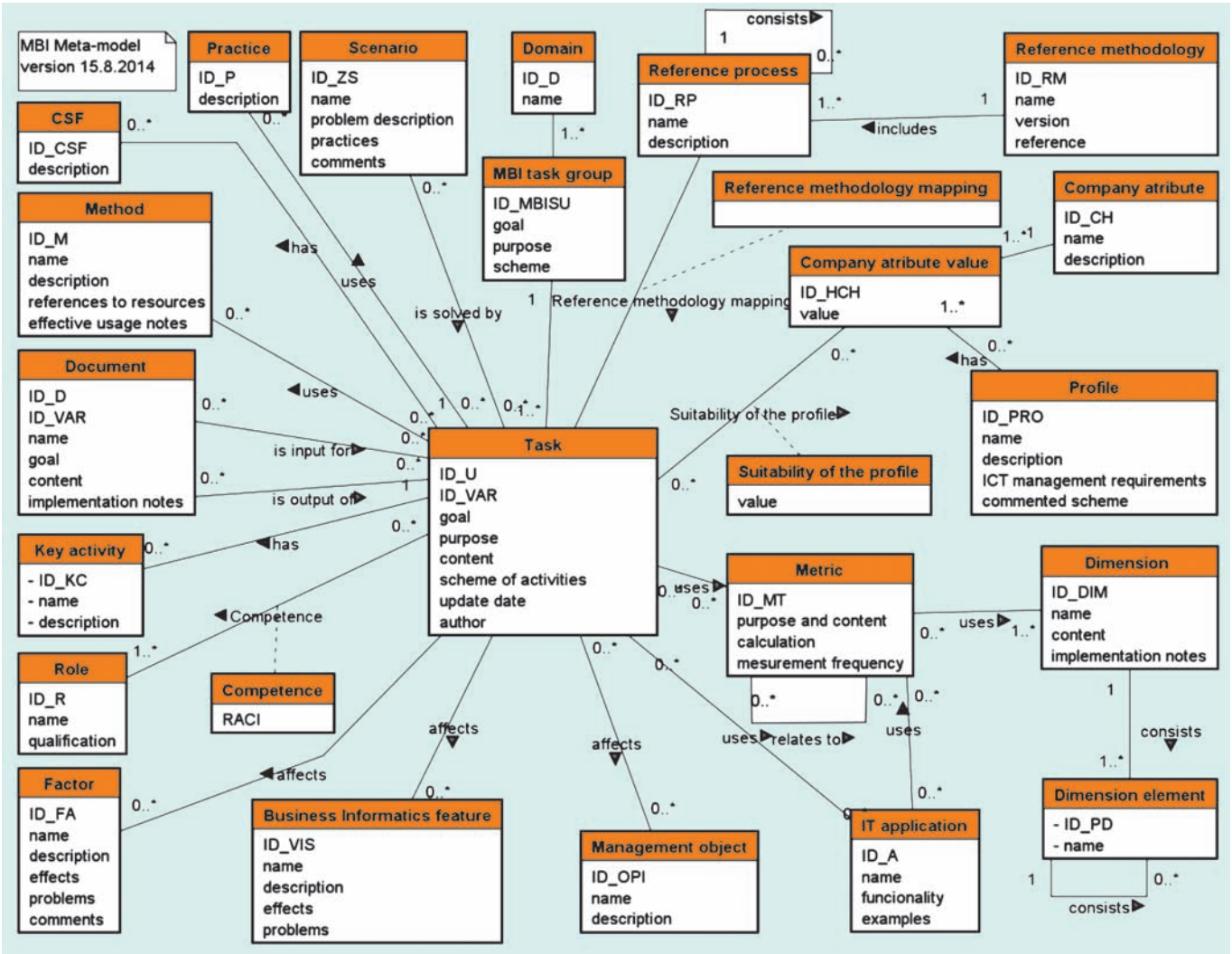


Figure 2 – *MBI Model Architecture*

Task, that represents a key MBI component, describes how to proceed in solving a particular IT management issue. The MBI model defines a large number of Tasks that are organized in a three-level hierarchy, i.e. Management Domains, Task Groups, and Tasks. To the examples of Tasks belong: Proposal for Enterprise IT System Sourcing, IT Service Implementation, Service Activation, Security Audit Implementation, etc.

Each Task has both identification attributes (i.e. ID, Variant, Author and Update Date) and attributes which represent a specific content of the Task (i.e. Goal, Purpose, Content, and Scheme of Activities).

An additional content is represented by relations to other classes. A variant of the Task describes specifics of a Task realization in various conditions according to an organization size, industry sector, or organization type. The most important related classes are the following:

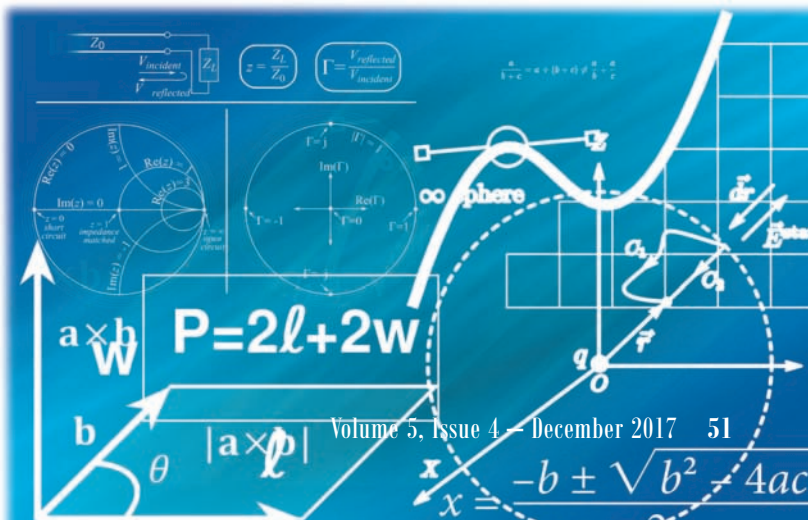
- The document represents a printed or electronic document that is used as a Task input or output.
- The scenario represents a typical issue that should be addressed in a business life.
- The application is software utilized for a given Task.
- Metrics are expressed in the context of dimensional modeling as indicators and their analytical dimensions.
- The method describes formalized process and guideline that lead to the fulfillment of a Task goal.
- Role expresses specific responsibilities of a role holder.
- Factor has a significant impact on the way a particular Task is performed (e.g. Organization Size, Industry Sector, Organization Type).

An important element of the MBI model is represented by Business Informatics Features. Regarding each Task, its possible impact on Business Informatics Features (e.g. Availability, User-friendliness, Security, Integrity, etc.) is measured in the form of yes/no record. This way it is possible to discover all the Tasks that affect a particular information system feature.

MBI Model Evaluation

The MBI model was described in detail in (Vorisek et al., 2012). For the purpose of an effective MBI model demonstration, evaluation, and usage, the MBI model was implemented as a web application (at the URL mbi.vse.cz). The MBI application was in a pilot usage from January 2014 to August 2014. During this time, the MBI application was tested by the MBI team and first MBI users. Specifically, the functionality, usability, performance, and load tests were performed. At the same time, the content of the MBI model was reviewed in a controlled manner. After this half a year pilot operation, the MBI application was refactored and improvement and enhancement were performed.

The MBI 2.0 application came into existence at the end of August 2014. Among the main enhancements are to mention user profiles and application login, full-text search, summary slide with key information related to each object, and documents for download. With the aim to enable tracking of the MBI application usage and obtaining feedback from its users, user registration was supplemented. The use of the MBI application is free of charge, the users are only obliged to register and confirm to the ethical codex. An MBI community was established shortly after the model's official presentation, which unites the MBI content authors and the most active users, organizes meetings, presentations, and training, and enables to exchange experience. Currently, the MBI application is in the Czech language, but an English version is being prepared.



Conclusions

In this article, the Management of Business Informatics (MBI) model was presented. To overcome issues in business informatics management, the MBI model was developed based on an extensive literature review, analysis of existing standards, methods and frameworks as well as generalized knowledge gained from numerous consulting projects across a wide spectrum of organizations. For the purpose of an effective MBI model demonstration, evaluation and usage, the MBI model was implemented as a web application. The MBI application underwent a pilot usage for half a year when functionality, usability, performance and load tests were performed and content of the MBI model was reviewed. This review resulted in an improved and enhanced MBI 2.0 application.

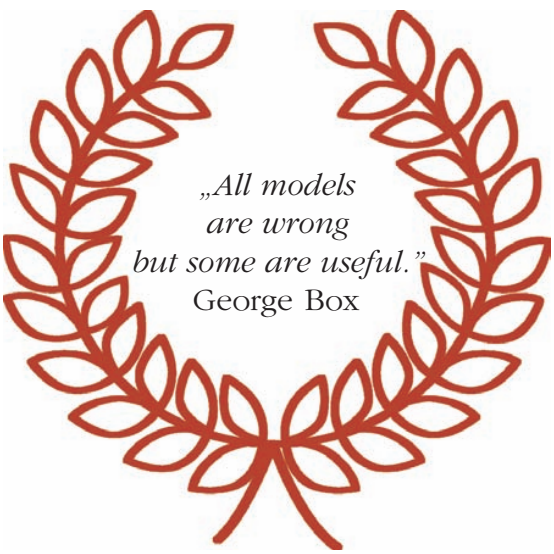
Acknowledgment

The work reported in this article was processed with the contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

REFERENCES

1. Brown, A.E. & Grant, G.G. (2005). Framing the Frameworks: *A review of IT governance research, Communications of the AIS 15*: pp. 696-712.
2. Buchwald, A., Urbach, N. & Ahlemann, F. (2014) Business value through controlled IT: toward an integrated model of IT governance success and its impact. *Journal of Information Technology* 29 (2). pp. 128-147.
3. CMMI Institute (2013) *CMMI-Development*. [Online] Available from: http://cmmiinstitute.com/cmmi-solutions/cmmi-for-development/. [Accessed: 26th October 2013].
4. Heinrich, L.J., Riedl, R. (2013) Understanding the Dominance and Advocacy of the Design-Oriented Research Approach in the Business Informatics Community: A History-Based Examination. *Journal of Information Technology*. 28 [1]. pp. 34-49.
5. Huang, R., Zmud, R.W. & Price, R.L. (2010) Influencing the effectiveness of IT governance practices through steering committees and communication policies. *European Journal of Information Systems*. 19. pp. 288-302
6. ISACA (2012) COBIT 5. Information Systems Audit and Control Association. *A Business Framework for the Governance and Management of Enterprise IT*.
7. ISACA (2012b) Governance of Enterprise IT (GEIT) survey. [Online] Available from: http://www.isaca.org/Pages/2012-Governance-of-Enterprise-IT-GEIT-Survey.aspx.
8. ITGI (2009). IT Governance Global Status Report 2008. *IT Governance Institute*.

9. ITGI (2011). Global Status Report on the Governance of EnterpriseIT: IT Governance Institute.
10. ISO/IEC 20000-1 Information technology – Service management – Part 1. *Service management system requirements.*
11. Küller, P., Vogt, M., Hertweck, D. & Grabowski, M. (2012). A Domain Specific Approach Journal of Innovation Management in Small & Medium Enterprises. *IT Service Management for Small and Medium-Sized Enterprises.* DOI: 10.5171/2012.475633.
12. Lorences, P.P., Ávila, F.F.G. (2013) JISTEM – Journal of Information Systems and Technology Management. *The Evaluation and Improvement of IT Governance.* pp. 219-234. ISSN online: 1807-1775.
13. Open Group (2009) TOGAF Version 9. *The Open Group Architecture Framework.* The Open Group, p. 778.
14. Pour, J. (2012). Systemova integrace, *Results of the survey of the management of enterprise ICT* No.1. pp. 49-57.
15. Pour, J., Vorisek, J. & Feuerlicht, G. (2013) Model for management of enterprise IT: considerations of the impact of Cloud computing. Pour, J., Vorisek, J. & Feuerlicht, G. In: *Confenis – 2013.* Linz: Trauner Verlag.
16. Scheeren, A.W., Fontes-Filho, J.R. & Tavares. E. (2013) Impacts of a Relationship Model on Informational Technology Governance: An Analysis of Managerial Perceptions in Brazil. *JISTEM – Journal of Information Systems and Technology Management.* 10(3). pp. 621-642 ISSN. DOI: 10.4301/S1807-17752013000300009.
17. TSO. ITIL (2007): *Introduction to the ITIL Service Lifecycle.* London. TSO2007
18. Van Grembergen, W. & De Haes, S. (2009). Enterprise Governance of Information Technology. *Achieving Strategic Alignment and Value.* New York: Springer Science + Business Media.
19. Vorisek, J., Pour, J. et al. (2012) *Management of Business Informatics.* Professional Publishing.
20. Weill, P. & Ross, J. (2004). IT Governance: *How Top Performers Manage IT Decision Rights for Superior Results.* Watertown: Harvard Business School Press.
21. Wilkin, C.L. & Chenhall, R.H. (2010) A Review of IT Governance: *A Taxonomy to Inform Accounting Information Systems Journal of Information Systems American Accounting Association* 24(2). pp. 107-146. DOI: 10.2308/jis.2010.24.2.107.



The Impact of Software Mass Customization

Larisa Gavrilă (1), Sorin Ionescu (2), Bogdan Țigănoaia (2), Gheorghe Militaru (2), Antonín Pavlicek (3)

(1) Vodafone Romania Technologie, Bucharest, Romania, (2) University POLITEHNICA of Bucharest, Romania, (3) University of Economics, Prague, Czech Republic

Abstract

Software customization and configuration are common practices in all software companies, and they are very often delivered to customers. The extent to which a company is offering software personalization services, it depends on the nature of the software and its flexibility, customer demands, the need to gain a certain market share or the need to be awarded on a certain bid regardless profit margin and enquired costs. The scope of this paper is to look into the impact of software personalization activities on companies that provide this services. An additional purpose consists in verifying if software personalization activities are activities with a positive impact on the overall financial statements.

Keywords: software personalization, software customization, impact on software companies

Introduction

In the making of software, a new concept of product customization appeared, mass customization. Davis (Davis, 1987) and Pine (Pine, 1993) were the first researchers who have studied the concept of mass customization. They described mass customization as a process by which a firm is using existing technology and management methods to ensure variety and customization of products through flexibility and fast response to market demand (Maarten ter Harmsel, 2012). Da Silveira (Da Silveira, Borenstein, Fogliatto, 2001) describes three reasons for which mass customization is required (Figure 1):

* Correspondence to Larisa Gavrilă: larisagavrila@gmail.com

Figure 1 – *Reasons for mass personalization*

Gilmore and Pine (Gilmore, Pine, 1997) defined four types of mass customization:

1. Collaborative customization: through this collaborative approach, producers are in a dialogue with their customers to determine the need for personalization.
2. Adaptive personalization: in this approach, the firm produces a standard product that then can be customized by the customers.
3. Transparent personalization: in this approach, clients are not informed that the products are customized for them although the company delivered a unique product.
4. Cosmetic customization: this approach is a shallow one because it presents in a different manner the same type of standard product.

There are four customization archetypes, as can be seen in table 1.

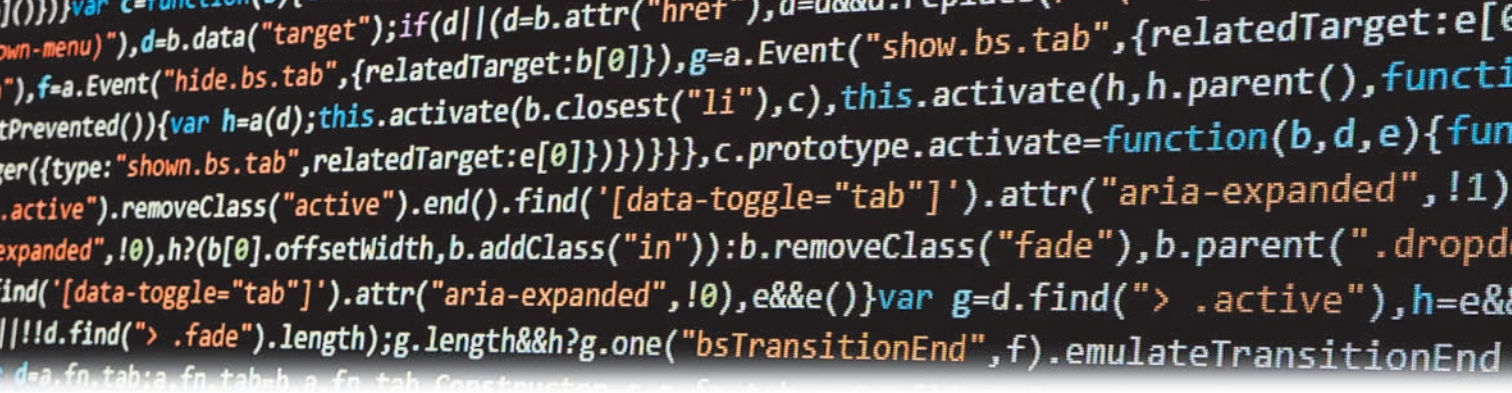
Table 1 – *Matrix of mass personalization*

Level of client's involvement	Modularity type			
	Projection	Manufacture	Assembly	Utilization
Projection	Processors		Concerned	
Manufacture				
Assembly	Modulators		Assemblers	
Utilization				

(Source: Da Silveira et al. 2001)

With regards to software applications, there are basically two directions: the creation of information packages and creation of on-demand applications. Vendors like SAP, Oracle, Microsoft focused mainly on delivering information packages that can be customized to a large extent but which, however, does not give the customer the opportunity to use their own working practices and must adapt to the workflow dictated somehow by the computer package, so that a competitive advantage can be affected.

With regards to the applications created at the request of the customer, they incorporate internal processes and procedures, assuming winning from the competitive advantage. Unfortunately, most of the time such applications are expensive includes a lengthy design and development and more often it happens that not all the initial planned functionalities can be delivered.



Research Methodology

The study includes a series of 63 companies listed on the NASDAQ Stock Exchange. The companies that were taken into consideration in the analysis were companies that carry out software personalization activities, as a result. After studying 63 annual reports from 2015, only 21 companies were preserved in the continuation of the study. Other companies even though it was mentioned in their annual reports that they perform software personalization activities, at the accounting level there was made no differentiation in this respect.

The companies included in the study were: The Ultimate Software Group Inc, MicroStrategy Incorporate, Tyler Technologies Inc, Netsuite Inc, Citrix Systems Inc, ServiceNow Inc, Salesforcecom Inc, Blackbaud Inc, Guidewire Software Inc, Splunk Inc, HubSpot Inc, Medidata Solutions Inc, CommVault Systems Inc, BroadSoft Inc, Paylocity Holding Corporation, PTC Inc, Cadence Design Systems Inc, Bottomline Technologies Inc, QAD Inc, Amber Road Inc, Red Hat Inc. There were taken into consideration values of income and expenditure from the past three years, values that are expressed in thousands of dollars. The annual reports were made available by accessing www.annualreports.com.

In order to analyze the software personalization impact over IT companies, a range of hypotheses was built. The tested hypotheses were the following:

Hypothesis 1: The amount of income generated by software personalization activities in the total income is significantly above 20%.

Hypothesis 2: The costs generated by software customization activities are important because they consist of a significant value compared to the total cost (over 20%).

Hypothesis 3: Software customization activities are profitable activities.

Hypothesis 4: Employees (internal or external) represent a very important capability necessary for customization of software applications.

Hypothesis 5: Investments in innovation activities have a positive influence over software personalization activities. For the assumptions' validation were the annual reports of 21 listed companies on the NASDAQ stock exchange were verified (The Ultimate Software Group Inc., 2015; MicroStrategy Incorporated, 2015; Tyler Technologies Inc., 2015; Netsuite Inc., 2015; Citrix Systems Inc., 2015; ServiceNow Inc., 2015; Salesforcecom Inc., 2015; Blackbaud Inc., 2015; Guidewire Software Inc., 2015; Splunk Inc., 2015; HubSpot Inc., 2015; Medidata Solutions Inc., 2015; CommVault Systems Inc., 2015; BroadSoft Inc., 2015; Paylocity Holding Corporation, 2015; PTC Inc., 2015; Cadence Design Systems Inc., 2015; Bottomline Technologies Inc., 2015; QAD Inc., 2015; Amber Road Inc., 2015; Red Hat Inc., 2015).

Hypothesis 1, 2, 3 and 4 have been verified through mathematical calculations, and hypothesis number 5 was verified by building in Eviews a simple linear regression using the method of least squares.

Research Results

Hypothesis 1: *the amount of income generated by software personalization activities in the total income is significantly above 20%*

After analyzing the revenue values generated by software personalization activities compared to total revenues in 2014 and 2015, it was concluded that less than 20% of the companies analyzed have revenue values generated by software personalization activities below 10% of total revenues and the vast majority of companies (over 70%) registered a percentage of revenues generated by software personalization activities equal to or greater than 20% of the total revenues (Figure 2 and Figure 3). The average percentage value of revenues generated by software personalization activities in the total revenues for the 21 companies in 2014 and 2015 is 20%.

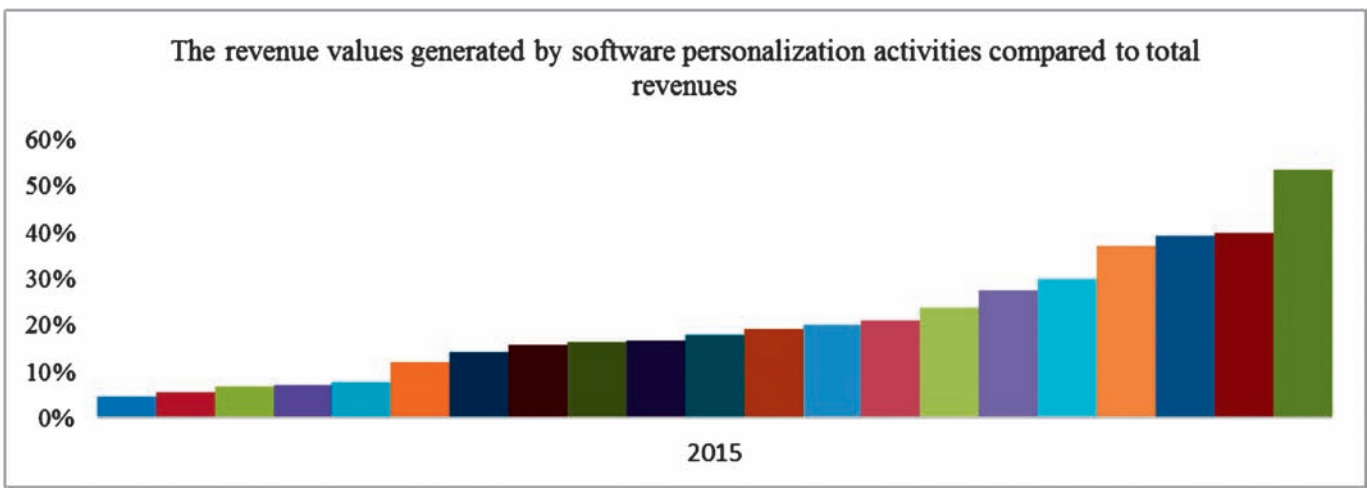


Figure 2 – *The revenue values generated by software personalization activities compared to total revenues in 2015*

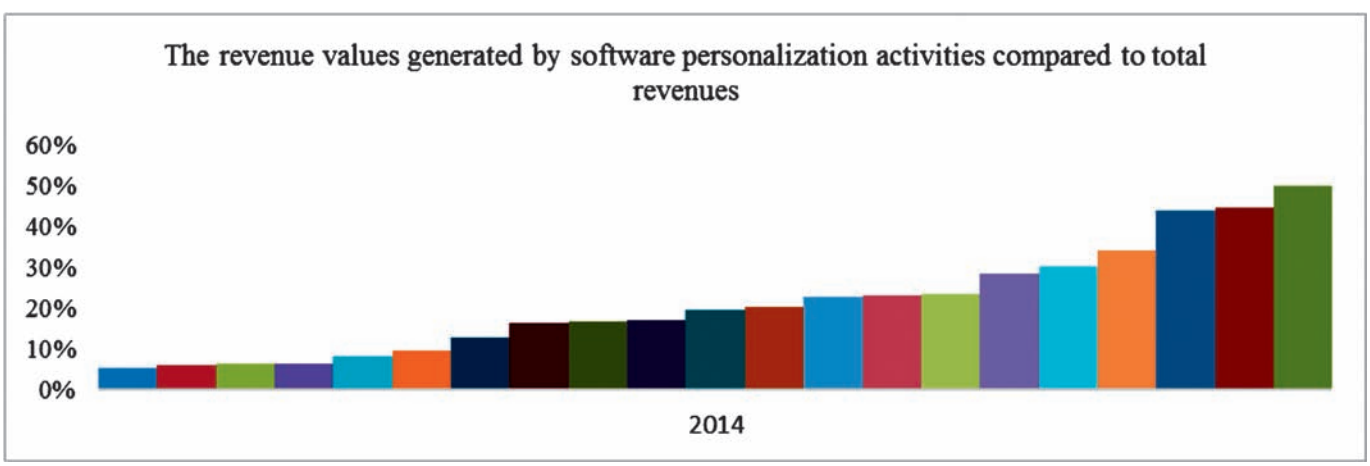


Figure 3 – *The revenue values generated by software personalization activities compared to total revenues in 2014*

Hypothesis 2: *the costs generated by software customization activities are important because they consist of a significant value compared to the total cost (over 20%)*

As a result of the analysis of the value of expenditure generated by software personalization activities in total expenditure, it was possible to come to the conclusion that they exceed the threshold of 20%, which emphasizes the idea of granting them greater attention and start improving processes within companies in order to provide low-cost software customizations (Figure 4 and Figure 5). Average amount of expenditure generated by software personalization activities in total expenditure is 54%.

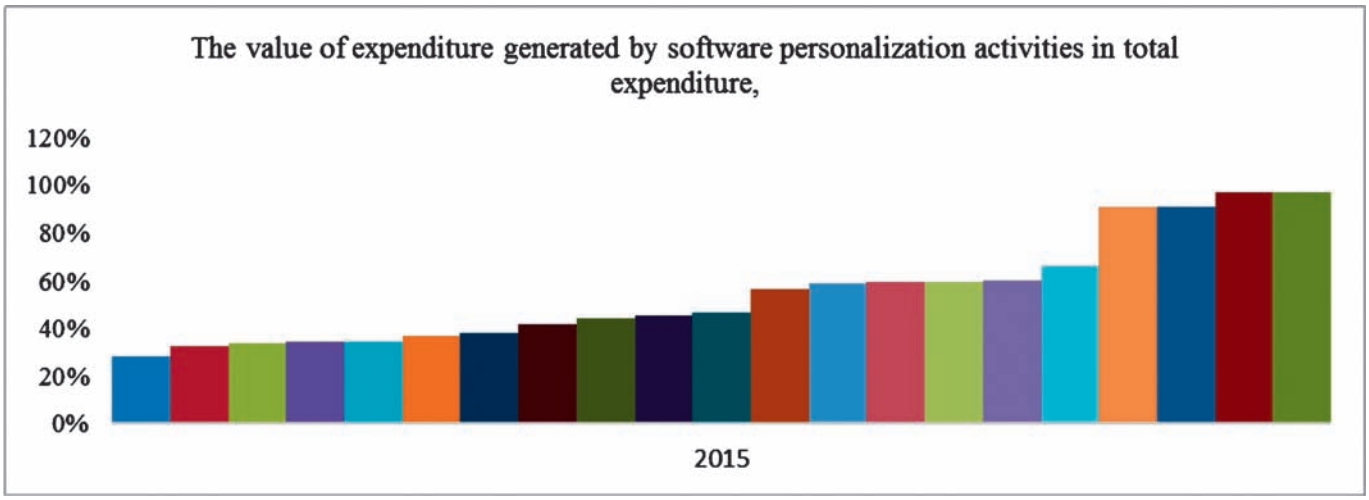


Figure 4 – *The value of expenditure generated by software personalization activities in total expenditure in 2015*

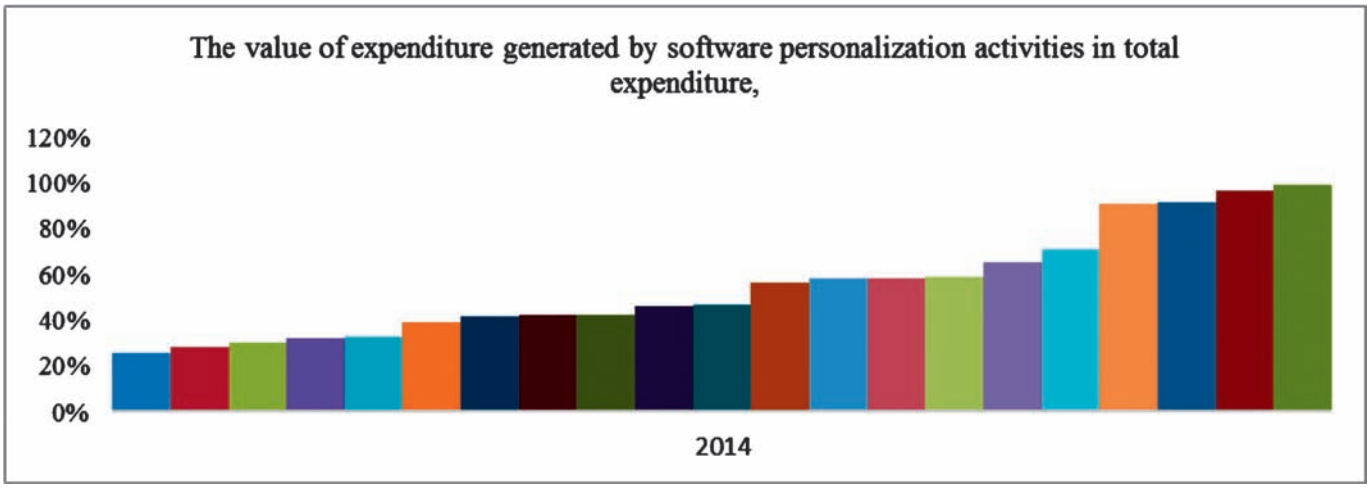


Figure 5 – *The value of expenditure generated by software personalization activities in total expenditure in 2014*

Hypothesis 3: *software customization activities are profitable activities*

To test such a hypothesis, it was calculated the difference between the income obtained as a result of customizing software and costs associated with these activities, without taking into account other revenues and costs.

By analyzing the profitability of these activities strictly in the years 2015-2013, it was concluded that a minimum of 67% of the companies analyzed would record higher revenues than the allocated costs in customization and an average of 71% of the companies would make a profit from strictly from this kind of activities (Figure 6).

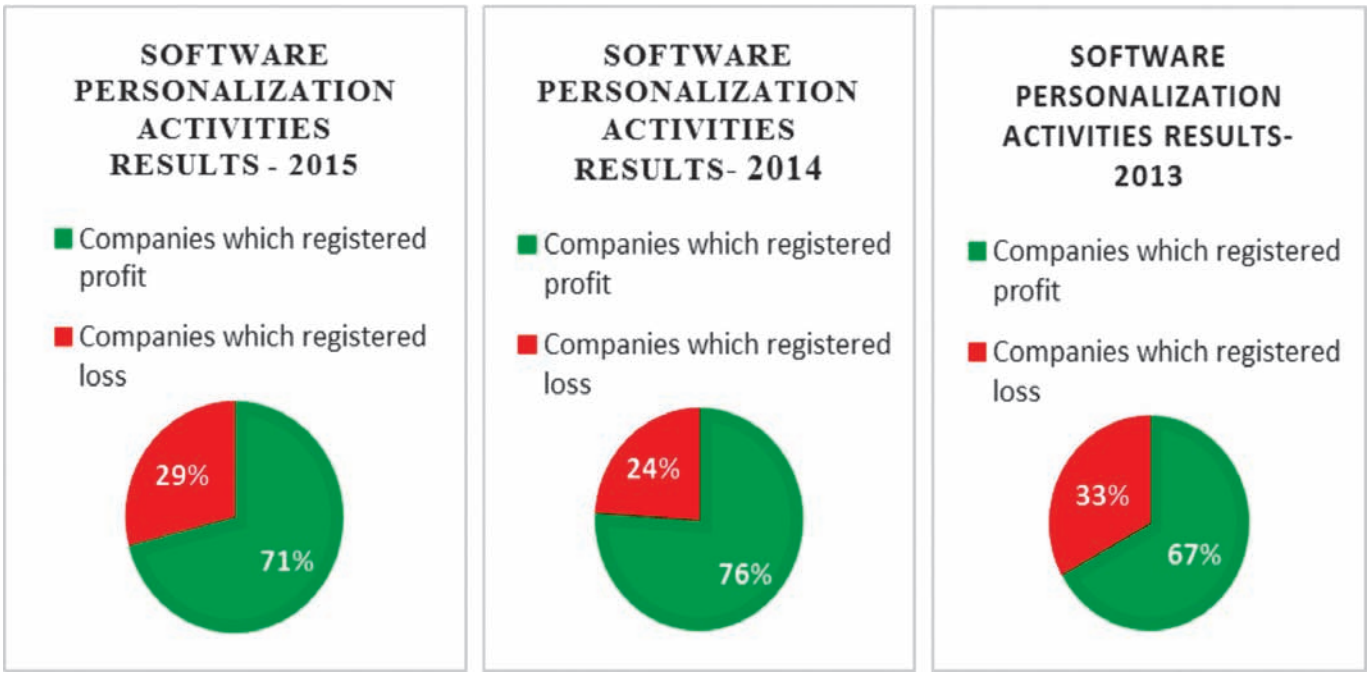


Figure 6 – *The profitability of the software personalization activities over a period of 3 years*

After verifying the hypotheses 1 and 2 it was possible to come to the conclusion that they are valid, additionally it was found that an average of 20% of total revenues represents revenues from software customization activities, an average of 50% of the total expenses are costs generated by software personalization activities and on average in 71% of companies the difference between revenues and expenses related to software personalization activities is positive.

These aspects can be mathematically transpose as follows:

- 0.2 x VT = VPSW results that VT = 5 x VPSW, **(1)**

where VT represents total revenues, and VPSW represents revenues generated by software personalization activities;

- 0.5 x CT = CTSW results that CT = 2 x CPSW, **(2)**

where CT represent total expenses, and CPSW represents expenses generated by software personalization activities;

- In a simplified manner PR = VT – CT, **(3)**

where PR represents the profit;

• From the relations **(1)**, **(2)** and **(3)** results that:

PR= 5 x VPSW – 2 x CPSW or PR = 2x (VPSW – CPSW) + 3 x VPSW, **(4)**

VPSW – CPSW > 0 on average in 71% of the cases **(5)**

VPSW > 0 **(6)**

From the relations (4), (5) and (6) results that on average 71% of the companies involved in software personalization activities are overall profitable (PR > 0).

In addition, even though we could have VPSW < CPSW it is still possible that 5 x VPSW > 2 CPSW (e.g. 7 < 8 but 5 x 7 > 2 x 8) so 5 x VPSW – 2 x CPSW > 0 meaning PR > 0.

Thus it can be concluded that on average more than 71% of IT companies that are involved in software personalization activities are profitable overall.

Hypothesis 4: *employees (internal or external) represent a very important capability necessary for customization of software applications.*

It can be observed that activities related to software personalization fit in the area of services: professional services, software services, deployment services, training and courses. So it can be concluded that in the services segment human resources and their expertize are key capabilities for a successful company.

Hypothesis 5: *investments in innovation activities have a positive influence over software personalization activities.*

Data from 21 companies were analyzed within three years, in the framework of the econometric model they were passed as a series of irregular data, and it was used the method of least squares in regression estimation. Linear regression wishes to highlight the relationship between investments in innovations and revenues generated by software personalization activities.

One can observe that the relationship between the two variables is a direct one:

Log(VP) = 0.6370492198*LOG(RD) + 4.136855798

The interpretation of this equation is as follows: for a rate of growth of research and development expenditure, the model predicts that revenue from software customization activities will increase with 0.63%, from which results in the positive impact of innovations on this segment.

By analyzing the result extracted from Eviews for this equation, it can be concluded that the variable research and development expenses are statistically significant and that is well-explained by applying Student's T-test (where the value of p < 5%). By observing the equation results, it can be noticed that the coefficient of determination R-squared has a value of 46.2% and this means that the evolution of the dependent variable is affected by the explanatory variable in 46.2% of the cases.

The validity of this model is verified by using the F test model having the following

assumptions (Andrei, 2008): H0 – the model is not valid, H1 – the model is valid.

The decision should be based on the p-value. Because the statistical value of p is very low in both equations, the error whereby the null hypothesis is rejected is also very small. So the null hypothesis can be rejected, and the conclusion is that the model is valid. Moving forward it was taken into consideration the value of p = .05 and value of F (62-1, 2-1) from F statistic table for –p = .05 (https://www.ma.utexas.edu/users/davis/375/popecol/tables/f005.html). By observing Figure 7, it can be noticed that F calculated (51.64) > F tabular (8.57), meaning thereby that the null hypothesis is being rejected.

Dependent Variable: LOG(VP)
Method: Least Squares
Date: 11/08/16 Time: 11:45
Sample: 1 62
Included observations: 62

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RD)	0.637049	0.088647	7.186382	0.0000
C	4.136856	1.043105	3.965905	0.0002

R-squared	0.462578	Mean dependent var	11.57155
Adjusted R-squared	0.453621	S.D. dependent var	1.419893
S.E. of regression	1.049549	Akaike info criterion	2.966325
Sum squared resid	66.09321	Schwarz criterion	3.034942
Log likelihood	-89.95607	F-statistic	51.64409
Durbin-Watson stat	2.110159	Prob(F-statistic)	0.000000

Figure 7 – *The relationship between research & development expenses and revenues generated by software personalization activities*

Conclusions

The exploratory study described above allows testing and verification of a series of hypotheses that have as main purpose bringing into the foreground the impact that software personalization activities have over private companies. A significant constraint was relevant to the inclusion or exclusion of companies in the study, a total of 42 companies analyzed were excluded when it was found that in their annual reports it was not clearly mentioned that companies carry out software personalization activities. However, having as starting point 21 companies, the assumptions mentioned above have been verified.

The study reveals that both revenues and expenditures on software customization activities have in most cases values above 20% of the total values reported. Regarding the profitability of the software personalization activities, it has been observed that in more than 71% of cases these activities are profitable and summing up

the companies that conducted this type of activities have considerable chances to be profitable. For developing software personalization activities, it has been demonstrated that the most important capability is the human resource together with its related expertise. Also, it was demonstrated that software personalization activities are positively influenced by investments in research and development.

A future study may consist in expanding the research base by adding a number of other companies that run software customization activities and the reassessment of the assumptions described above. The same hypothesis can be tested in a lager time scale. Last but not least, through mathematical calculations and econometric measurements it might be possible to determine the minimum threshold of the revenues or expenses generated by software personalization activities so that the profitability of the company remains positive.

REFFERENCES

1. Amber Road Inc, Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1314223/000131422316000021/ambr-1231201510xk.htm, [Accessed: 20.12.2016].
2. Andrei, T. (2008) *Introduction in econometrics using Eviews*, Economic House, Bucharest.
3. Blackbaud Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1280058/000128005816000045/a201510-k.htm, [Accessed: 20.12.2016].
4. Bottomline Technologies Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1073349/000119312516694935/d220707d10k.htm, [Accessed: 20.12.2016].
5. Broadsoft Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1086909/000108690916000021/bsft-20151231x10k.htm, [Accessed: 20.12.2016].
6. Cadence Design System, Annual Report 2015, retrieved https://www.sec.gov/Archives/edgar/data/813672/000081367216000040/cdns0102201610-k.htm, [Accessed: 20.12.2016].
7. Citrix Systems Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/877890/000087789016000184/ctxs12-31x201510xk.htm, [Accessed: 20.12.2016].

8. CommVault systems Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/ data/1169561/000116956116000029/a2016033110k.htm, [Accessed: 20.12.2016].
9. Da Silveira, G., Borenstein, D., Fogliatto, F.S (2001) *Mass customization: Literature review and research directions*, International Journal of Production Economics, 72 (2001), pp. 1-13.
10. Davis, S. (1987) *Future perfect*, Reading.
11. Gilmore, J.H., Pine, B.J. (1997) *The four faces of mass customization*, Harvard Business Review, 75. pp. 91-101.
12. Guidewire software Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1528396/000152839616000056/gwre-7312016x10k.htm, [Accessed: 20.12.2016].
13. HubSpot Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1404655/000156459016013204/0001564590-16-013204-index.htm, [Accessed: 20.12.2016].
14. Maarten ter Harmsel, (2012) *Mass customization as a solution for the Service Industry*, University of Twente.
15. Medidata Solutions Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/ data/ 1453814/000145381416000174/a10-kxq42015.htm, [Accessed: 20.12.2016].
16. MicroStrategy Inc, Raport Anual 2015, https://www.sec.gov/Archives/edgar/data/1050446/000119312516479811/d102713d10k.htm, [Accessed: 20.12.2016].
17. Netsuite Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1117106/000111710616000050/a2015netsuiteform10-k.htm, [Accessed: 20.12.2016].
18. Paylocity Holding Corporation, Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1591698/000110465916139345/a16-12777_110k.htm, [Accessed: 20.12.2016].
19. Pine, B.J. (1993) *Mass customization: the new frontier in business competition*, Harvard Business Press, 1st Edition.
20. PTC Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/857005/000085700516000071/ptc9-30x1610xk.htm, [Accessed: 20.12.2016].

21. QAD Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1036188/000156761916002175/h10035677x1_10k.htm, [Accessed: 20.12.2016].
22. Red Hat Inc. Annual Report, (2015). Retrieved from https://www.sec.gov/Archives/edgar/data1087423/000119312515153023/d836093d10k.htm, [Accessed: 20.12.2016].
23. SalesForce.Com Inc. Annual Report, (2015). Retrieved from https://www.sec.gov/Archives/edgar/data/1108524/000110852415000008/crm-2015131x10k.htm, [Accessed: 20.12.2016].
24. ServiceNow Inc. Annual Report, (2015). Retrieved from https://www.sec.gov/Archives/edgar/data/1373715/000137371516000324/now-20151231x10k.htm, [Accessed: 20.12.2016].
25. Splunk Inc., Annual Report 2015, retrieved from https://www.sec.gov/Archives/edgar/data/1353283/000135328316000033/a01311610k.htm, [Accessed: 20.12.2016].
26. Tyler Technologies Inc, Raport Anual 2015, https://www.sec.gov/Archives/edgar/data/860731/000156459016013137/tyl-10k_20151231.htm, [Accessed: 20.12.2016].
27. Ultimate Software Group Inc, Raport Anual 2015, https://www.sec.gov/Archives/edgar/data/1016125/000101612516000168/ulti-20151231x10k.htm, [Accessed: 20.12.2016].

„Discovery is seeing what everybody else has seen, and thinking what nobody else has thought."
Albert Szent-Gyorgi

The Principle of Diversity in Management

Cristina Elena Bîgioi (1), Adrian Doru Bîgioi (2)

(1) University POLITEHNICA of Bucharest, Romania, (2) University of Economic Studies, Bucharest Romania

Abstract

The issue debated in various articles, the gender inequality is an old problem, considered in corporate governance. The business world is dominated by men, despite women's progress. The purpose of this article is to analyze the principle of diversity, more exactly the inequality among people who form the board of directors of companies listed on the stock exchange in Romania. The inequality is monitored for 30 companies on three levels: nationality, age, and gender. The research is based on analysis of documents published on the website of the sample companies that refer to August 31, 2016. Study results show that the structure of governing bodies in the number of women is less than men, there are very few people over the age 60 years and in foreign owned companies dominate people of foreign nationality. The principle of diversity in terms of a balance between men and women, Romanian and foreigners, young and old, is not respected by selected companies.

Keywords: performance, board of directors, directorate, inequality

Introduction

In the European Union, equality between women and men is a fundamental value that is reflected in all EU policies and projects. However, there are considerable differences between men and women in terms of risk of poverty, labor market occupancies, political power, and access to education.

According to the European Index of Gender Equality (2015) issued by the European Institute for Gender Equality, based on data from 2005, 2010 and 2012, Romania

„All too often, a successful new business model becomes the business model for companies not creative enough to invent their own."
Gary Hamel

* Correspondence to Cristina Elena Bîgioi: cristina.dumitru@upb.ro

is the EU country with the highest inequality of gender recorded on: positioning on the labor market, economic situation, financial resources, education, work-leisure ratio, representation in political structures, health status and access to health structures. Moreover, both intervals analyzed, Romania Gender Equality Index was declining. The EU believes that, in terms of social justice and democratic, balanced gender representation in positions of power is essential. Men are the majority of the EU countries in the political, economic, banking. Women are underrepresented in decision-making positions, particularly in management bodies of central banks. In the period 2005-2012, the representation of women in economic structures has the highest growth, the gap decreasing by 12%. The greatest progress was made in the presence of women in boards of companies listed on stock exchanges.

A survey conducted in 2011 at the request of the European Commission shows that most Europeans share the view that women should be equally represented in the management of the company (TNS Opinion&Social, 2011). In November 2012, the European Commission presented a legislative proposal that women hold at least 40% of the positions of non-executive directors of listed companies (European Commission, 2016).

Given the concern for gender inequality, we aim in the study proposed to analyze whether there is gender inequality in the boards of directors for companies listed on the stock exchange in Romania at the end of 2015.

Literature Review

The performances of the organizations are the result of mobilizing resources they have, primarily of the human resources. In this context and to face an increasingly fierce competition environment, managers explore all methods for flexibility and adaptation to internal and external requirements of the organization (Ionescu, 2014).

More than ever, perhaps, the focus should be on the quality and flexibility of human resources, as long as, in quantitative terms, the human resources have not recorded an increase (Nicolae, 2010).

But in these conditions, phenomena like school dropout, inefficient vocational training, and gender inequality when it comes to career development are still present. Entrepreneurship development in Romania tried indirectly to offer solutions to these problems by providing opportunities for human resource development on their own. Furthermore, entrepreneurship is a conscious choice of the „special" human resources which have vision, gut-feeling, and perseverance. These people improve the parameters of the economic engine and create wealth in the field in which they operate (Nicolae, 2015).

Presence of women in the leadership structures has been the subject of various studies and research nationally and especially internationally.

Within the banking system from Romania, women are „under-represented" at the level of board directors, whether they are banking companies as a member of multinational holdings, whether they are credit institutions with local/mixed capital (Turlea & Nedelcu, 2015).

In developing economies, the number of women in management structures is higher in small companies, which tend to be controlled by the family. A study undertaken taking into account 92.4% of companies quoted on the stock exchange in Indonesia do not indicate an association between the number of women in management structures and the performance of the entity (Darmadi, 2010).

In studies conducted the authors sought to identify the added value brought by the presence of women in management structures. Financial performance was shown to be higher for Dutch companies that have women directors than those who do not have women in leadership structures (Lückerath-Rovers, 2010).

Women have a different style of leadership. Their presence on the boards of Norwegian companies increases the council's efficiency by reducing the level of conflict and ensuring high quality of the council's activities (Nielse & Huse, 2010).

400 leaders of companies worldwide consider that reducing the gender gap depends on, in this moment, less education and more of how men and women manage to work together and create a working atmosphere in which to develop all talents personal. Everyone stands to gain if women remain engaged in their careers and contribute to increasing the economic value of companies (Ernst&Young, 2015). The study identifies three steps to accelerate gender equality: improving women's access to positions of leadership, accelerate cultural change by changing organizational policies, elimination of realized and unconscious prejudices.

The motivation of the staff to achieve organization's objectives can only be performed by a set of concerted policies and actions, both financial and non-financial that meets the aspirations of employees, their needs for personal development, esteem and self-realization (Ionescu, 2014).

Schmid & Urban (2016) conducted a larger study which considers 53 countries that demonstrated very clearly that where there is a mandatory share, the presence of women in leadership increases firm value. The stock market reacts more negatively to withdrawals of female board members compared to male counterparts. The impact of women's presence on firm value differs from country to country; the impact is greatest where the presence of women in leadership is less common. Overcoming difficulties on the way to leadership demonstrates the women's skills which then determine the company's value growth. In countries with the rigorous selection, women compared with men shows a greater ability in terms of education and social connections. The study also mentions a small rise from 8% to 9% of women in management structures during 1998-2010.

Several countries, including Norway, Italy, Belgium, France, Iceland, and Germany have introduced the legally binding presence of women on the board of directors, failure to regulate attracting removal company in Norway. Introducing mandatory quota on the number of women in management in Norway in 2006 reduced the short-term profitability and increased employment of labor. Profits were reduced because of labor costs due to fewer layoffs and greater occupancy (Matsa & Miller, 2012).

Bianco, Ciavarella & Signoretti (2013) identified two models, analyzing the presence of women in management structures in Italy before the introduction of the mandatory considering the listed companies in 2008-2010. In the majority of diverse boards at least one of the women has a family connection with the controlling shareholder, more frequently found in smaller companies, firms with a concentrated ownership, businesses that operate in the consumer sector and those with larger boards. By contrast, unaffiliated women are more common in widely held companies, companies with younger and more highly educated boards, those with a higher proportion of independent directors and those with fewer „connected" directors. With reference to governance-related outcomes, the number of board meetings is positively correlated with the presence of women on boards, while no difference is found between male and female directors in board meeting attendance.

Carrasco et all (2015) test for 32 countries if the variation in the number of women in management structures can be attributed to differences in cultural contexts between contries. The results show that countries that have the highest tolerance for inequality in the distribution of power, and those who tend to value the role of people show generally a lower representation of women on boards.

Gyapong et all (2015) analyzed 245 companies listed in South Africa in 2008-2013 and identified a positive relationship between firm value and gender and ethnic diversity. Company value is greater when there are at least three women in leadership. In companies with good governance, ethnic diversity has a value more relevant than gender diversity. The financial crisis is associated with a tendency to restructure the leadership in terms of gender and ethnicity.

The differences between women and men in decision-making and leadership can be classified into three broad categories (Patel, 2013): personal differences, professional differences, and risk response. Personal differences relate to low confidence of women in financial matters, women show a greater social sensitivity, emotional intensity greater for women, especially in adverse situations (respond emotionally, a contrast to the men), men are more optimistic. Professional differences refer to making decisions that involve money or valuables.

It showed that women invest less in risky assets (Charness & Gneezy, 2012) and fear of competition (Niederle & Versterlund, 2007). The risk response differs for women. Women estimate higher probabilities of winning and lower probabilities of losing risky thing.

According to Article 142 of Law 31/1990 of Romania, the role of the Board is to accomplish all documents „necessary and appropriate to achieve the objects of the company, except those reserved by law for the general meeting of shareholders." The Board of Directors has the following attributions:

a) determining main directions of activity and development of the Company;
b) establishing accounting policies and financial control system and approving the financial planning;
c) the appointment and removal of directors and determining their remuneration;
d) supervising Director's activity;
e) preparing the annual report, organizing a general meeting of shareholders and implementing their decisions;
f) the filing for insolvency procedure for the society.

The constitutive act may stipulate that a corporation is managed by a directorate and a supervisory board. Leadership rests exclusively of directors, which meets the documents necessary for the objects of the company, except those reserved by law for the supervisory board and general meeting of shareholders.

The duties of the Supervisory Board are:

a) exercise permanent control over the management of the company by the directorate;

b) appoint and dismiss members of the directorate;
c) verify compliance with the law, the Articles of Association and the decisions of the general assembly operations leading society;
d) report General Meeting of Shareholders on the surveillance activities.

The constitutive act sets the term of office of directors, directorate members, members of the supervisory board, the maximum duration is 4 years. A person may exercise simultaneously up to 5 warrants for administrator and/or member of the supervisory board in joint-stock company with headquarters in Romania. A corporation that is required to audit the annual financial statements must have at least 3 directors, at least 3 members of the Executive Board and between 3 and 11 members of the supervisory board.

Data and Research Methodology

The purpose of the article is to identify inequality (of gender, nationality, and age) in the management structures (board of directors) of entities listed on the stock exchange in Romania. Steps to achieve the objective consist in: identify the entities that will be analyzed, a collection of data required, data analysis, formulating conclusions.

The research methodology consists of direct observation; data necessary for the study were drawn from the information or documents published on websites of the analyzed entities and refer to the current situation at 31.08.2016. The information required to be identified refers to the composition of the Board of Directors, following the group members in three respects: age, nationality, gender. Data were collected for a sample of 30 entities, representing 8.7% of the total of 345 joint stock companies listed on the Bucharest Stock Exchange. 6 of the 30 selected companies have majority foreign capital.

From processing the data obtained through direct observation of the information published on the official internet pages of the entities under review, the following issues were noted.

Gender inequality. In the case of entities that are part of the sample, the lack of women is noticed in 8 entities, and for other 22 entities representation of women is minimum 14% and maximum 75% (in just 4 companies women have a representation of over 50%). The highest rate of profitability (ratio between profit and turnover) is recorded by an entity that meets the most gender equality (42.86% women).

Within the sample of 30 selected companies, there are 156 members of the boards, of which 39 are women. Thus, overall, the percentage of women is 25% within the management structure, according to Table 1.

Table 1 – *Percentage of women in the Board of Directors*

	Men	Women
Total members	117	39
Percentage	75%	25%

(Source: The authors, based on the research)

In percentages, the presence of women is slightly higher for companies with Romanian capital (25.64%) compared to entities with foreign capital (23.08%), as shown in Figure 1:

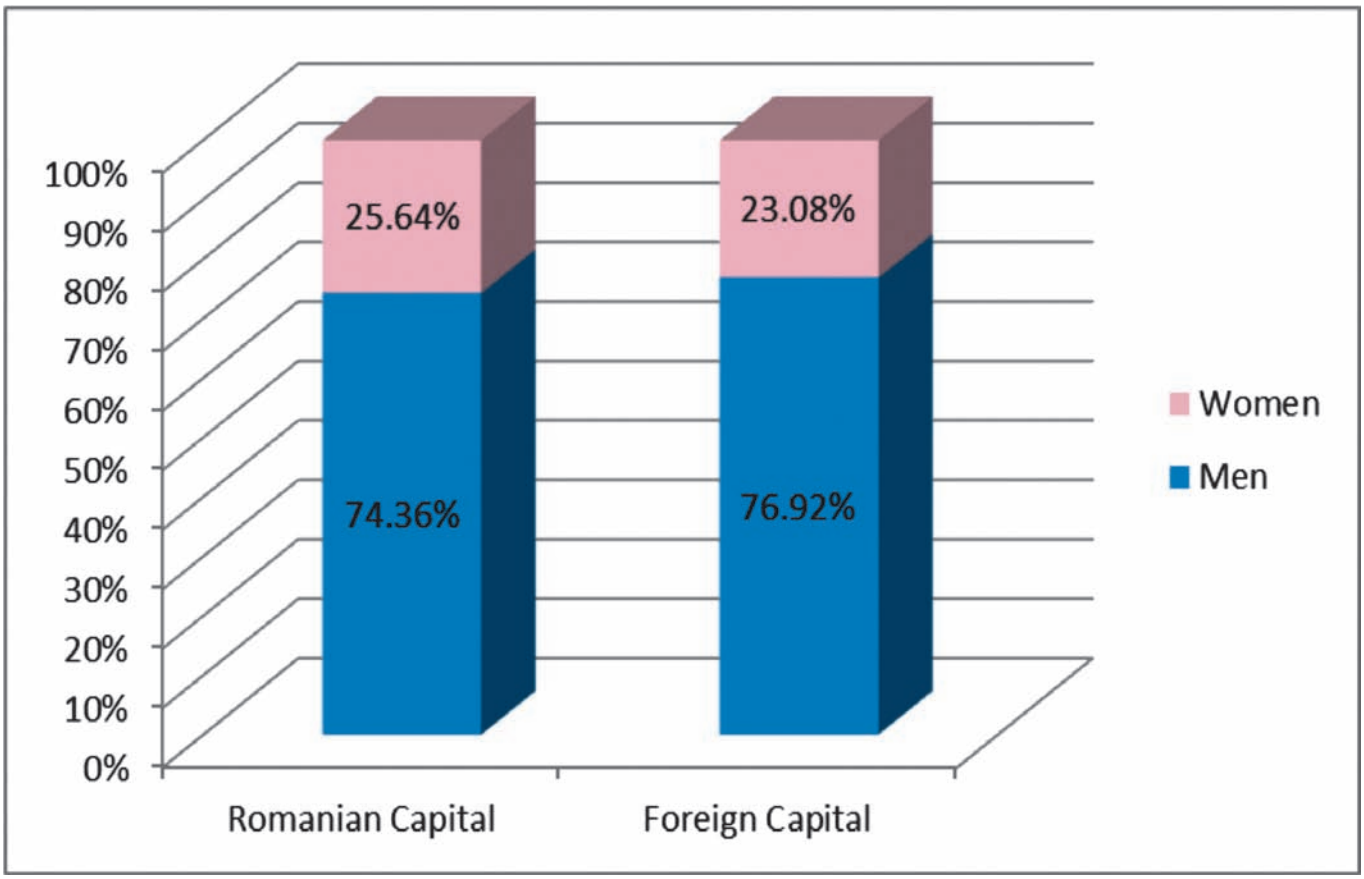


Figure 1 – *Distribution of members by gender*

In the case of entities with foreign capital, the presence of women is zero for two entities, for two entities the gender inequality is imperceptible and for an entity, Male/Female ratio is 1/6. The absence of women in the board is distinguished in 6 entities with Romanian capital (25%). The composition of Board of Directors depending on affiliation capital is presented in Table 2.

Table 2 – *Gender inequality depending on capital*

	Romanian capital	Foreign capital
Men	87	30
Women	30	9

Inequality on nationality. 19 entities have not people of foreign nationals on the Board of Directors. There are two entities that comply with the nationality equality equally but have different profitability. It can not be identified a correlation between profitability and equality on the nationality of members of the Board. In terms of nationality, the majority of people in leadership structures are of Romanian nationality (127 people out of 156), according to the distribution shown in Table 3.

Table 3 – *The distribution of people by nationality*

	Romanian capital	Foreign capital	Total
Romanian	109 (93.16%)	18 (46,15%)	127
Foreigner	8 (6.84%)	21 (53.85%)	29
Total	117	39	

Concerning companies with Romanian capital, over 93% of people are of Romanian nationality, while for companies with majority foreign capital percentage for Romanian citizens is around 46% (Figure 2).

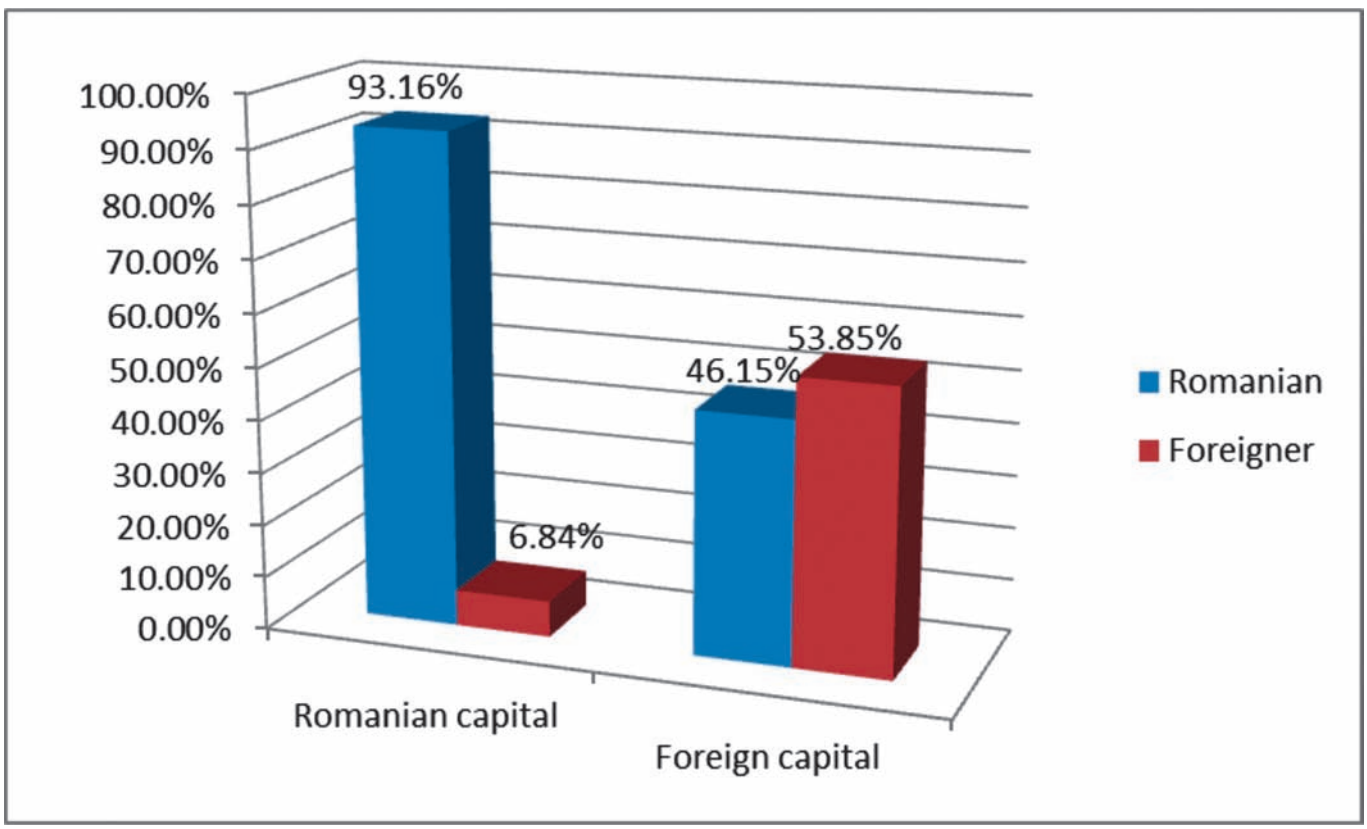


Figure 2 – *Distribution by nationality*

In the group of six entities with foreign capital the following aspects are distinguished:

- all members of an entity are of foreign nationals,
- all members of an entity are of Romanian nationality,
- an entity has more than 70% of members of foreign nationals,
- three entities have under 50% members of foreign nationals.

In the group of 24 entities with Romanian capital, only in 7 cases there are members of foreign nationals, representing a share less than 45%.

Inequality on age. Regardless of the origin of the share capitalis distinguished preponderance of people aged between 50 and 60 years. There is a poor representation of people over 60 and nearly nonexistent for people under 30 years. There is no entity with members in every 5 intervales. The greatest profitability is obtained by an entity with board members in each of the last 4 intervals. The only entity with all members over 60 years, is still reaching profitability.

The entities with Romanian majority capital have about the same number of people in three age intervals. There is only one person aged less than 30 years and one Romanian capital entity that has all board members last age range (over 60 years). There are two companies with foreign capital with person framed in the last age range. Table 4 shows the number of people grouped into 5 age intervals.

Table 4 – *The distribution by age*

	<30	30-40	40-50	50-60	>60
Romanian capital	1	32	31	34	19
Foreign capital	0	8	14	15	2
Total persons	1	40	45	49	21

Percentage distribution by age range is presented in Figure 3:

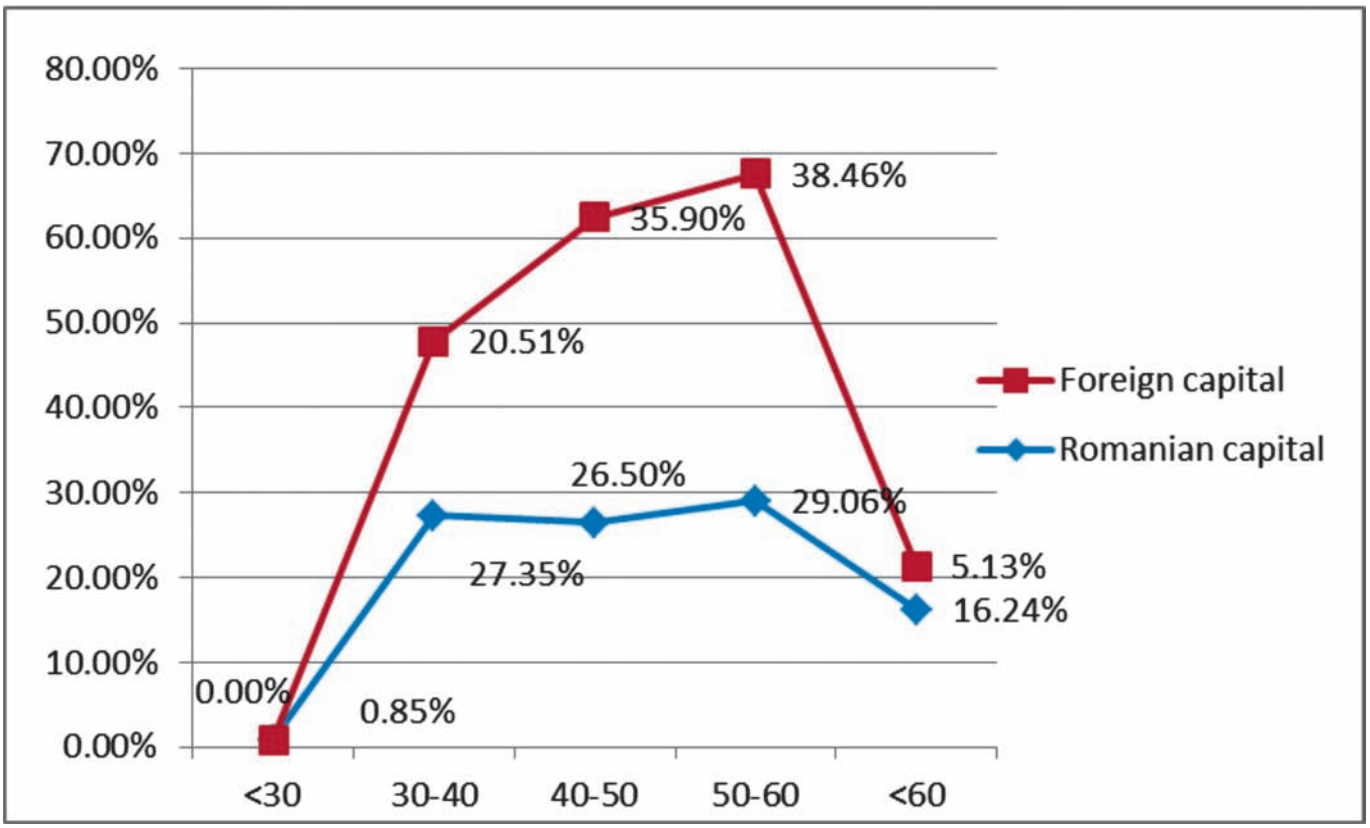


Figure 3 – *The percentage distribution by age categories*

Conclusions

After analyzing the results obtained, we found that the companies selected respect partially the principle of diversity. The presence of women on boards is only 25% of all members. There are some companies with a board composed exclusively of men, but no one company has only women. Regardless of the origin of the share capital, women have the same low representation.

The number of foreigners in Board of Directors is lower than the number of Romanians. The foreigners represent only 22% of the number of members. In companies with Romanian capital, the percentage of foreigners is smaller, while in companies with foreign capital, the percentage of Romanians is smaller, but the ratio Romanians/foreigner is much lower in the latter case.

In terms of age, people under 30 years are almost nonexistent, and those over 60 years are underrepresented. We believe that the entities must take into account the principle of diversity in management.

A possible future research could consider extending the analysis to all companies listed on the stock exchange in Romania.

REFERENCES

1. Bianco, M., Ciavarella, A. & Signoretti, R. (2013) Women on Corporate Boards in Italy. *Bank of Italy* Occasional Paper No. 174. Available at http://dx.doi.org/10.2139/ssrn.2297407. [Accessed: 18.02.2017]
2. Carrasco Gallego, A., Francoeur, C., Labelle R., Laffarga, J. & Ruiz-Barbadillo, E. (2015) Appointing Women to Boards: Is There a Cultural Bias? *Journal of Business Ethics,* Vol 129. Available at http://ssrn.com/abstract=2643861. [Accessed: 18.02.2017]
3. Charness, G. & Gneezy, U. (2012) Strong Evidence for Gender Differences in Risk Taking. *Journal of Economic Behavior & Organizations*, no. 83, pp. 50-58.
4. Darmadi, S. (2010) Do Women in Top Management Affect Firm Performance? Evidence from Indonesia. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1728572 [Accessed: 18.02.2017]
5. Ernst Young (2015), Women. Fast forward. The time for gender parity is now. Available at www.ey.com. [Accessed: 18.02.2017]
6. European Institute for Gender Equality (2015), Gender Equality Index – Report, Available at http://eige.europa.eu/sites/default/files/documents/mh0215616enn.pdf. [Accessed: 18.02.2017]
7. European Commission (2016). Report on equality between women and men. Available at http://ec.europa.eu/justice/gender-equality/files/annual_reports/2016_annual_report_2015_ web_en.pdf. [Accessed: 18.02.2017]

8. Gyapong, E., Monem, R. & Fang, H. (2015), Do Women and Ethnic Minority Directors Influence Firm Value? Evidence from Post-Apartheid South Africa. *Journal of Business Finance and Accounting*. Available at http://ssrn.com/abstract=2707147. [Accessed: 18.02.2017]
9. Ionescu, M, (2014). The role of the budgetary system in achieving entreprise performance. *Manager Journl*, no 19, pp. 98-108. Available at http://manager.faa.ro/en/article/The-Role-Of-The-Budgetary-System-In-Achieving-Enterprise-Performance~779.html. [Accessed: 18.02.2017]
10. Ionescu, S.C., (2011), Introducere în management (engl. Introduction to Management), Politehnica Press Bucharest.
11. Luckerath-Rovers, M. (2010) Women on boards and firm performance. *Journal of Management & Governance*, Volume 17, Issue 2, pp. 491-509.
12. Matsa, D. & Miller, A. (2012) A Female Style in Corporate Leadership? Evidence from Quotas. *American Economic Journal: Applied Economics,* Vol 5, No 3.
13. Nicolae, S. (2010) The Knowledge Based Society – Myth or Reality for Romania, *Communications of the IBIMA,* Available at http://www.ibimapublishing.com/journals/CIBIMA/cibima.html. [Accessed: 18.02.2017]
14. Nicolae, S. (2015) The Profile of users of educational services in the field of entrepreneurship. *The international conference in economics and administration, ICEA-FAA 2015*, Available at http://icea-conference.eu/icea/wp-content/uploads/2015/07/FF_FINAL_ 31mai_ICEA-2015.pdf._[Accessed: 18.02.2017]
15. Niederle, M., & Versterlund, L. (2007) Do Women Shy Away from Competition? Do Men Compete too much? *Quarterly Journal of Economics*, 122(3), pp. 1067-1101.
16. Nielsen, S. & Huse, M. (2010) The contribution of women on boards of directors: going beyond the surface. *Corporate Governance: An International Review*, Vol. 18, No. 2, pp. 136-148.
17. Patel, G. (2013). Gender differences in leadership styles and the impact within corporate boards. Available at http://www.cpahq.org/cpahq/cpadocs/Genderdiffe.pdf. [Accessed: 18.02.2017]
18. Schmid, T. & Urban, D. (2016) Women in Corporate Boards: Good or Bad? AFA Meeting Paper. Available at http://dx.doi.org/10.2139/ssrn.2344786. [Accessed: 18.02.2017]
19. TNS Opinion&Social, (2011). Women in decision making positions. Available at http://ec.europa.eu/public_opinion/archives/ebs/ebs_376_en.pdf. [Accessed: 18.02.2017]

20. Turlea, E. & Nedelcu, M. (2015), Studiu privind prezența femeilor în componența consiliilor de administrație. (engl. Study on the presence of women in the composition of boards of directors). *Audit financiar* no 2 (122), pp. 34-42.
21. Law no. 31/16.11.1990 of Commercial Companies. *Monitorul Oficial al României*, partea I, 14 april 2009.

FAIMA
Business & Management Journal
A quarterly review

UNIVERSITATEA POLITEHNICA DIN BUCUREȘTI
FAIMA
FACULTATEA DE ANTREPRENORIAT, INGINERIA ȘI MANAGEMENTUL AFACERILOR

Volume 5, Issue 1 March 2017

CREATION OF VALUE

NOWADAYS PEOPLE KNOW THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING.
OSCAR WILDE

GENERATING VALUE THROUGH PARTNERSHIPS
Roman Danel, Michal Řepka, Robert Amann

VALUE THROUGH CONTINUOUS IMPROVEMENT
Rajeev Chadha

OBTAINED VALUE THROUGH QUALITY INSPECTION
Fiorenzo Franceschini, Maurizio Galetto, Gianfranco Genta, Domenico Augusto Maisano

FAIMA
Business & Management Journal

A quarterly review

Volume 5, Issue 2 June 2017

COMPANIES RELATIONS

In the long history of humankind, those who learned to collaborate most effectively have prevailed.

CHARLES DARWIN

THE DEVELOPMENT OF RELATIONS THROUGH SOCIAL MEDIA
Antonín Pavlíček

THE BUSINESS VALUE OF INNOVATION MANAGEMENT
Titu-Marius Băjenescu

MEASURING THE TALENT OF THE EMPLOYEES
Reem Abi Abdallah

Topics in future issues of FAIMA Business & Management Journal

Governance and Management

Volume 6, Issue 1 – March 2018

Innovation Management

Volume 6, Issue 2 – June 2018

Challenges in Business Informatics

Volume 6, Issue 3 – September 2018

Perception Management

Volume 6, Issue 4 – December 2018