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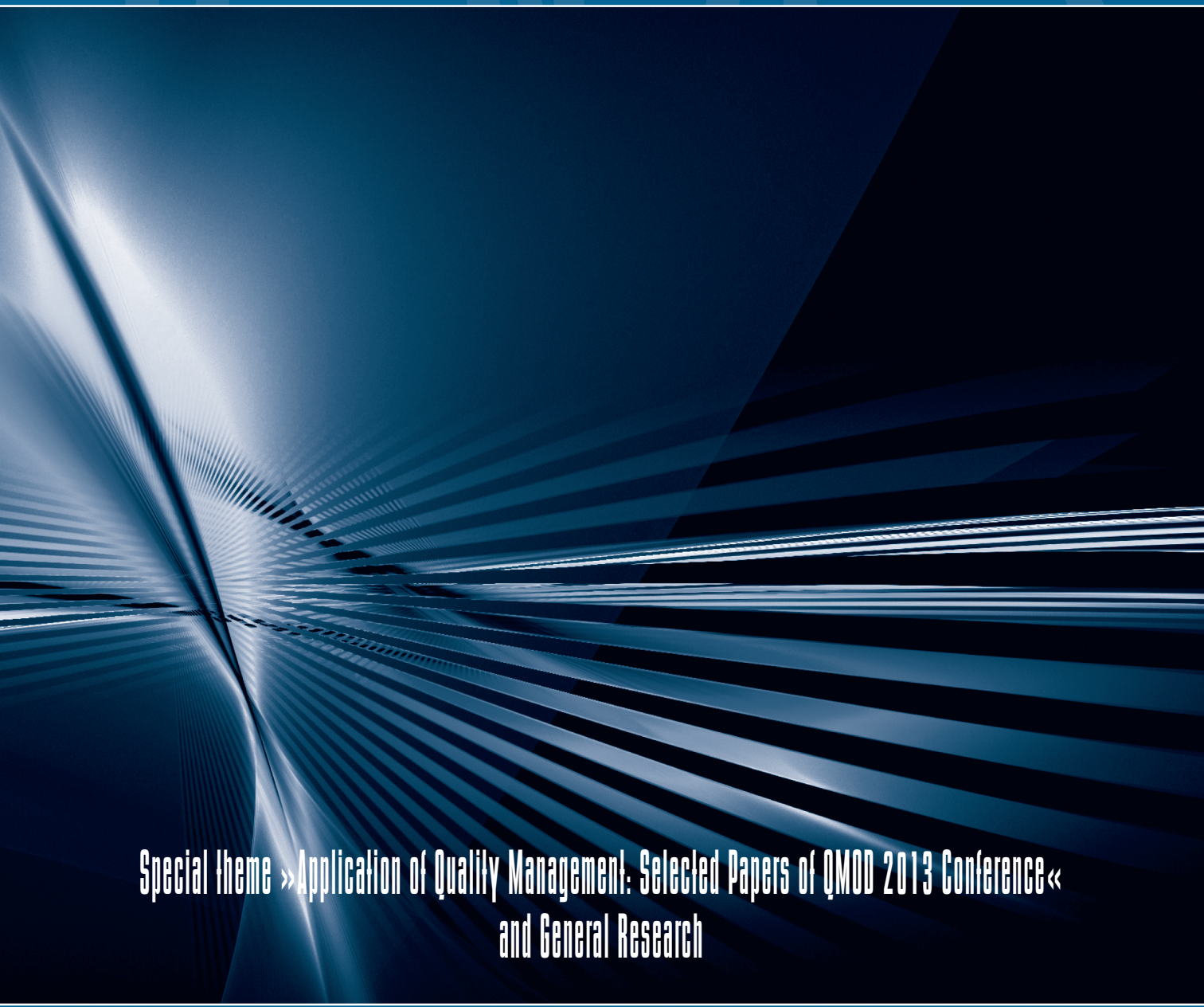

Special theme »Application of Quality Management: Selected Papers of QMOD 2013 Conference« and General Research

Revija za management, informatiko in kadre

ORGANIZACIJA

Organizacija is an interdisciplinary peer reviewed journal that seeks both theoretically and practically oriented research papers from the area of organizational science, business information systems and human resources management. Topics will be drawn from, but are not limited to, the following areas:

- organizational theory, development and restructuring of organizations;
- new and innovative organizational structures and approaches;
- managerial aspects of quality management;
- organizational behavior;
- human resources management;
- development, restructuring and management of information systems;
- interorganizational systems, electronic commerce;
- decision making, decision support.

In particular, we seek papers which cover state-of-art developments in organizational theory and practice, and present new insights that improve our understanding in the subject area of the journal

Organizacija je interdisciplinarna znanstvena revija, ki objavlja prispevke s področja organizacije, informatike in kadrovskega managementa. Primeri tematskih sklopov, ki jih pokriva revija, so:

- teoretične osnove organizacijskega razvoja ter spreminjanja organizacijskih struktur in procesov
- novi organizacijski pristopi ter njihova uporaba
- organizacijski ukrepi za doseganje večje produktivnosti, ekonomičnosti in rentabilnosti poslovanja in proizvodnje
- management kakovosti
- kadrovanje in izobraževanje kadrov pri prestrukturiranju podjetij
- stimulativnost nagrajevanja v spremenjenih lastninskih razmerah
- prestrukturiranje organizacijskih in informacijskih sistemov
- načrtovanje, razvoj in uporaba informacijske tehnologije in informacijskih sistemov
- medorganizacijski sistemi, elektronsko poslovanje
- odločanje, podpora odločanju, direktorski informacijski sistemi

Vsebina ni omejena na navedene tematske sklope. Še posebej želimo objavljati prispevke, ki obravnavajo nove in aktualne teme in dosežke razvoja na predmetnem področju revije, ter njihovo uvajanje in uporabo v organizacijski praksi.

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Editorial

The aim of the special issue »Application of Quality Management: Selected Papers of QMOD 2013 Conference" published in this issue of the Journal Organizacija is to present 5 selected papers presented at the 16th Quality Management and Organizational Development (QMOD) conference on Quality and Service Sciences ICQSS 2013 which was held in Portorož, Slovenia from September 4 to 6, 2013. The conference was organized by Lund University and Linköping University, hosted by University of Maribor.

Over 200 participants from 32 countries participated in the conference and 147 papers were presented – the following 5 were selected to be published in this special issue:

- *Christer Osterman and Anders Fundin*
  Exploring approaches how to measure a lean process
- *Ilija Djekic, Dragan Zivanovic, Sladjana Dragojlovic and Radoslava Dragovic*
  Lean manufacturing effects in a Serbian confectionery company – Case Study
- *Beata Starzyńska*
  Practical Applications of Quality Tools in Polish Manufacturing Companies
- *Marlene Paula Castro Amorim, Maria João Rosa and Sandra Santos*
  Managing customer participation and customer interactions in service delivery: the case of museums and educational services
- *Damjan Maletič, Matjaž Maletič, Viktor Lovrenčič, Basim Al-Najjar, Boštjan Gomišček*
  An application of analytic hierarchy process (AHP) and sensitivity analysis for maintenance policy selection

The special issue includes papers dealing with a wide area of quality management and application of its distinct approaches, methods and tools as they were experienced in different European countries.

The readers will find information as well some practical advices how to implement the selected themes of quality management, as follows:

- *Measuring the implementation of lean in a process and some key factors for a successful implementation of standardized work and problem solving methods on group level;*
- *Evaluation of effects of implementing lean manufacturing in a confectionery production company, emphasizing observed benefits and constrains;*
- *Application of tools and techniques of quality management in manufacturing companies at distinct stages of the production process;*
- *Research on determinants of customers' quality perceptions in service processes in order to explore relevant quality aspects/dimensions related to the performance of customer participation and customer to customer interaction;*
- *Application of an analytic hierarchy process for the evaluation/ selection of maintenance policy with the purpose of structuring the decision making process.*

The guest editors are confident that the selection of the included papers and topics will help other researcher to find stimulation for original research work as well as encourage companies to implement presented approaches and methods to benefit from the research work already performed by the contributing authors.

We would like to thank the esteemed authors for their effort as well as Journal Organizacija for showing the interest in the research work presented at the QMOD 2013 conference and the fruitful cooperation with the editors of the Journal Organizacija – we hope we have put together a collection of selected papers that will satisfy the high demand for quality research of the Organizacija`s readers and community.

The Guest Editors
Su Mi Dahlgaard-Park
Jens J. Dahlgaard
Boštjan Gomišček

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Exploring Approaches How to Measure a Lean Process

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Purpose: The purpose of the research is to explore a practical method of measuring the implementation of lean in a process. The method will be based on examining the abilities of a group. At this scale the ability to work standardized and solve problems is important. These two abilities are dependent of each other and are fundamental for the group's ability to create a stable result. In this context the method of standardized work (SW) is define to be the methods used in a process to generate stable results. Problem solving (PS) is defined as the methods used to return a process to a condition where SW is possible.
Methodology / approach: The research is conducted in a multiple case study in four large global manufacturing companies. The order of the data collection is: Firstly, interviews with the individuals that are centrally responsible for overall implementation of lean in the organization. Secondly, observe the implementation of SW and PS at the group level. In total 7 groups have been studied and 19 respondents interviewed.
Findings: Results show that the central definition of the methods for *standardized work* does not by itself have a direct impact on success of implementation of SW at group level. The method of SW where similar on a general level in the different cases, but with varying levels of implementation at group level was applied. Results also show that key factors for a successful implementation of *standardized work* on group level are: Ownership of the process, Direct connection to result of process, Correct workload and Leader demand. Methods of PS at group level where dissimilar despite a superficially similar approach. The evaluation method used was successful in providing comparable results between the cases.
Research limitations: A limitation of this research is within the scale of the measurement, as it only examines the group level. The research is further limited to four companies and seven groups.
Originality/value of paper: This paper aims to fill a gap in the established measurement methods of lean, as it examines the abilities of SW and PS at the group level of a process. These abilities are often referred to as essential in lean theory. However, there has been little scholarly work in defining the methods of SW and PS or the key factors affecting the methods at an operational level.

Keywords: Lean, Performance measures, Problem solving, Standardized work, Stability

1 Introduction

Lean production has spread across the world the last few decades. Various organizations have tried to implement the tools and systems over the years, with mixed results (Emiliani and Stec, 2005). The definition of lean as a concept is not always clear, however. In his review of contemporary literature on lean, Pettersen (2009) concludes that:

"*There is no agreed upon definition of lean that could be found in the reviewed literature and the formulation of the overall purpose of the concept are divergent. Discomforting as this may seem for lean proponents, there seems to be quite good agreement on the characteristics that define the concept, leading to the conclusion that the concept (lean) is defined in operational terms alone*".

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The methods used to measure the application of lean are equally diverse. However, there are several indicators and methods being proposed. A common approach are ways of measuring value flow and waste as popularized by the book "Learning to see" by Rother (1999). Another way of evaluating is to measure the application of lean methods. This can be done with, for example, an assessment system following a graded checklist were the application of different methods are assumed to lead to a more efficient process (Bhasin, 2011).

One commonly used assessment model is developed by Karlsson and Åhlström (1996); the researchers operationalize principles of lean production by identifying nine variables of lean implementation. These variables are of importance as they give a review of the progress in introducing lean production from both a Managers and a Strategy perspective. In this they assume an implicit connection between lean production and enhanced performance (Karlsson, 1996). In the challenge of measuring lean, there are also methods that consider more holistic perspectives, such as Dynamic multi Dimensional Performance (Bhasin, 2008), while the method derived from the research work by Karlsson and Åhlström (1996) can be used either with a systems perspective or with a top down approach.

With the purpose of complementing previous research, current study aims to evaluate a method that also is able on an *operational* level. The method is tested through case studies to ensure that the results are comparable and can be analyzed to find patterns and key factors.

The idea of a method for evaluation on an operational level is based on the actual application of fundamental methods of lean. Common for most lean implementation is the attempt to continuously improve (Monden, 2012; Wilson, 2010). In order to successfully do so, there has to be a stable situation from which to improve. Using the words by Jeffrey Liker, "*One must standardize, and thus stabilize the process, before continuous improvements can be made*" (Liker, 2004). In line with Liker, Rother (2010) put forward that , "*If a process is not stable, you will need to address this before trying to make other improvements, because without a stable process, further improvements will not stick"*(Rother, 2010).

Based on above reasoning, one of the most common methods used to achieve stability in a process is in this current study referred to as *Standardized Work* (SW), see for example Liker and Meier (2007). The main method used to respond to process variation is here referred to as *Problem Solving* (PS) The connection between the two methods is explored in the book *The evolution of a manufacturing system at Toyota* (Fujimoto, 1999), where the ability to solve problems at all levels is connected to the ability to create and follow standardized operating procedures.

Hence, as a mean to further explore lean evaluation methods on operational level, the research questions explored in this paper are:

1. How can methods of PS and SW be applied to measure lean in a process?
2. What key factors have impact on the success of the application of SW and PS in a lean process?

2 Theoretical framework

SW and PS have to be defined in operational terms. Therefore three different perspectives are examined in describing how a group operates. The individuals contribution to the results of a process is fundamental (Liker and Meier, 2007). Developing the skill and commitment of individuals and at the same time promoting group work and effectiveness are keys to success. According to Liker, "*Excellent individual performers are required to make up teams that excel"*(Liker, 2004). In line with Liker, but with other words, Taichi Ohno uses the analogy of a boat rowed by eight men to explain the connection between individual effort and group performance (Ohno, 2013).

Equally emphasized is the role of a proper leadership in lean, see Liker (2004). Developing people and groups is one of the leaders primary tasks (Liker and Hoseus, 2008). Therefore, a leadership perspective is added to the perspectives of the individual and the organization. Hence, three perspectives are considered.

- *The Individual* within the group. The methods and conditions necessary for an individual to perform well within a group.
- *The Organization*. How individuals in a group work together.
- *The Leadership* of a group. How you train and support people.

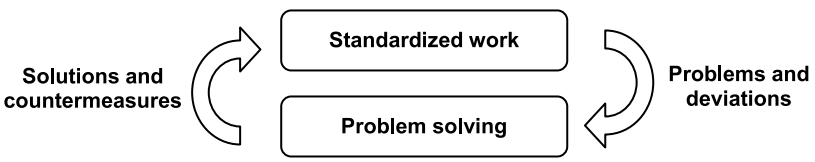

Figure 1: Connection between Standardized work and Problem solving

A further factor that has to be considered together with the three perspectives above, is the connection between the methods of SW and PS. The following model is proposed, see Figure 1.

The purpose of SW is to provide a collection of methods to assure safety and reliability of a process. The term *Standardized Work* can be misleading when mixed-up with the term *Standard*. Standard is here defined as a specific method within SW.

PS is in the current study defined as the methods used to return a process to a condition were SW is possible if there is a problem or the process is unstable (Liker and Hoseus, 2008).

3 Research methodology

The following chapter describes the how the case study protocol is designed, as well as contextual considerations. Before the main study, a pilot study was conducted in order to verify the case study protocol.

3.1 Design of the case study protocol

A particular problem when designing the protocol is how to handle lean "jargon". The case study protocol is therefore based on the *purpose* of SW and PS. This provides general questions applicable in any process working with lean. The definition of the *purpose* and the subsequent formulation of the questions used in the case study protocol, are derived from first author's 11 years of experience in the application of lean as well as from theory.

The questions are then grouped accordingly:

1. Methods that are directly connected to how the Individual within the group performs a certain task in SW or PS.
2. Methods that are connected to how SW and PS is Organized within the group.
3. Methods that are connected to group Leadership.

Although there is a number of papers and books describing SW and PS on a theoretical level, very little scholarly work capture the details of the methods. This is a problem addressed by Olivella et al. (2007), "*LP [Lean production] theory has mostly been spread by the publication of Monden (1983), Ohno (1988) and Womack et al. (1990), whereas LP practices have been diffused by former Toyota engineers."(Olivella et al., 2007)*.

The questions are further divided into aspects, to ensure that the answers are possible to compare between cases. Aspects are defined to be specific parts of the methods for SW and PS. In the case study protocol these aspects are based on experience of the first authors in the application of SW and PS as well as existing audit protocols. This gives the cases a common reference to ensure comparability. These aspects are intended to be answered with Yes, No or Not Applicable ("-") if the aspect was irrelevant in that particular case, see Table 1.

3.2 Contextual considerations

The main focus of the study is on the *application* of the structure for standardized work and problem solving methods at group level, as it is defined by the lean support function, see Figure 2.

Application is defined as: The method that is used by the group for SW and PS.

Use is defined as: The usage of the information described *in* the method.

The study used to verify the measurement method is based on four large Swedish companies. The cases are anonymised for the confidentiality of the participating companies and people, as suggested by (Yin, 2009), and will be

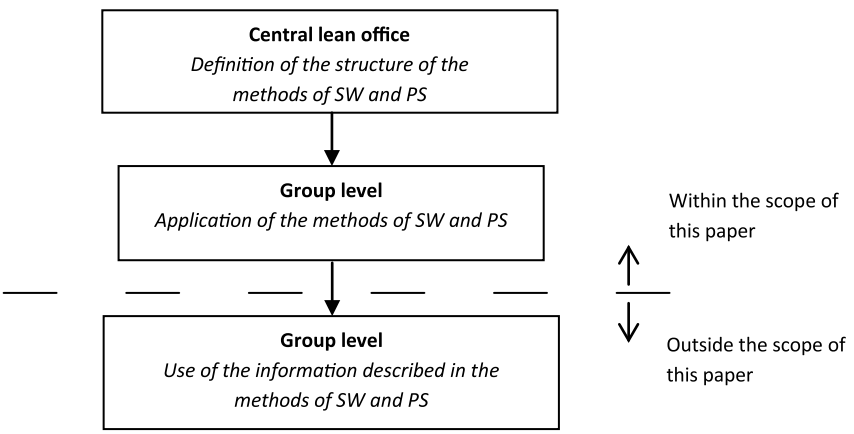

Figure 2: Contextual considerations: Application and use

further introduced in the data section below as Case A, B, C and D.

The study is a multiple case study, as defined by Yin (2009), with a mixed methods approach inspired by Creswell (2009). Moreover, as suggested by Yin (2009), the underlying methods of SW and PS were organized in a case study protocol to ensure reliability and to provide a quantitative approach. Data was collected using observation of the application of SW and PS on the group level. The case study protocol was also used for semi structured interviews, see Bryman (2008), in which the people working in the process are asked to exemplify how the application of SW and PS worked within their context. The answers given were written as a comment directly linked with the aspect.

In all cases in the process, every person that was interviewed in the groups was asked to exemplify and show real cases of the application of SW and PS within their process to ensure the validity of the answers. All standards and problem solving methods observed were real standards used in production and real problems that had been solved by the groups. The examples are evaluated based on first author's experience of the topic. This, in accordance with Yin (2009), is a skill required by a case study investigator in which the investigator not only records the answers but also interprets them.

Using a case approach as suggested by Yin (2009), the cases are selected as a means to give variation of factors of production with two process companies and two manufacturing companies with significantly different products. None of the companies are in direct competition. The cases are similar as they are proficient in lean with 3-20 years of experience. Furthermore, the cases are large enough so that they have a need of a central lean office, which is a support function with the purpose of developing methods and competence in lean for the organization.

3.3 Pilot study

A pilot study was conducted to verify the questions, scale, method and structure of the case study protocol (Yin, 2009) The pilot study was conducted in stages using two separate, but sequentially connected, groups in Case C. These groups are not connected to the ones used in the main study (see group C1 and C2 below).

3.4 Cases

Case A is part of a large international Business to Business company specialized in material processing. Two groups working in different independent processes were studied at case A and will henceforth be referred to as group A1 and A2. The following people were interviewed: A manager in the central lean office, one second level manager, three first level managers and three operators.

Case B is part of a large group of companies controlled by a central headquarter. Case B is a Business to Business food processing facility. The products are mainly sold to stores or other companies in Sweden. Two groups working in parallel processes were studied at Case B and will henceforth be referred to as group B1 and B2. The following people were interviewed: A manager of the lean office of the plant, one first line manager and two group leaders.

Case C is an international Business to Business and Business to Consumers manufacturing company. Two groups working in different non connected processes were studied at case C and will henceforth be referred to as Group C1 and C2. The following people were interviewed: A manager of the central lean office, one first line manager, two group leaders and one technician.

Case D is a heavy equipment manufacturing company. The products are sold Business to Business and Business to Consumers. One group was studied at Case D and it will henceforth be referred to as Group D1. The following people were interviewed: A manager of the lean office of the plant and one first level manager.

In all cases a manager for the central lean office was interviewed first to record a definition of the lean system of the company. This was used to understand the application of the lean system in the groups. Even if the people involved in the case studies do not have equal positions in the different cases, all respondents seem to be familiar with the application of SW and PS in their own groups. Hence, the cases seem to be comparable even though the answers came from different sources within each company.

4 Findings from the empirical investigation

Findings from the empirical investigation are summarized, see Table 1. The table shows all case study protocols; the protocol is specified in the three columns to the left.

4.1 Different levels of standardization

SW I 1 and SW I 2 have been found to have different levels when comparing the cases, see Table 2. Multiple second level documents were typically connected to one first level document detailing every step of the work sequence.

The process industries (Case A and B) have only one level of standardized work with essentially only "What" and "How" descriptions. Only one group (Group A1) has some description of "Why" and the description was not well-defined. The manufacturing companies (Case C and D) both have two levels of SW.

The SW within the process industries were machine centric and connected to the places on the equipment on which the tasks where to be performed. The SW of the man-

Table 1: Case study protocol and empirical findings

Y: Aspect used in that method **N**: Aspect not used in that method **»-«** Not applicable in that case,
SW= Standardized Work, **PS**= Problem Solving, **I**= Individual, **O**= Organizational, **L**= Leadership.

Note: *SW I 1* ***Con to meth***.= *Connection to method,* ***Acc time/var*** *= Accumulated time per variant*
SW O 2 ***System****= There is a system for rebalancing work between positions*
SW O 2 ***Range****= Does there exists limits in which to balance work between positions?*
SW O 4 **Involved**= The response of the assisting function. They can directly help with the process or try to solve the problem or both.
PS I 5 **Assign res** = Is there a formal way of assigning resources to implement the solution?
PS O 1 **Previous att**.= Is there a record of previous attempts to solve the problem?
PS L 4 **Res. follow up**= Are the results of the PS followed up?

Case study protocols			**Case A**		**Case B**		**Case C**		**Case D**
Group			**A1**	**A2**	**B1**	**B2**	**C1**	**C2**	**D1**
SW	**Questions**	**Aspects**							
SW I 1	How do I know *what* to do and in what *order*?	Job name	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
		Work sequence	**Y**	**Y**	-	-	**Y**	**Y**	**Y**
		Variant info	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
		Con to meth.	**-**	-	-	- .	**Y**	**Y**	**Y**
		Time	N	N	**Y**	N	N	N	**Y**
		Acc time/var	N	N	-	-	N	**Y**	**Y**
		Safety info	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	Y
		Ergonomic info	**Y**	**Y**	**Y**	N	N	**Y**	Y
		Assignor	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	Y
		Revision	**Y**	**Y**	**Y**	**Y**	**Y**	N	Y
		Date	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	Y
SW I 2	How do I know *how* to do my job?	Method name	-	-	-	-	**Y**	**Y**	**Y**
		What	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
		How	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
		Why	**Y**	N	N	N	**Y**	**Y**	**Y**
		Illustration	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
		Time	N	N	**Y**	N	N	N	**Y**
		Ergonomic info	N	N	N	-	**Y**	**Y**	**Y**
		Safety equipm.	**Y**	N	**Y**	**-**	**Y**	**Y**	**Y**
		Assignor	N	N	**Y**	-	**Y**	**Y**	**Y**
		Revision	N	N	**Y**	-	**Y**	**Y**	**Y**
		Deviation log	**Y**	N	**Y**	-	N	N	**Y**
SW I 3	How do I *organize* my work?	Get/remove	**Y**	**Y**	-	**Y**	Y	Y	Y
		Systemization	**Y**	**Y**	-	**Y**	Y	Y	Y
		Maintenance	**Y**	**Y**	-	-	Y	Y	Y
		Standardization	**Y**	**Y**	-	Y	Y	Y	Y
		Sustain	**Y**	**Y**	-	Y	Y	Y	Y
SW I 4	How do I know if I need to *call for help*?	Definition of Takt	**Y**	**Y**	-	-	Y	Y	Y
		Takt gives ref	**Y**	**Y**	-	-	Y	Y	Y
		Availability of ref	**Y**	**Y**	-	-	Y	Y	Y
SW O 1	How do we create *stability*?	Mix of tasks	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**
		Process buffer	Y	Y	-	-	**Y**	**Y**	N
		+/- people	Y	**Y**	-	**Y**	**Y**	**Y**	N

Table 1 (continued)

Case study protocols			**Case A**		**Case B**		**Case C**		**Case D**
Group			**A1**	**A2**	**B1**	**B2**	**C1**	**C2**	**D1**
SW	**Questions**	**Aspects**							
SW O 2	*Who does what* and how do we *avoid overburdening*?	System Range	N N	N N	- -	- -	Y Y	Y Y	Y Y
SW O 3	*Who knows what* and what is the *risk*?	Everyone noted Skill level Backup plan Training plan	**Y** **Y** N N	**Y** **Y** **Y** N	**Y** **Y** - **Y**	**Y** **Y** **Y** **Y**	N N N N	Y Y Y Y	Y Y Y Y
SW O 4	How do we *return to normal* as soon as possible?	Call for Andon Response time Registration Involved	**Y** 10m-1Day **Y** Support functions	**Y** Minutes **Y** -	**Y** Seconds N Help	**Y** Seconds N Help	**Y** Seconds Y Help/ probl solve	**Y** Seconds **Y** Help	**Y** 30 Seconds **Y** Help/ probl solve
SW O 5	*What is happening* and where are we *heading*?	Info collected Frequency Evaluate Decisions Priorities	**Y** Every list run **Y** **Y** **Y**	**Y** 3x/shift N N N	**Y** 1/shift **Y** **Y** -	**Y** 1/h **Y** **Y** **Y**	Y 4/d **Y** **Y** **Y**	**Y** 4/d **Y** **Y** **Y**	**Y** Shiftstart **Y** **Y** **Y**
SW L 1	How do I know what to check and how do I find time to do it?	Check planned Check done Check method Result noted	**Y** **Y** **Y** **Y**	**Y** **Y** N **Y**	**Y** **Y** **Y** **Y**	N **Y** N N	Y Y Y Y	Y Y Y Y	Y Y Y Y
SW L 2	How do I make sure that everyone is able to do their *job* at the *right level*?	Training plan Resources New or replace Followed up	Y Y Y **Y**	**Y** N N **Y**	**Y** **Y** **Y** **Y**	**Y** **Y** **Y** **Y**	Y Y Y Y	Y Y Y Y	Y Y Y Y
PS	**Questions**	**Aspects**							
PS I 1	What *conditions* are needed to succeed in problem solving?	Time Resources	**Y** **Y**	- -	**Y** **Y**	**Y** **Y**	- -	**Y** **Y**	**Y** **Y**
PS I 2	What has *happened*?	Problem label Date Description Consequence Assignor Affected Process System History Prev. attempt Illustration	**Y** **Y** N N **Y** N N N **Y** **Y** N	- - - - - - - - -. - -	**Y** **Y** **Y** **Y** **Y** N N N N N N	**Y** **Y** **Y** **Y** **Y** **Y** **Y** **Y** N N **Y**	**Y** **Y** **Y** **Y** N **Y** N N N N N	**Y** N N N **Y** N N N N **Y** N	- **Y** **Y** **Y** **Y** **Y** **Y** N **Y** **Y** **Y**

Table 1 (continued)

Case study protocols			**Case A**		**Case B**		**Case C**		**Case D**
Group			**A1**	**A2**	**B1**	**B2**	**C1**	**C2**	**D1**
SW	**Questions**	**Aspects**							
PS I 3	How do we *quantify and define* the problem?	Categories Point of occurrence	**Y** **Y**	- -	**Y** N	**Y** **Y**	**Y** N	**Y** N	**Y** N
PS I 4	What is the *cause* of the problem?	Cause & effect Validation	N N	- -	**Y** **Y**	**Y** **Y**	**Y** **Y**	**Y** N	**Y** N
PS I 5	What can we *do about* it?	Solution space Choose alt. Impl. plan Assign res.	Y **Y** **Y** **Y**	- - - -	**-** - - -	**Y** **Y** **Y** **Y**	N N **Y** **Y**	N **Y** **Y.** **Y**	**Y** **Y** N N
PS I 6	Does the *solution* fix the problem?	Containment Short term Long term	**Y** N N	- - -	- - -	**Y** N N	**Y** **Y** **Y**	**Y** **Y** **Y**	N N N
PS I 7	How do we *implement* the new method?	Change meth. Change supp. Communicate Phys change	Y **Y** **Y** **Y**	- . - . - -	**Y** **Y** **Y** **Y**	**Y** **Y** **Y** **Y**	Y Y Y Y	Y Y Y Y	Y Y Y Y
PS O 1	Is the method *adaptable*?	Adapt meth. Nature of prob Avail. resou. Reoccurrence Previous att.	N N N N N	- . - - . - - .	**Y** **Y** **Y** **Y** N	**Y** **Y** **Y** **Y** N	N N N N N	**Y** Y Y Y Y	Y Y Y Y Y
PS O 2	Do we have a *history*?	Presentation Decision meet Priority History	N N N N	- - - -	**Y** **Y** **Y** **Y**	**Y** **Y** **Y** **Y**	N N N N	**Y** **Y** **Y** **Y**	**Y** Y Y Y
PS L 1	What problem should we work with?	Is it a problem Important Ability Resources	**Y** **Y** N **Y**	- - - -	**Y** **Y** **Y** Y	Y Y Y Y	**Y** **Y** **Y** -	**Y** **Y** **Y** **Y**	**Y** **Y** **Y** **Y**
PS L 2	Do we have people with the ability to solve problems?	Training system Trainers Certification	N N N	- - -	**Y** **Y** **Y**	**Y** **Y** **Y**	N N N	**Y** **Y** N	**Y** N **Y**
PS L 3	Do we have a way of transforming the solution into standardized work?	Comp. matrix Planning Temp q check Verification	N N N N	- - - -	**Y** **Y** **Y** **Y**	**Y** **Y** N N	N **Y** **Y** **Y**	**Y** **Y** **Y** **Y**	**Y** **Y** **Y** **Y**
PS L 4	Do we know that the problem is solved and will not come back?	Res. follow up Consequences Resource Lessons	**Y** **Y** N **Y**	-. - - -	N N N **Y**	**Y** **Y** N **Y**	Y N N **Y**	N **Y** N N	**Y** **Y** N **Y**

Table 2: Levels of standardization

Standardization	Process industry	Manufacturing industry
Level 1	What , How	Sequence, What
Level 2		How, Why

ufacturing industries were position centric and connected to the work on a product that a person was to perform. The connection between SW and the final result of the process are therefore indirect in the process industries and direct in the manufacturing industries. Generally the observed work load / person are significantly lower in the process industries compared to the manufacturing industries.

4.2 Ownership

In the manufacturing industries the indicated sense of ownership of the SW by the groups is more evident than within the process industries. This is indicated by the fact that the "Why" description in (SW I 2) is more important and elaborated in the manufacturing industries; this is also confirmed in the discussions and interviews of the people in the processes.

4.3 The reference system

The reference system connects the demand of the customer to the performance of the group. The reference system of case A is not important for the group. If the equipment followed an intended pattern, it is found to be tolerable. In Case B, customer demand is not translated into a reference for the group. In Case B the end product was consumed in patterns over the year with seasonal high and low demands. Case C and D both have long lead times to the end customer but still translate the leveled demand of the customers into references available in real time.

4.4 Response time

As noted in SW O 4 the response when calling for support, was usually fast. The notable exception is Case A; the response time shows variation from a few minutes to a full working day. For Case C and D the sense of urgency is linked with higher workload and a real time reference (SW I 4) resulting in a quick response when a deviation occurred.

4.5 Training, support and frequency for follow-up

The inclination to use SW for training of employees and frequency for follow-up is more evident in Case C and D compared to Case A and B, were SW more seldom is used as a reference. The frequency for follow-up is seen as something important as it gives the organization the correct incentives and reinforced the importance of SW.

The differences in application seem to be mainly divided between the manufacturing companies and the process companies. Apart from the differences noted above, there are large similarities in how the cases have defines and applied standardized work. What is interesting here is that it seems to be independent of processes, preconditions, market demands and products.

4.6 Problem Solving

The pattern of difference between manufacturing and process companies does not follow through to PS. All cases, except Case A2, used different forms of *Five why* and *Ishikawa diagrams* as part of their problem solving methods but they used the methods in different ways. This is also true comparing groups within the same company. The exception (Case A2) stated that they did not use any method for problem solving. This is despite the fact that there are well defined methods within that company. Case B2 and Case D1 show the best structured and most supported methods. Both groups assigned time for problem solving on group level in a structured way.

However, none of the cases followed-up the amount of resources used during the problem solving activities and no conclusions were drawn regarding that. All groups allocated resources for PS except in Case A2 and C1 as indicated by PS I 1. No groups followed up the actual amount of resources used for the PS as indicated by PS L 4 and the understanding of problem solving methods seems to be different among the lean support functions in the four cases.

4.7 Analysis of the findings

Lean theory is clear on the importance of SW and the need to create stability in the process as a foundation for Continuous Improvement. Despite that most theory is vague in the specifics of how to operationalize SW, there was a remarkable consensus between the central lean support functions regarding general methods and definitions of SW in the different cases.

There is a notable difference in the level of detail in the work descriptions between the process industries and the manufacturing industries. This can be attributed to the fact that the quality of the result was directly linked with the manual labour being performed in the manufacturing industries whereas the SW of the process industries is more aimed at the needs of the process equipment and thus only had an indirect connection to the result of the process.

Lean theory is also clear on the importance of PS although there is a variation within the terminology used

in the literature. In some theory, the emphasis is put on the endeavor to continuously improve the process. Other literature distinguishes between the effort to stabilize a process from the effort to improve and generate a new process. The theory is vague regarding the specific methods for PS regardless of the emphasis. The connection between PS and generating new SW is clear for all groups. The connection between not being able to follow SW, and thus having a problem, and PS methods are not evident in Cases A and B. It was more evident in Case C and D.

Finally, referring to ownership, PS in Case A and B are often managed by handing over the problem to a support function and by that also handing over the ownership of the problem. Case C and D indicated more of a sense of ownership and responsibility of the problem. What is interesting in these cases is that this sense of ownership remained even after asking for support.

5 Results

Referring back to the research questions, the following chapter provides the results from the research study.

5.1 Key factors

Even though each central lean support function spends considerable effort defining SW, the application of SW differed at the group level. Thus it can be concluded that a detailed definition of the methods for SW in itself was not enough to guarantee success in the application of SW at the group level.

Four key factors have been found to affect the application of SW on group level.

1. Ownership of the process
2. Leader demand
3. Correct workload
4. Proximity to the results of the process

According to observations and confirmation by direct questions, in Case A and B the responsibility for creating SW is mainly assigned to a support function. In Case C and D the sense of ownership for the SW is within the group. Ownership of the content of SW is assumed by the group and the details of "how" and "why" is more evident in the observed examples. Thus, it can be concluded that a group that assumes ownership of the method will be more successful in the application of SW than a group were the responsibility for the SW is delegated to a supporting function. This is also in line with contemporary lean theory, see (Liker, 2004). Frequency of following-up by process leaders on the details of SW can also be seen as contributing to a higher incentive in case C and D compared to case A and B. This is also in line with lean theory, see (Liker and Hoseus, 2008, Fujimoto, 1999).

The Workload per position is higher in Case C and D compared to Case A and B, making it important in Case C and D to specify a detailed description of SW, giving a higher sense of ownership. The Proximity to the process result seems to be more important for individuals working in Case C and D as they directly create the result of the process compared to Case A and B. Neither workload nor proximity to results are found as key factors when reviewing previous research.

With regards to PS the key factors are more difficult to distinguish. Based on Group B2, a structured method is in place and the leader of that group could provide evident examples of successful application of a PS method. The important factors in B2 are: Dedicated resources for the PS, Deep training in the method of PS and Leader support.

This is supported by the discussions within Group C2 and D1, however, further case studies are needed to verify this.

5.2 Method of evaluation of SW and PS on group level

The purpose of the method of evaluation of SW and PS at group level is to operationalize a method with which one would be able to reliably compare different processes. Formulating the questions of the case study protocol based on the purpose of the methods for SW and PS proved to be fruitful. Even though the cases are different, both in process and purpose, the common denominator is to understand how work is performed by individuals and how the work is organized and managed.

The key factors determining the success of implementation of SW and PS on group level are not directly exposed through the questions of each case study protocol, but are revealed through the comparison between the cases and through the answers from respondents in the interviews. Key factors proposed in current paper will have to be further verified in future studies however.

The inclusion of aspects to further detail the questions was successful as it gave a fine-tuned resolution of the case studies. The aspects ensured that the same details were observed in all cases and these acted as the lowest common denominators in the case study protocols. Thus it can be concluded that the proposed method might be used as a complement to the methods proposed by Rother (1999), Karlsson and Åhlström (1996) and Bhasin (2011) as it provides an operational perspective on a process.

6 Future research

Current exploratory multiple case study aims to examine *what* defines SW and PS methods and how it is *applied* on the group level of companies. However, the results and

findings so far are one dimensional only. The case study protocol will have to be further revised and expanded to give a more multidimensional view of the application of SW and PS within a process.

In order to do so, the following matrix is proposed where the "What" column is covered in current paper and future research suggests studies covering "How" and "Why", see Table 3.

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Table 3: Future research

	WHAT	HOW	WHY
Individual	Defining methods for SW and PS used mainly for the generation of results of the process.	Observing how the defined methods for SW and PS for individuals are used in the active process.	Understanding the underlying attitudes of the individuals using SW and PS in a process.
Organizational	Defining methods for SW and PS used for organizing the work and information of the process.	Observing how the methods for the organization of SW and PS are used.	Understanding the underlying values that connect leaders and individuals within a process.
Leadership	Defining methods used for leading people and groups within SW and PS.	Observing how the defined methods are used by the leaders of the process.	Understanding the principles and values that govern the leadership behavior in SW and PS.

Note: »What«, »How« and »Why« are not the same as those defined in SW I 1 and SW I 2 in Table 1. In this table, these are linked with exploring more dimensions of the measurement method as such.

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Raziskava pristopov k merjenju vitkega proizvodnega procesa

Namen: Namen raziskave je proučiti praktično uporabno metodo za merjenje vitkosti v proizvodnih procesih. Metoda je osnovana na raziskovanju sposobnosti skupine. Na tej ravni je pomembna sposobnost delati po standardih in reševati probleme. Ti dve sposobnosti sta med seboj odvisni in sta ključni za to, da skupina dosega stabilen rezultat. V tej zvezi je je metoda standardiziranega dela (SW) opredeljena kot metoda, uporabljena, da v procesu generira stabilne rezultate. Reševanje problemov (PS) je definirano kot zbir metod, ki se uporabijo za vračanje procesa v pogoje, kjer je možno standardizirano delo.
Metodologija/pristop: Raziskava je bila izvedena kot študija več primerov v štirih velikih globalnih proizvodnih podjetjih. Zaporedje zbiranja podatkov je bilo naslednje: najprej smo izvedli intervjuje z managerji, ki so bili odgovorni za celotno uvedbo vitkosti v organizaciji. Nato smo opazovali uvedbo standardiziranega dela in reševanja problemov na ravni skupine. V celoti smo proučevali 7 skupin in izvedli intervjuje s 19 osebami.
Ugotovitve: Rezultati kažejo, da osrednja definicija metod za standardizirano delo sama po sebi nima neposrednega vpliva na uvedbo standardiziranega dela na ravni skupine. Metode standardiziranega dela so bile v različnih primerih podobne na splošni ravni, toda na nivoju grup uporabljene v različnem obsegu. Rezultati tudi kažejo, da so ključni dejavniki za uspešno uvedbo standardiziranega dela na nivoju skupine naslednji: lastništvo procesa, neposredna povezava procesa in rezultatov dela, primerna delovna obremenitev in zahteve vodje. Metode reševanja problemov na ravni skupine so bile različne kljub – površno gledano – podobnemu pristopu. Metoda vrednotenja, ki smo jo uporabili, je bila uspešna in je dala rezultate, primerljive med različnimi proučevanimi primeri.
Omejitve raziskave: Omejitev je , da v obsegu merjenja proučuje le raven skupin. Rezultati so nadalje omejeni na 4 podjetja in 7 skupin.
Originalnost: Cilj članka je zapolniti vrzel v uveljavljenih metodah merjenja vitkosti kadar proučujemo možnosti standardiziranega dela in reševanja problemov na skupinski ravni procesa. Te sposobnosti so pogosto opisane kot ključne za teorijo vitke proizvodnje. Znanih je malo akademskih raziskav v zvezi z definicijo metod standardiziranega dela in reševanja problemov ali ključnih dejavnikov, ki vplivajo na te metode na operativnem nivoju.

Ključne besede: Vitkost, merjenje dela, reševanje problemov, standardizirano delo, stabilnost

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Lean Manufacturing Effects in a Serbian Confectionery Company – Case Study

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Background and Purpose: The objective of this paper was to evaluate effects of implementing lean manufacturing in a Serbian confectionery production company during a period of 24 months, emphasizing observed benefits and constrains. Company 'case study' is a leading confectionery producer in Serbia with annual production of more than 25,000 t.
Methodology/Approach: The research method was case study. The approach in implementing lean manufacturing was structured in five phases, as follows: (i) training, (ii) analysis of lean wastes on one technological line, (iii) choice of lean tools to be implemented in the factory, (iv) implementation of lean tools in production and maintenance, (v) development of continual improvement sector and further deployment of lean tools.
Results: Lean manufacturing tools implemented in the production process were visual control and single minute exchange of dies (SMED). Maintenance process implemented 5S with total productive maintenance (TPM) and problem solving sessions being the tools implemented in both processes. During the observed period, results of these tools showed the following: visual control tables initiated 61 improvement memos out of which 39% were fully implemented; a total of 2284 minor problems had been recorded, with over 95% of issues revealed in due time; total SMED time decreased for 7.6%; 19 problem solving sessions were initiated with 58% of solving effectiveness, and the remaining converted to on-going projects. In maintenance 5S improved from 29.9 to 60.3; overall equipment effectiveness (OEE) indicator increased from 87.9% to 92.3%; mean time between failure (MTBF) increased for 16.4%.
Conclusion: As a result of all activities, 20 in-house trainings and 2 'kaizen' events including motivational training have been initiated with 54 documents being revised and improved in order to contribute to more efficient processes.

Keywords: Lean manufacturing; confectionery production; benefits; constraints

1 Introduction

The birth of lean was in Japan within Toyota in the 1940s and was developed with its suppliers in the 1950s and 1960s as the Toyota Production System (TPS) (Ohno 1998; Schonberger, 2007). The basic idea in TPS is to produce the kind of products needed, at the time needed and in the quantities needed such that unnecessary intermediate and finished product inventories can be eliminated (Monden, 1983). It is based around the desire to produce in a continuous flow which did not rely on long production runs to be efficient (Melton, 2005).

Lean tools and techniques within the 'lean manufacturing' concept include: (a) Streamlined layout – a layout designed according to optimum operational sequence; (b) Standard work – consistent performance of a task according to defined methods with no waste; (c) Visual control – a visual method of measuring performance at the 'shop floor; use of this technique enables a fast check of all information – tooling, parts, production activities and process indicators at a glance; (d) 5 S's (sort, set in order, shine, standardize, sustain) – five activities used to create a workplace suited for visual control and lean practices; (e) Point-Of-Use-Storage (POUS) – raw materials, parts, information, tooling, work

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standards, supplies and procedures are stored where needed; (f) Batch size reduction is a technique in reducing batches to the smallest possible size to enable single and continuous flow; (g) SMED (single minute exchange of dies) – a changeover reduction technique defined as a time between the last good piece of the current run and the first good piece of the next run; (h) Poke yoke – an 'error-proofing' technique – a process used to prevent errors from occurring or to immediately point out a defect as it occurs; (i) Self-inspection – inspection and process control by competent employees so they understand if the product passed to next operation is of acceptable quality; (j) 'Jidoka' or 'autonomous machine' - form of automation in which equipment automatically inspects each item after producing it, ceases production and notifies humans if a defect is detected; (k) Total productive maintenance (TPM) which covers practices primarily designed to maximize equipment effectiveness through planned predictive and preventive maintenance of the equipment and use of maintenance optimization techniques; (l) Just-in-time (JIT) philosophy related to 'zero inventories' or 'stockless' production so batches should always be as small as possible, in order to achieve one-piece flow with batches sizes of one so ''only the necessary products, at the necessary time, in the necessary quantity are delivered''; (m) Cellular and flow – physically linking and arranging manual and machine process steps into the most efficient combination; (n) Kanban – a visual signal to support flow by 'pulling' product through the manufacturing process as required by the internal / external customer; (o) Value stream mapping (VSM) a method of mapping current and future value flow of the entire production process (Alukal and Manos, 2006; Holweg, 2007; Melton, 2005; Rooney and Rooney, 2005; Rubio and Corominas, 2008; Shah and Ward, 2003, 2007)

The objective of this paper was to evaluate effects of implementing lean manufacturing in a Serbian confectionery production company during a period of 24 months, emphasizing observed benefits and constrains.

1.1 Effect of lean manufacturing in food industry

Effects of implemented various quality improvement concepts have been analyzed by various authors focusing their research on different segments (Table 1). Depending on the timing of evaluation of effects, three different kinds of evaluations can be recognized: *ex ante* (prior to implementing an improvement concept), ongoing/mid-term (during implementation) and *ex post* (upon implementation).

Lean manufacturing has its advantages in the fact that it's a concept that was developed more than 50 years ago and has been theoretically analyzed by many authors. In order to evaluate these effects, the *ex post* approach is used through structured surveys with the possibility to enumerate the inputs and outcomes, but with certain difficulties in estimating the overall benefits and constraints. Limited studies from the field, time consuming approach, small sample size and a few studies from the food industry raise doubts about the relevance of results and challenge this approach.

2 Materials and method

A structured survey was conducted from January until March 2013. The data used for this research were collected, processed and analyzed for a period of 24 months (2011-2012). The continual improvement manager of the company was asked to provide the authors with their QMS documents and record. Review of documentation covered overview of production, maintenance, control and training records including records of non-conforming products, list of corrective and preventive actions and management review, including various monthly reports. Structure survey included on-site visits to the company and meetings, including e-mail and phone communication during the survey period. Data were processed using ©Microsoft Office Pack 2007.

Table 1: Effects of implemented quality improvement concepts according to recent studies

Topic covered	**Authors**
Quality management performance and effects	(Arauz and Suzuki, 2004; Lagrosen and Lagrosen, 2005; Van Der Spiegel, Luning, De Boer, Ziggers, and Jongen, 2006; van der Spiegel, Luning, Ziggers, and Jongen, 2003)
Use of quality tools in quality management	(Alsaleh, 2007; Sousa, Aspinwall, Sampaio, and Rodrigues, 2005)
Total quality management practices	(Beheshti and Lollar, 2003; Fotopoulos, Psomas, and Vouzas, 2010; Psomas and Fotopoulos, 2010)
Lean manufacturing	(Cagliano, Caniato, and Spina; Eroglu and Hofer, 2011; Losonci, Demeter, and Jenei, 2011; Panizzolo, 1998; Shah and Ward, 2003)

2.1 Calculating and evaluating the results

In order to present results, calculation of various indicators is further explained. Overall equipment efficiency as an indicator of total productive maintenance (TPM) was calculated by using the equation (1.1) (Chan, Lau, Ip, Chan, and Kong, 2005; Feld, 2001; Smith and Hawkins, 2004).

$$OEE = Equipment\ Availability\ x\ Performance\ Efficiency\ x\ Quality\ Rate\ [\%] \quad (1.1)$$

Evaluating time saving in product changeovers, SMED index has been calculated according to the equation (1.2).

$$SMED = \frac{\Sigma planned\ changeover\ time - \Sigma achieved\ changeover\ time}{\Sigma achieved\ changeover\ time} \cdot 100\ [\%] \quad (1.2)$$

Mean time between failure (MTBF) presents a statistical estimate of the time a component, subassembly, or operating unit will operate before failure will occur (Higgins and Wikoff, 2008). Calculation of this indicator is expressed in equation 1.3.

$$MTBF = \frac{(Operational\ time) - (failure\ time)}{number\ of\ failures}\ [h] \quad (1.3)$$

2.2 Company 'case study'

Company 'case study' was established 45 years ago and has developed from a small plant in Požarevac (Republic of Serbia), which initially employed 37 people and produced 167 tons of confectionary products annually, to what it is today – market leading company with factories in two cities - Požarevac (two production plants "I" and "II") and Vršac and annual average production of over 25,000 tones. Basic production portfolio covers 177 different products / stock keeping units (SKUs) produced on 16 production lines. On the 4th Brand Fair held in Belgrade in 2008, company's biscuit was promoted for "the most loved domestic brand" in all categories. In 2009, company was promoted as the company with products of the best quality. In May 2010, they received traditional annual reward of Belgrade Chamber of Commerce "Belgrade winner" for exceptional professional results in 2009. In the same year they received a 'Halal' certificate[1] for over 80 company products enabling export and trade with Muslim countries.

The company implemented and certified its quality management system according to ISO 9001 in 1997. Food safety system based on hazard analysis and critical control points (HACCP) was certified in 2002 being upgraded in 2011 by certifying their food safety management system according to ISO 22000 and FSSC 22000. In year 2004 they certified their environmental management system (EMS) according to ISO 14001 and in 2011 their occupational, health and safety management system according to BS OHSAS 18001.

In the mid of 2010, company decided to implement lean manufacturing in the company with the aim of improving effectiveness and efficiency focusing on production and maintenance. Period of implementation was November 2010 – December 2012 and the approach in implementing lean manufacturing was structured in five phases: (i) training, (ii) analysis of lean wastes on one technological line, (iii) choice of lean tools to be implemented in the factory, (iv) implementation of lean tools on chosen production lines in production and maintenance, (v) development of continual improvement sector and further deployment of lean tools throughout the entire factory.

3 Results

3.1 Initial training

First activity in implementing lean manufacturing was to conduct awareness training to middle management responsible for production, maintenance, control and purchasing processes. It included managers, shift leaders, supervisors, engineers and technologists. A total of 82 employees attended five one-day trainings during November and December 2010. The training covered introduction to the following lean tools referred to as building block of lean (G. and A., 2006): streamlined layout, standard work, visual controls, 5S, POUS, batch size reduction, SMED, poka-yoke, self-inspection, autonomation, TPM, JIT, cellular and flow, pull system / kanban. Value stream mapping has not been covered during the initial training. During the training, all participants were asked to evaluate possibility of implementing certain tools within their process in order to help the management in developing lean manufacturing. First option gave the respondents the opportunity to rate their degree of agreement with statement concerning usage of tools in the company according to a five-point Likert scale. The usage of tools was rated from 1 'not applicable in the company' to 5 'very applicable in the company', where 2 was referred to 'hardly applicable', 3 to 'possible to use' and 4 to 'applicable' (Table 2).

3.2 Analysis of wastes on one technological line

Waste of resources has a direct impact on costs and quality. Conversely, the elimination of wastes results in higher qual-

1 Halal foods are foods that Muslims are allowed to eat under Islamic dietary guidelines

Table 2: Use of lean tools in the company

Lean tools	Mean[1] (n=82)	Sd[2]	No answer [%][3]	Rank 1 [%][3]	Rank 2 [%][3]	Rank 3 [%][3]	Rank 4 [%][3]	Rank 5 [%][3]
5S	4.7	0.5	2.4%	0.0%	0.0%	3.7%	20.7%	73.2%
Visual control	4.6	0.7	3.7%	0.0%	0.0%	8.5%	24.4%	63.4%
Standard work	4.3	0.9	2.4%	1.2%	4.9%	8.5%	29.3%	53.7%
Poka Yoke	4.3	0.8	4.9%	0.0%	3.7%	9.8%	36.6%	45.1%
Streamlined layout	4.2	0.9	3.7%	1.2%	2.4%	13.4%	34.1%	45.1%
TPM	4.1	0.8	6.1%	0.0%	4.9%	13.4%	41.5%	34.1%
Self-inspection	4.1	1.0	7.3%	1.2%	7.3%	14.6%	30.5%	39.0%
POUS	4.0	0.8	3.7%	0.0%	1.2%	24.4%	40.2%	30.5%
SMED	3.8	0.8	6.1%	0.0%	6.1%	23.2%	43.9%	20.7%
JIT	3.8	1.1	4.9%	4.9%	6.1%	20.7%	32.9%	30.5%
Batch size reduction	3.8	0.8	4.9%	0.0%	6.1%	24.4%	46.3%	18.3%
Autonomation	3.5	0.9	6.1%	3.7%	6.1%	35.4%	36.6%	12.2%
Kanban	3.0	1.1	9.8%	9.8%	20.7%	30.5%	22.0%	7.3%
Cellular and flow	2.5	1.1	4.9%	23.2%	20.7%	30.5%	20.7%	0.0%

[1] 1 = 'not applicable in the company', 2 = 'hardly applicable', 3 = 'possible to use' 4 = 'applicable', 5 = 'very applicable in the company'
[2] Sd – standard deviation
[3] 100 % corresponds to *n* = 82 respondents

ity, customer satisfaction, profitability, effectiveness and efficiency, (Alucal and Manos, 2006).

Due to the overall complexity of the company with many technological lines and diversity of product portfolio, it has been decided to evaluate lean 'wastes' on technological line "No. 9" where five different products are manufactured and changeovers are interesting due to the fact that for some changeovers, detailed cleaning and sanitation should be performed in order to avoid allergen cross contamination. The line works in three shifts, seven days a week. Evaluation of wastes was performed by observing the production process for four days in a row during the first month of the project (January 2011). Three methods were used: (i) interviewing workers on the line, (ii) reviewing available documents and records and (iii) taking photos and videos of most significant wastes.

First observation was connected to identifying the most predominant waste. Any activity in a process which does not add value to the customer is called 'waste', (Alukal and Manos, 2006; Melton, 2005). Eight types of waste have been evaluated, as follows: (i) defects, (ii) overproduction, (iii) waiting, (iv) non value added processing, (v) transportation, (vi) Inventory, (vii) motion of workpower and (viii) employee knowledge (Rooney and Rooney, 2005). Inventory was identified as the most significant confirming Ohno's conclusion that "the greatest waste of all is excess inventory" (Ohno, 1998).

Deeper analysis of wastes connected with time showed that SMED results have the greatest variations in both directions above and below targeted time. Records showed rounded figures on 5 minutes with low level of employee awareness on the importance of precise recording SMED results. Also, for some combinations of changeovers, there were no targeted times. Estimation of time savings for decreasing targeted values for one minute every two months for long changeovers (over 45 minutes) and one minute quarterly for shorter changeovers would achieve saving between 6,6% and 10%. However, the primary task was to define target values.

In the same analysis, deployments of losses connected with OEE were transfers to six TPM losses, as follows: failures and set-up adjustments (connected with availability), reduced speed and minor stoppages (connected with performance) and production defects, start-up rejects and yield (connected with quality rate), (Higgins and Wikoff, 2008; Smith and Hawkins, 2004). Analysis showed the distribution of the losses with set-up and failures being the predominant with 66.4% of total lost time, followed by defects participating with 19.9% and reduced speed and minor stoppage contributing with 13.7%.

3.3 Choice of lean tools to be implemented in the factory

Upon completion of training and analysis of wastes on one technological line, a 'Kaizen' event has been organized in order to present the results and inform employees which

tools are to be implemented. In order to accept employees' choice of tools, management accepted their choice of 5S and visual control (Table 2). On the other side, in line with the results from the analysis of waste where time has been identified as the major improvement resource, TPM and SMED have been chosen by the management. Finally, problems solving session have been initiated by employees from quality control.

Lean manufacturing tools implemented in the production process were visual control and single minute exchange of dies (SMED). Maintenance process implemented 5S with total productive maintenance (TPM) and problem solving sessions being the tools implemented in both processes.

4 Discussion

4.1 Visual control tables

First visual control table has been posted on line "11", in the third month of the observed period. It has been decided to use control tables and record all problems that occurred during the week. Upon successful experience, two types of tables were designed – for communicating problems and for communicating performance indicators with improvement memos. In the next four months a total of 30 visual control tables have been placed within the production plant "I": two for the overall production, 11 next to production lines, 13 next to packaging system, three in raw materials preparation area and two in maintenance. A problem table consisted of the following data (date, shift, problem, solution, responsible person, due date, status and duration of downtime). Overall production performance indicators were number of quality and food safety complaints, product quality index and the number of injuries. Next to production and packaging lines indicators were Overall Equipment Effectiveness (OEE) index, product quality indicators and parameters from control charts. Production plant "II" started with the project in the 9th month and until the end of the first year a total of six tables have been placed for the overall production, for production lines and for packaging systems.

During the observed period visual control tables initiated 61 improvement memos out of which 39% were fully implemented and a total of 2284 minor problems had been recorded, with over 95% of issues revealed in due time.

4.2 Overall Equipment Effectiveness

One of the fundamental measures used in TPM is OEE. World-class levels of OEE start at 85%, targeting equipment availability at 90%, performance efficiency at 95% and quality rate at 99% (Smith and Hawkins, 2004). The OEE index has been followed on nine production lines for the period of two years and it increased from 87.9% to 92.3% (Table 3).

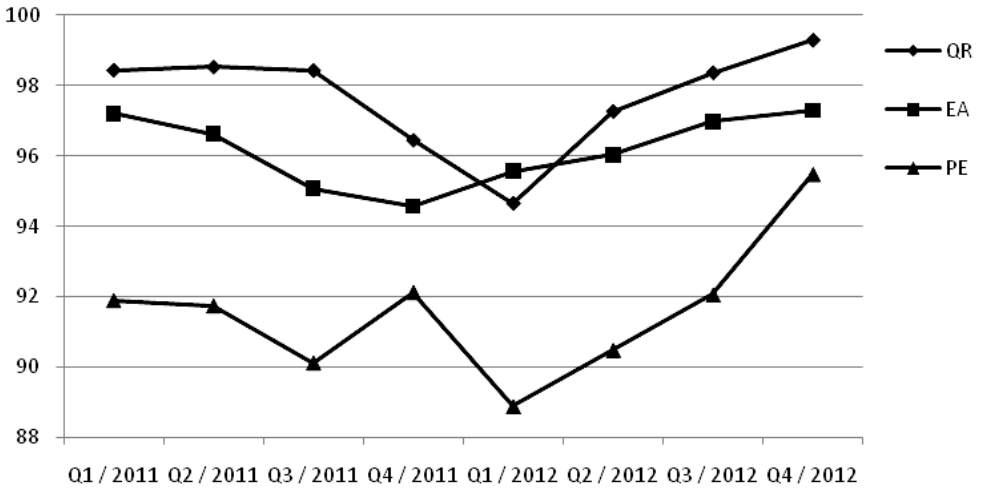
During the first quarter of 2012 more precise method of recording data has been established so a certain dropdown effect occurred. Figure 1 gives an overview of the three indicators used for calculating OEE during the 24 month period.

4.3 SMED

In line with visual tables, within the production area "I", 24 SMED tables have been posted in order to follow the time for changeovers. In the first twelve months, time for changeovers have been recorded and followed on a shift basis in order to determine necessary time for all product combina-

Table 3: OEE on production lines during the observed period

	OEE							
	Q1 / 2011	**Q2 / 2011**	**Q3 / 2011**	**Q4 / 2011**	**Q1 / 2012**	**Q2 / 2012**	**Q3 / 2012**	**Q4 / 2012**
Production line 1	85.2%	87.9%	83.2%	81.6%	82.5%	83.6%	89.7%	91.1%
Production line 2	90.4%	86.8%	82.7%	88.8%	86.4%	92.3%	92.6%	93.6%
Production line 3	89.9%	81.1%	84.9%	72.1%	58.0%	75.2%	83.6%	85.6%
Production line 4	87.9%	85.6%	78.4%	75.2%	68.7%	76.6%	77.5%	86.1%
Production line 5	87.6%	84.2%	80.8%	86.1%	80.5%	81.7%	87.7%	95.3%
Production line 6	90.2%	90.6%	87.5%	85.8%	83.7%	89.9%	90.7%	96.1%
Production line 7	85.1%	86.6%	85.1%	85.8%	83.2%	84.4%	83.1%	87.5%
Production line 8	88.1%	90.1%	85.6%	91.1%	93.6%	92.6%	94.6%	98.3%
Production line 9	86.9%	93.6%	90.8%	90.2%	88.5%	84.0%	90.5%	96.7%
OVERALL	**87.9%**	**87.4%**	**84.3%**	**84.1%**	**80.6%**	**84.5%**	**87.8%**	**92.3%**



Legend: EA - Equipment Availability; PE - Performance Efficiency; QR - Quality Rate

Figure 1: Overview of of the three indicators used for calculating OEE during 24 months

tions. It is important to highlight that on some production lines up to 20 different products are produced so it took several months in order to record all changeover combinations. After the first year, time for changeovers has been determined and reset every three months. Table 4 shows SMED results for the second year of the project. Negative results show that more time was needed for changeovers than planned. This is in direct relation to problems that occurred on the lines and downtime that occurred from various failures. On the other side, on lines that didn't have problems positive results show big opportunities for decreasing time. Latest fine-tuning in 2012 decreased SMED time for 7.6% or 3473 minutes.

4.4 Problem solving sessions

Problem solving sessions started in the 10th month of the project as an initiative of the Quality Assurance Department. As an input for problem solving sessions, initial training of the middle management from various sectors (production, quality, maintenance, design & development) in order to

Table 4: Quarterly analysis of changeovers in the second year

	Changeover improvement rate			
	Q1 / 2012	**Q2 / 2012**	**Q3 / 2012**	**Q4 / 2012**
Production line 1	8.7%	3.5%	8.9%	1.9%
Production line 2	0.1%	-13.3%	4.1%	-38.3%
Production line 3	29.8%	-3.6%	8.2%	26.7%
Production line 4	-20.0%	0.0%	0.0%	40.0%
Production line 5	39.7%	19.0%	44.9%	41.4%
Production line 6	5.3%	7.4%	-32.9%	-2.8%
Production line 7	-12.5%	-15.9%	-17.3%	-10.6%
Production line 8	-17.4%	-14.2%	-48.7%	6.1%
Production line 9	-6.9%	-10.8%	-19.4%	-1.8%
Minutes of decreased time	**1950**	**133**	**525**	**865**

Positive results show rate of improving (decreasing) total changeover time; negative results show higher results than planned.
Q1 / 2012 (months 13 – 15), Q2 / 2012 (months 16 – 18), Q3 / 2012 (months 19 – 21), Q4 / 2012 (months 22 – 24)

achieve multidisciplinary team. Training included problem solving techniques, Ishikawa diagrams, root cause analysis and 5W methodology. Brainstorming was promoted giving all participants equal possibility to identify root cause(s) and suggest solutions. A total of 19 problem solving sessions with an average of two meeting per session were initiated with 58% of solving effectiveness, and the remaining converted to on-going projects. Problems that were being solved indicate four categories – equipment efficiency, product quality, production process capability and organization of work. In average, eight participants took active roles per every session.

4.5 5S

In months 4 – 6 of the first year, training for implementing 5S tools in maintenance has been performed. Along with the training a checklist has been created to evaluate implementation of all five steps in 5S giving each "S" 5 question weighing 20 points (4 points each). In total 100 points was the maximal value for full implementation. First set of question for "sort" outlined sorting of equipment, spare parts, tools, aspects of visual control and existence of obsolete inventory (with red tags) including written standards and documents. Second set of questions for "set in order" highlighted existence of location indicators for shelves and storage areas, item indicators and various signboards, quantity indicators, demarcation and inventory areas and arrangement of jigs and tools. "Shine" set of questions emphasized cleanliness of floors, machines, work surfaces, cleaning responsibilities and habitual cleanliness. Fourth set of questions for "standardize" highlighted use of 5S documents and visual standards of the maintenance area as well as improvement ideas and plans. Set of "sustain" questions, highlighted overall evaluation in light of awareness of workers, storage of all elements (tools, equipment, and parts), area control and use of visual control tables. Starting from the 6th month, 5S has been evaluated on a quarterly basis in 5 sectors - 'Fitters workshops', 'Mechanical workshops', 'Handy storage', 'Storage of spare parts' and 'Offices' (Table 5). Overall, in maintenance 5S improved from 29.9 to 60.3.

The main two constraints were to use "red tags" and identify unnecessary inventory as well as to sustain 5S practice. Mainly workers complained that they have their own working habits for many years and that sustain of 5S is time consuming.

4.6 Total productive maintenance

Total productive maintenance (TPM) was another tool used. Within the project, three main pillars have been identified: autonomous maintenance, planned maintenance and quality maintenance. Within planned maintenance, calculation of maintenance indicators has been initiated during the 16th month. As the key indicators mean time between failure (MTBF) has been calculated for production line "11" for the period 2006 – 2011 in order to evaluate this indicator in light of existing practice. MTBF has been calculated for all components on the production line, as well as for the entire line as an entity. At the end of 24 months MTBF has been calculated for nine production lines and results are presented in Table 6.

As a result of implementing TPM, new and developed TMP work instructions have been created in order to avoid technological failures that can be prevented. On five technological lines with developed work instructions, MTBF of components improved for 36%.

4.7 Development of continual improvement sector

After 12 months, a new organizational function has been established – the continual improvement (CI) manager with the responsibility to promote cultural change necessary to implement lean manufacturing. Its main objective is to identify opportunities for continual improvement in

Table 5: Evaluation of 5S in various areas of maintenance department

	Fitters workshops	Mechanical workshops	Handy storage	Storage of spare parts	Offices	Overall score
Q2 / 2011	29	26	38	36.5	20	29.9
Q3 / 2011	37	36	33.5	44	26.5	35.4
Q4 / 2011	28.5	42	38.5	50.5	37.5	39.4
Q1 / 2012	38	40	43.6	65	48.1	46.94
Q2 / 2012	48.6	50	52.5	70	58.8	55.98
Q3 / 2012	48	55	53	69	65.3	58.06
Q4 / 2012	56.5	54	53.3	70	67.7	60.3

Figures present achieved scores during evaluation from 1 – 100 (1 min, 100 max)

Table 6: MTBF at the end of first and second year of the project

	Average MTBF in 2011 [h]	Average MTBF in 2012 [h]	Improvement [%]
Production line 1	225.3	228.7	1.5%
Production line 2	114.8	155.0	35.0%
Production line 3	55.9	60.9	8.8%
Production line 4	319.8	312.9	-2.1%
Production line 5	50.6	82.0	61.9%
Production line 6	156.0	170.3	9.2%
Production line 7	55.1	59.5	7.9%
Production line 8	204.6	241.8	18.2%
Production line 9	66.3	70.9	6.9%
		Average	16.4%

Positive results show improved MTBF (increased time compared to previous year); negative results show shortening in calculated MTBF

two directions. First is working with all employees through organizing internal trainings and presenting lean tools as well as organizing weekly workshops with production, quality assurance and maintenance. All employees have the possibility to initiate their own suggestions for improvement and CI manager is responsible to evaluate all suggestions and to organize and monitor their implementation. Second is calculating and evaluating production, quality and maintenance indicators and identifying areas for optimizing quality costs, resources and processes.

5 Conclusion

As a result of all activities, 20 in-house trainings and 2 'Kaizen' events including motivational training have been initiated with 54 documents being revised and improved in order to contribute to more efficient processes.

The main challenge in this project was gaining commitment from employees due to the fact that some employees understood the entire project as additional control, more work for them and threat of losing their jobs. Middle and top management put much effort in promoting the entire idea and explaining the necessity for workers to participate and give their contribution. Unlike implementing management standards where implementation process is usually a 'top - down' method, in lean manufacturing, the company implemented 'down-up' method enabling workers fully participate and giving them the possibility to present their improvement ideas.

Limitations of the research stem from the use of results from one company so the results should not be generalized. Given the great technological and other differences within various food industries, more research is necessary to determine if similar results would be derived from different companies across various other food industries.

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Učinki vitke proizvodnje v slaščičarskem podjetju v Srbiji – študija primera

Ozadje in namen: Cilj članka je ovrednotiti učinke uvedbe vitke proizvodnje v slaščičarskem podjetju v Srbiji v obdobju 24 mesecev, s poudarkom na ugotovljenih pridobitvah in omejitvah. Proučevana organizacija je pomemben izdelovalec slaščic z letno proizvodnjo več kot 25,000 t.
Metodologija/pristop: Uporabili smo metodo študije primera. Pristop uvajanja vitke proizvodnje je potekal v 5 fazah: (1) usposabljanje, (2) analiza izmečka na eni od tehnoloških linij, (3) izbira orodij vitke proizvodnje za uvedbo v tovarni, (4) uvedba teh orodij v proizvodnji in vzdrževanju in (5) uvedba sektorja za stalno izboljševanje in nadaljnji razvoj vitkih orodij.
Rezultati: Orodja vitke proizvodnje, ki smo jih uvedli v proizvodni proces, so vizualni pregled in enominutna menjava barvil (SMED). V procesu proizvodnje so bila uvedena naslednja orodja: sistem 5S, celovito produktivno vzdrževanje (TPM) in sestanki za reševanje problemov. Rezultati v opazovanem obdobju so naslednji: vizualna kontrola je dala 61 sugestij za izboljšave in 39% od njih je bilo uvedenih v celoti. Zaznanih je bilo 2284 manjših problemov, celoten čas SMED se je zmanjšal za 7,6%; izvedenih je bilo 19 sestankov za reševanje problemov z učinkovitostjo reševanja 58%; reševanje ostalih problemov je bilo vključeno v tekoče projekte. Pri vzdrževanju se je S5 izboljšal od 29,9 na 60,3. Splošni indikator učinkovitosti opreme (OEE) se je povečal od 87,9% na 92,3%. Povprečni čas med odpovedmi (MTBF) pa se je povečal za 16,4%.
Zaključek: Rezultat vseh aktivnosti je 20 usposabljanj v organizaciji in dveh ‚kaizen' dogodkov, vključujoč motivacijsko usposabljanje, 54 dokumentov je bilo spremenjenih in izboljšanih, da bi prispevali k bolj učinkovitemu procesu.

Ključne besede: vitka proizvodnja; slaščičarstvo; koristi; omejitve

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Practical Applications of Quality Tools in Polish Manufacturing Companies

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Background and Purpose: Modern companies have found themselves in a situation where the ability for the dynamic adaptation to the changing market conditions is a key competitive advantage. Therefore they are continually searching for intensive ways of improvement of their processes and products. The basis for the implementation of such strategy is the efficient use of information resources. In quality management, appropriate tools and techniques equip decision-makers with information, necessary to take: correction, corrective, preventive, and finally – improvement actions.
Design/Methodology/Approach: The paper presents the results of the survey, conducted on a representative sample of manufacturing companies in Great Poland (region of Poland). The main goal of the survey was to ascertain, from the quality assurance perspective, what kind of problems, at which stage of production process are the most frequent and what kind of quality tools and techniques are used by practitioners for their solutions. Furthermore, the respondents evaluated the importance of appearing problems as well as the effectiveness of used tools.
Results: The results of the survey show that quality tools are most frequently implemented at the manufacturing phase of the production process, then at the production set-up stage and measurement phase. On the manufacturing phase example it was shown, which of the tools included in the survey, are effectively used for problem solutions, concerning the process inputs, process performance and management of the processes.
Conclusion: The obtained results allow contradicting the thesis spreading quality tools universality. In the context of production process stages, some of them are oriented towards selected phases and, such as, may be effectively used by practitioners.

Keywords: quality management; quality tools & techniques; process improvement; manufacturing processes

1 Introduction

Modern companies found themselves in a situation where the ability of a dynamic adaptation to changing market conditions is a key competitive advantage. This means that all the employees of companies responsible and involved in the process must be equipped with right tools, enabling them to quickly and easily take effective improvement activities in all the areas of value creation for the customer. In the manufacturing companies, process improvement, understood as the increase of process ability to meet the requirements, is implemented in the form of two strategies: extensive and intensive actions. The basis of the realization of strategy of intensive activities (*small-step ongoing improvement activities*) is the efficient use of the available resources, with particular emphasis on information resources. In the case of quality management, including the aforementioned function of improvement, in order to collect and process data and information, one uses instruments, traditionally described as quality tools and techniques (QT & T). They equip decision-makers with properly processed information necessary to take: correction, corrective, preventive, and finally – improvement actions in manufacturing processes.

According to (McQuater et al., 1995), tools and techniques are practical ways, skills, means or mechanisms that are used in the realization of specified tasks. In (McQuater et al., 1996) the concept of techniques and

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tools of quality management is described as a means of practical conduct, skills and instruments applicable to specific tasks, including facilitation of changes or improvements. In (McQuater et al., 1995) and (Dale and McQuater 1998) a quality tool is defined as a specific procedure, focused on a particular task and used independently. In (Gregory, 1993), tools are also defined as those that integrate, to some extent, external requirements with the results of the organization's internal operations. In (Dean and Bowen, 1994) a technique is described as a specified, step by step, procedure method applied with the intention of making practical action more effective. On the other hand, in (McQuater et al., 1995) a technique is defined as a set of tools. In (Dale and McQuater, 1998) the definition of a technique is clarified as a comprehensive, integrated approach to problem solving, based on the usage of a number of supportive tools. As a result, the SPC is a technique, determined by a set of applicable tools in statistical process control: control charts, histograms, graphs, etc. Examples of techniques are also: QFD, FMEA, DOE. According to (Bamford and Greatbanks, 2005), the tools and techniques of quality management enable:

- examination of the areas that cause the most problems;
- presentation of complex data in a simple and transparent way;
- determination of the causes of problems;
- identification of the causes of process variation;
- showing the distribution of the data;
- showing the relationships between the variables of the process;
- setting priorities for action.

One can also generalize the benefits arising from the application of quality tools and techniques in terms of processes and entities. In the first case it is:

- improvement (McQuater et al., 1995), (Bunney and Dale, 1997), (Herbert, Curry and Angel, 2003), (Bamford and Greatbanks, 2005), (Lagrosen and Lagrosen, 2005), (Tari, Molina and Castejon, 2007)
- increase in productivity (Herbert, Curry and Angel, 2003).

In the second:

- increase of pro-quality awareness (Lagrosen and Lagrosen, 2005);
- increased commitment in relation to quality issues (Lagrosen and Lagrosen, 2005);
- promoting work in teams (Herbert, Curry and Angel, 2003);
- facilitating communication (Herbert, Curryand Angel, 2003), (Ahmed Hassan, 2003);
- increase of customer satisfaction (Lagrosen and Lagrosen, 2005).

From the point of view of practical application of quality tools and techniques, divisions of instruments, locating individual instruments in methodologies of organizational activities, are very important. These include the described in the literature methods:

- problem solving (Ahmed and Hassan, 2003), (Fukui et al., 2003), (Rooney and Heuvel, 2004), (Tague, 2005), (Tang et al., 2007);
- improvement (Brassard and Ritter, 1994), (Asaka and Ozeki, 1996), (Shiba and Walden, 2002), (Bamford and Greatbanks, 2005), (Tague, 2005).

The starting point for the search of useful tools in practice is most frequently methodical sphere of activities carried out in order to solve a problem or improve the implementing process. In this way - tools are associated with the stages of the methodologies of organization activities, such as PDCA (Dahlgaard et al., 2013). The variety of the offered methodologies of problem solving/process improvement causes that the proposed, in their framework, sets of quality tools and their assignment to the various phases of methodologies, differ from one another (for example in (Brassard and Ritter, 1994; Shiba and Walden, 2002; Fukui et al., 2003). In the studies there is no "bottom-up" perspective on the matter yet, which would include while selecting appropriate tools and techniques of quality management – knowledge and experience of practitioners, either directly or indirectly involved in the realization of the improved processes. In the studies one has tried to prove the hypothesis that the choice of quality tools and techniques is dependent on the particular stage in the production process and on the nature of the problems, which they are intended to solve.

2 Methodology

In the conducted study, as the subject of statistical population, one has specified a company with already implemented standardized management system that meets at least one of the quality management standards (e.g. ISO 9001, ISO 14001, EMAS, GMP, etc.); however the possession of the certificate system was not a necessary condition. Possession of standardized management system was to guarantee the existence of the so-called pro-quality awareness in the given enterprise.

As the test body a manufacturing and / or service company has been chosen (where the services offered require the implementation of technological process). The study adopted a group of companies in accordance with the code of the European Classification of Economic Activities NACE. In order to ensure that the sample is representative and that sampling is current and complete, an online database of companies has been used. It was made available by the company, which is engaged in the professional development of databases.

The study adopted a limit to the sampling methodology. The main criterion for selection was a deliberate restriction to a geographical segment (Wielkopolska region) with

simultaneous maintenance of the representativeness of the sample and the selection of the quota. The population of the surveyed companies was divided into layers: (a1) manufacturing companies, (a2) production and service companies, (a3) production and trade enterprises, (a4) manufacturing, service & trade companies, (a5) commercial enterprises, (a6) service companies, (b1) small enterprises (employing up to 50 people), (b2) medium-sized enterprises (employing 51-250 people), (b3) large companies (employing more than 250 people) (c1) with domestic capital, (c2) with foreign capital.

In line with the above presented methodology, a list of companies has been prepared that meet the required in the definition of population criteria: management system in place, the type of business production or selected services. The last criterion of selection was related to the cost-aspect concerning further research. The population estimated 372 companies, and sample size of 100 companies was selected.

Due to the industry criterion, among respondents there were mostly companies of the metal industry (24%), automotive (19%) and machinery (9%). Full cross-section of industries is shown in Figure 1.

The questionnaire included a total of 37 tools and techniques of quality management. One of the keys to their inclusion in the questionnaire were operating in theory (and practice) classification divisions into such groups of quality tools as: traditional, new, statistical and additional; and the group of quality techniques, where each of the listed groups of instruments covered comparable number of seven to eight representatives:

- traditional quality tools group: check sheet, histogram, control chart, fishbone diagram, Pareto diagram, flow-chart, scatter diagram (TQT);
- new quality tools group: affinity diagram, relationship diagram, matrix diagram, tree diagram, prioritization matrix, process decision program chart, arrow diagram (NQT);
- statistical quality tools group: sampling (selection of samples for statistical surveys), statistics (statistical measures of location and variability), distributions (distributions of statistics described by the probability distribution function), interval of confidence (determination of the confidence interval of the average or fraction), hypothesis testing (formulation and verification of statistical hypotheses), analysis of variance, regression and correlation analysis, process capability indices (SQT);
- additional quality tools group: brainstorming, ABCD method, decision matrix, force field analysis, ABC method, 5W2H, 5S, Poka-Yoke/Mistake proofing (AQT);
- quality techniques group: QFD, FMEA, DoE, statistical quality inspection, SPC, MSA, testing requirements and satisfaction of customers (QT).

A standardized questionnaire was designed in a way that allowed - while indicating by the respondent well-known and used in the audited company tool / technique of quality - simultaneous determination of:

- at which stage of the production process it is useful (in case of bigger number of adequate tools, respondents had to identify the most commonly used tool), wherein in the production process the following steps have been identified:
  - market research (1-MR)
  - designing of the product (2-DP)
  - technical preparation of production (3-TPP)

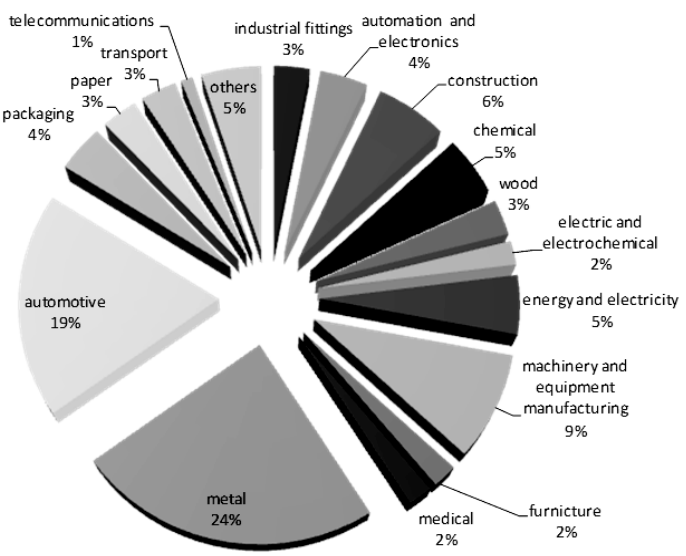


Figure 1: Companies surveyed (100 respondents) according to the industry

- manufacturing process (4-MP)
- monitoring and measurement (5-MM)
- transport (6-T)
- warehousing (7-W)
- sales (8-S)
- support service (9-SS)
- utilization of the product (10-UP)

- what problem solving it is designed to solve (without reference to the phase of the methodology of problem solving):
  - man
  - low qualifications (1)
  - poor work culture (2)
  - interpersonal conflicts (3)
  - lack of motivation and engagement (4)
  - lack of creativity (5)
  - others (6)
  - material
  - non-compliance (low quality) (7)
  - inhomogeneity (once well, once wrong) (8)
  - deliveries with inadequate quantity (9)
  - delivery not on time (10)
  - others (11)
  - method
  - inadequate manufacturing techniques, methods of service delivery, etc. (12)
  - lack of full information about the process (13)
  - others (14)
  - machine
  - too low quality ability of a machine, device, equipment (15)
  - high failure rate (16)
  - difficulties to use (17)
  - others (18)
  - performance of the process
  - process instability/variability of the results of the process (19)
  - high number of discrepancies / high fraction of defects (20)
  - low efficiency (21)
  - high costs of quality (22)
  - others (23)
  - monitoring and measurement
  - insufficient process control (24)
  - insufficient acceptance criteria of the performed work (25)
  - measurement methods inadequate to the requirements (26)
  - inappropriate measurement & control instruments (27)
  - others (28)
  - management
  - downtime (29)
  - delays (30)
  - creation of „bottlenecks" (31)
  - lack of standards concerning work performance (32)
  - „bureaucracy" of the process (33)
  - inadequate flow of information (34)
  - too little data analysis and presentation of the results (35)
  - lack of feedback information concerning non-compliance (36)
  - too short time on decision making (37)
  - ineffective supervision of documentation (38)
  - others (39)
  - environment
  - difficult cooperation with suppliers (40)
  - inadequate working conditions (41)
  - others (42).

Subsequently, on the basis of the collected during the research data, qualitative reasoning has been conducted, which included an analysis of the occurring problems during specified stages in the production process and

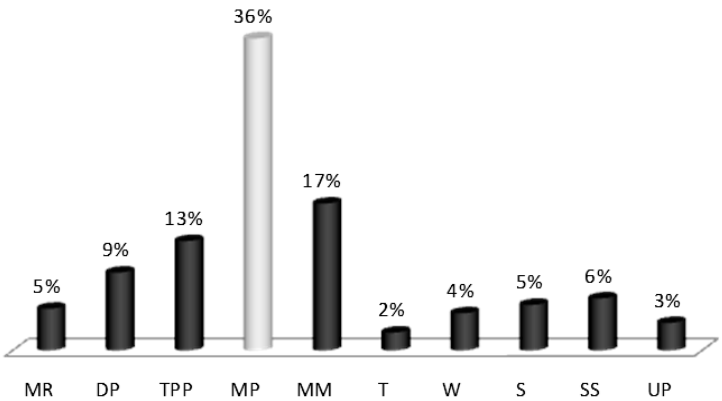


Figure 2: Number of indications (in %) of problems that occur at different stages of the production process in the surveyed enterprises

identification of quality management tools used in practice to solve them.

3 Results

Due to the data collected in the survey one may observe that the quality tools and techniques are used to solve problems of various kinds, most frequently however (Figure 2):
in the process of production (36% of all responses);

- in the direct "neighborhood" of the manufacturing process, i.e. in the technical preparation of production (13% of responses), and in the control processes and measurements (altogether 17% of responses);
- as well as in the "further environment" of the manufacturing process - in the design of products (9% of responses) and servicing (6% of responses).

QT&T instruments are used less frequently in such phases of the production process as:

- market research and sales (5% of responses);
- warehousing and transport (4% and 2% of responses);
- in the utilization phase of products (3% of responses).

Further part of the paper presents the results of analyses of data from the manufacturing phase (MP) in the production process. The rationale for the selection of the step "manufacturing process" for further analysis is that during the manufacturing process occur most problems (36% of the earlier mentioned indications); they are at the same time

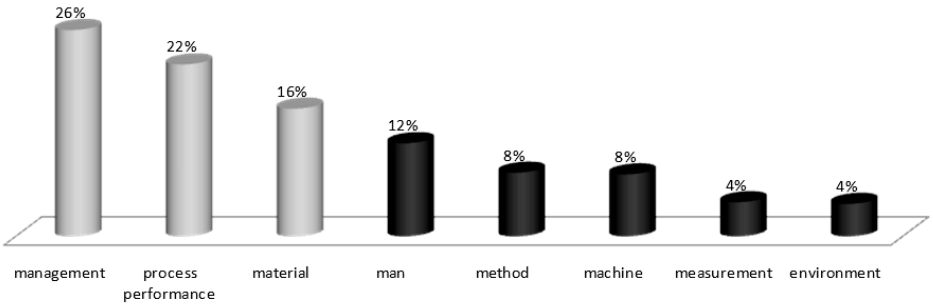
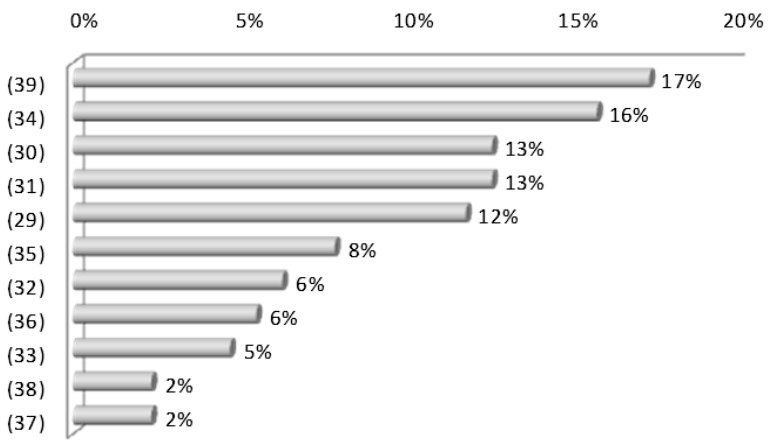


Figure 3: The frequency of indications to subcategories of problems *in the manufacturing processes of the surveyed companies*



Legend:
(39) others
(34) inadequate flow of information
(30) delays
(31) formation of 'bottlenecks'
(29) downtime
(35) too little data analysis and presentation of results
(32) lack of standards concerning work performance
(36) lack of feedback information on discrepancies
(33) "bureaucracy" of the process
(38) ineffective monitoring of documentation
(37) too short time on decision making

Figure 4: The frequency of indications to subcategories of the problem "management" of manufacturing process

the representatives of all eight categories of problems, defined in the study. On the basis of the most common problems in the manufacturing process, i.e.

- management of the process;
- performance of the process;
- process supplying (materials and resources)

Their sub-categories have been indicated; one has also shown which tools are reached out for in the Polish manufacturing companies in order to solve the problems and how the effectiveness of their usage is evaluated (Figure 3).

The problem in the manufacturing process - management

Figure 4 shows that the most common problems in the category "management" of the manufacturing process - apart from the classified by respondents as "others" (17%), are problems associated with inadequate flow of information in the process ("do not arrive on time to the appropriate recipients"). Furthermore, the distinguished problems are: arising delays, "bottlenecks" and downtime.

The most commonly used tools in solving specific problems include: brainstorming (altogether 28% of indications) flowchart (total 15% of responses) and the PDPC (9% of responses), and the degree of their use - as concerns the remaining tools - is shown in Figure 5.

Respondents also evaluated the validity of the analyzed problem for the stability of the manufacturing process. Moreover, they estimated the importance of the occurring problem using a scale from 1 - little importance to 5 - very high importance. Among the respondents indicating occurrence of problems related to the management (on the significance of problems there were altogether 93 indications of 126 possible problems in this category)

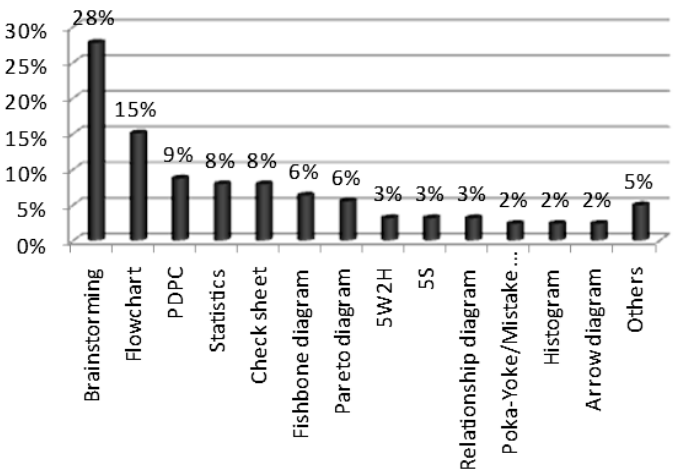


Figure 5: Tools and methods of quality management used in solving problems of the category "management"

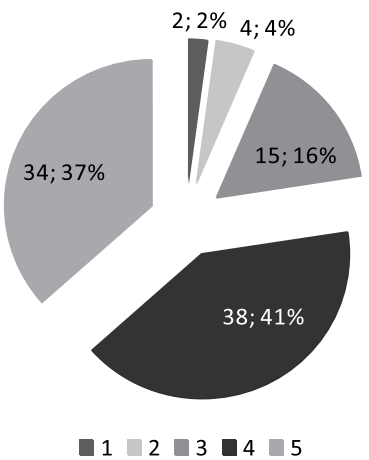


Figure 6: The significance of the problems associated with the management of the manufacturing process

78% of them identified these problems as important and very important (Figure 6).

Another aspect was to evaluate the effectiveness of the use of quality management tools, which are used to solve problems in the category of "management". There was a total of 125 indications to 126 possible. As many as 83% of respondents identified effectiveness of the evaluated tools as high and very high (Figure 7).

The problem in the manufacturing process - the performance of the process

Figure 8. shows that the most common problems in the category of "process performance" are a large number of discrepancies / defects fraction (30% of indications), variability of the process results (28% of responses) and low efficiency of the process (19% of responses).

The most commonly used tools in dealing with specified problems include descriptive statistics (20% of responses), Pareto diagram (12% of responses) and process capability indicator (10% of responses), the degree of their usage - as concerns the remaining tools - is shown in Figure 9.

Respondents also evaluated the validity of the analyzed problem for the stability of the manufacturing process. Among the respondents indicating the occurrence of problems related to the performance of the process (on the significance of problems there were altogether

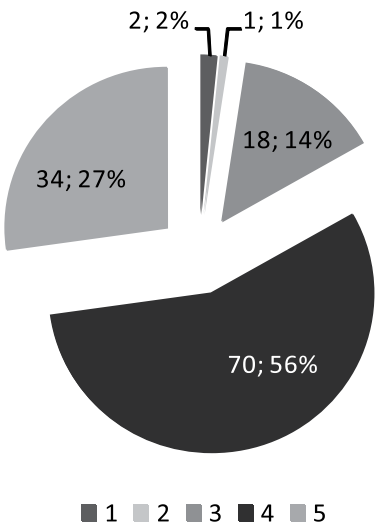
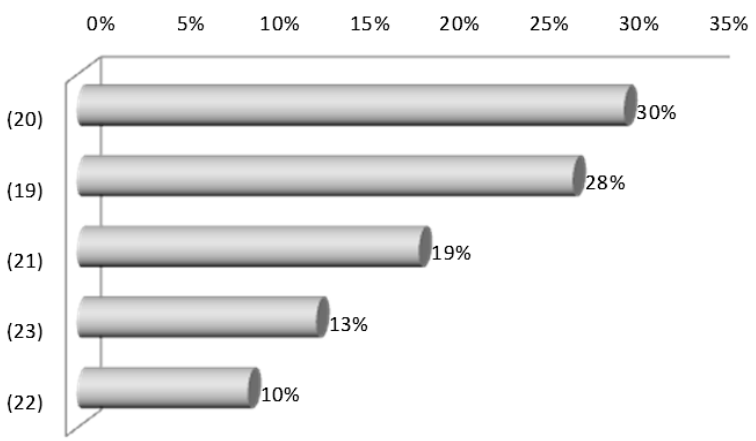


Figure 7: The effectiveness of the tools used to solve problems in the category "management"



Legend:
(20) a large number of discrepancies / high fraction of defects
(19) process instability / variability of process results
(21) low efficiency
(23) others
(22) high costs concerning quality

Figure 8: The frequency of indications to subcategories of the problem "process performance"

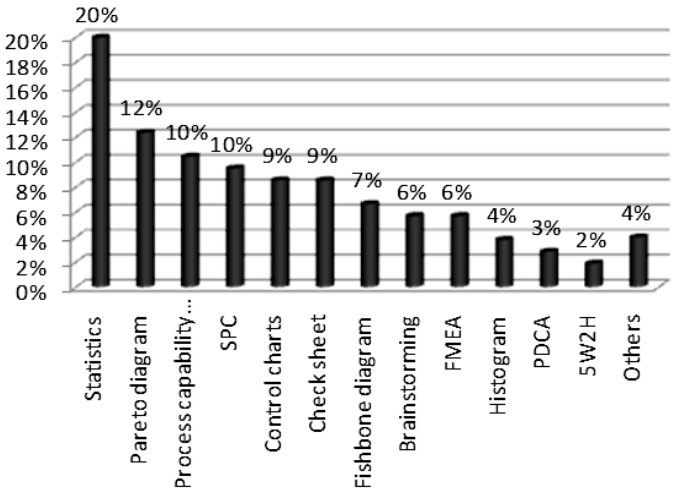


Figure 9: Tools and methods of quality management used in problem solving in the category of "process performance"

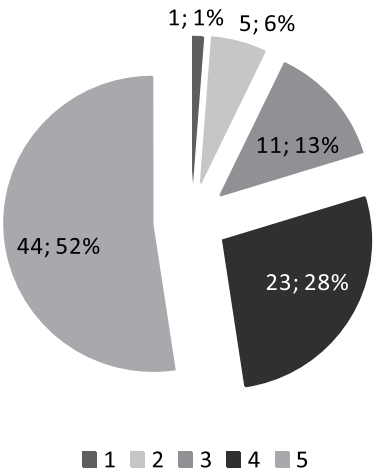


Figure 10: The significance of the problems associated with the performance of the manufacturing processes

84 indications to 105 possible problems in this category) 80% of respondents identified these problems as important and very important (Figure 10).

Another aspect was to evaluate the effectiveness of the usage of quality management tools, which are applied to solve problems in the category of "process performance". A total of 103 indications has been obtained per 105 possible. As many as 86% of respondents identified effectiveness of the evaluated tools as high and very high (Figure 11).

The problem in the manufacturing process - material (of process supply)

Figure 12 shows that the most common problems in the category of "process supply" are low quality of input material (37% of responses), followed by deliveries against the quantitative specification (21% of responses) and the inhomogeneity of the supplied materials (18% of responses).

The most commonly used tools in dealing with specified problems include: the check sheet (26% of responses), statistical control of deliveries (17% of responses) and also FMEA method (13% of responses), the degree of their use - as concerns the remaining tools - is shown in Figure 13.

Respondents also evaluated the validity of the analyzed problem for the stability of the manufacturing process. Among the respondents indicating occurrence of problems related to the process supply (on the significance of problems there were altogether 68 indications of 78 possible problems in this category) 85% of

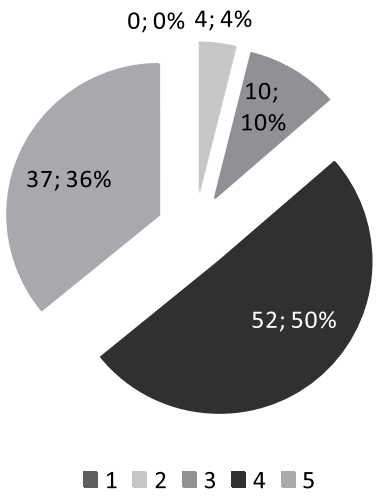
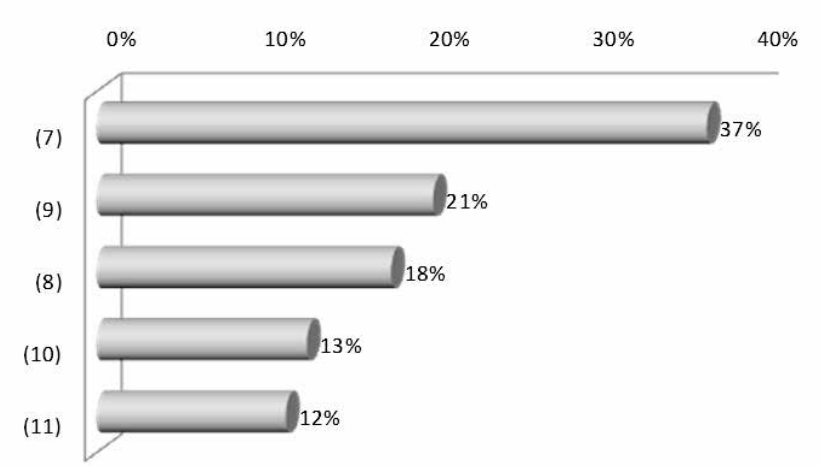


Figure 11: The effectiveness of the tools used to solve problems in category of "process performance"



Legend:
(7) non-compliance (low quality)
(9) deliveries with inadequate quantity
(8) inhomogeneity (once well, once wrong)
(10) deliveries not on time
(11) others

Figure 12: The frequency of indications to subcategories of the problem "process supply"

respondents identified these problems as important and very important (Figure 14).

Another aspect was to evaluate the effectiveness of the usage of quality management tools, which are applied to solve problems in the category of "process supply." There was a total of 77 indications out of 78 possible. As many as 82% of respondents identified effectiveness of the evaluated tools as high and very high (Figure 15).

4 Discussion and conclusions

Application of tools and techniques of quality management is different at different stages of the production process (Figure 16). The market research (MR) goes primarily to the collection of quality management techniques (QT) with the leading role of methods testing the requirements and satisfaction of customers. At this stage, statistical tools (SQT), new (NQT) and additional (AQT) are used sparsely. During the design, the complement of tools and engineering design systems are quality management techniques, together with traditional tools (TQT) and additional ones. The dominant set of quality tools at the stage of technical preparation of production (TPP) consists of QT, TQT and additional tools, while the first and second group of tools definitely stands out due to the highest number of indications of the respondents.

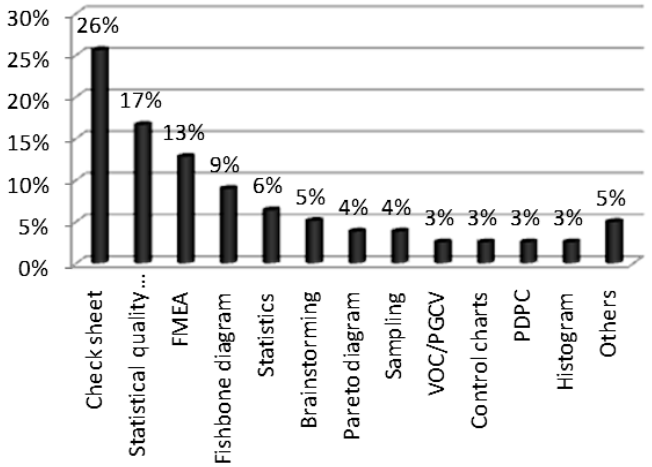


Figure 13: Tools and methods of quality management used in problem solving in the category of "process supply"

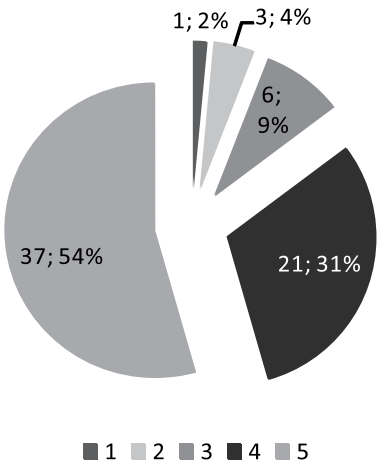


Figure 14: The significance of the problems associated with the process supply

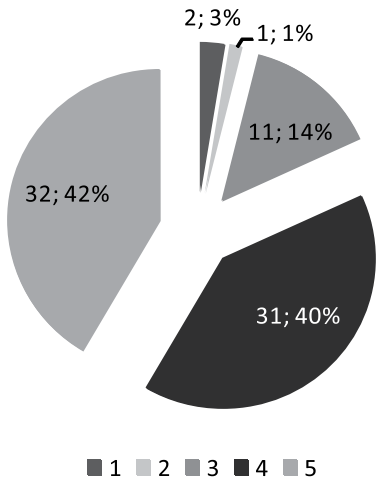
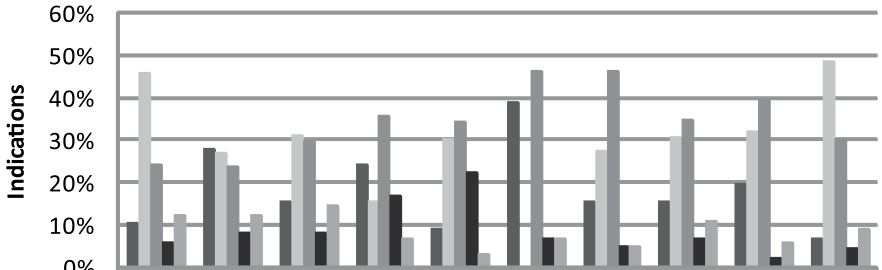


Figure 15: The effectiveness of the tools used in problem solving in the category of "process supply"



	MR	DP	TPP	MP	MM	T	W	S	SS	UP
AQT	11%	28%	16%	24%	9%	39%	16%	15%	20%	7%
QT	46%	27%	31%	16%	30%	0%	28%	31%	32%	49%
TQT	25%	24%	30%	36%	35%	46%	47%	35%	40%	30%
SQT	6%	8%	8%	17%	23%	7%	5%	7%	2%	5%
NQT	12%	12%	15%	7%	3%	7%	5%	11%	6%	9%

Figure 16: The frequency distribution of QT&T indications in groups according to the stages in the production process

In the manufacturing process itself the most frequently used tools are those from the traditional group; in the second place - additional tools, which shall be a reference to the methods of organizing processes in a wider range. It is the area where new tools are most frequently used! (as compared with other stages of the production process). The latter ones, in turn, are least useful in the control phase and during the measurement (MM). In this part of the process one usually reaches for more complex instruments, that is the quality techniques (including SPC, MSA, DoE, statistical inspection), statistical tools and traditional tools (having in their sets also quantitative tools). During transport one uses tools and techniques of quality management least frequently (total 28 responses). They are more useful in the case of warehousing processes - in the context of controls and deployment of resources (traditional tools applied most frequently here). The system of indications to usage of QT & T in the phase of service is derived from the techniques and tools used in the design and manufacturing phases (most indications concern TQT, QT and AQT), though their cardinality in these phases of the manufacturing process is much lower. It turns out that the quality tools and techniques are also useful in the EoL-phase of a product. This is particularly visible in the case of indications to the set of quality techniques and traditional tools, used in the phase of product utilization. Popularity of usage of quality tools and techniques in the UP phase - puts these instruments - due to the cardinality of indications throughout the whole production process - in the penultimate position in the ranking. One should however remember that problems related to the so-called end of the product's life have only recently been gaining in importance as far as the activity of manufacturing companies is concerned.

The collected data show that the tools and techniques of quality can be attributed to one of three categories:

- process-dedicated, are applied in selected stages of the manufacturing process (e.g., 4 - stage of manufacturing), and are also useful for solving all kinds of problems at this stage of the process, they can include: control sheets, descriptive statistics, block diagram and FMEA method;
- problem-dedicated; are used to solve problems of specified nature and are also useful at all stages of the manufacturing process, they may include: control sheets and block diagrams;
- so called "island-like", i.e. centered around the "neighboring" manufacturing process stages in connection with the problems of a specified nature, they may include: FMEA, SPC, DoE, indicators of qualitative abilities, sampling.

Gathered in the study material is a reflection of the degree of usage and suitability assessment - in the context of solving problems and improving processes – of quality tools and techniques in manufacturing companies in Poland. It is also a basis for the already developed decision support system of the selection of the tools and techniques of quality (Starzyńska, Hamrol, 2013). Surveys were carried out within the scope of one's own project, entitled "Development of a new – based on the knowledge of workers – method of selection and application of the quality management instruments for the improvement of manufacturing processes in manufacturing companies" (No. N503263234), funded by the Polish Ministry of Science and Higher Education, realized between 2008 and 2010.

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Praktična uporaba orodij kakovosti v poljskih proizvodnih podjetjih

Ozadje in namen: Sodobna podjetja so se znašla v položaju, ko je sposobnost dinamičnega prilagajanja spreminjajočim se tržnim pogojem ključna konkurenčna prednost. Zato stalno iščejo intenzivne načine za izboljšanje izdelkov in procesov. Osnova za uvedbo takšne strategije je učinkovita uporaba informacijskih virov. Pri upravljanju s kakovostjo se uporabljajo ustrezna orodja in tehnike da pripravijo odločevalcem informacije potrebne za korektivne in preventivne ukrepe in ukrepe izboljšanja.

Zasnova/metodologija/pristop: V članku so prikazani rezultati raziskave izvedene na reprezentativnem vzorcu proizvodnih podjetij iz Velikopoljske regije. Osnovni cilj raziskave je ugotoviti kakšni problemi z vidika zagotavljanje kakovosti in v katerih fazah proizvodnega procesa so najbolj pogosti in katera orodja in tehnike kvalitete praktiki uporabljajo za njihovo reševanje. Ocenjevali smo tudi pomembnost ugotovljenih problemov in učinkovitost uporabljenih orodij.

Rezultati: Ugotovitve raziskave kažejo, da se orodja kvalitete najbolj pogosto uvajajo v fazi izdelave v proizvodnem procesu, nato v pripravi proizvodnje in v fazi meritev. Na primeru faze izdelave smo pokazali katera obravnavana orodja se učinkovito uporabljajo za reševanje problemov, upoštevajoč vhod v proces, izvedbo in upravljanje procesov.
Zaključek: Dobljeni rezultati nam dovoljujejo, da nasprotujemo tezi o univerzalnosti orodij kakovosti. Upoštevajoč faze proizvodnega procesa ugotavljamo, da so nekatera usmerjena predvsem na posamezne faze in so kat takšna lahko učinkovita v praksi.

Ključne besede: upravljanje kakovosti, orodja in tehnike kakovosti, izboljšanje procesa, proizvodni proces

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Managing Customer Participation and Customer Interactions in Service Delivery: the Case of Museums and Educational Services

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Background and Purpose – In this study we investigate determinants of customers' quality perceptions in service processes which involve customer participation and customer to customer interaction (CCI). Building on existing multi-dimensional approaches to service quality we explore relevant quality aspects for related to the performance customer participation and CCI.
Design/Methodology/Approach – The study builds on focus groups conduct with employees and customers of a leading provider of educational and science services, which offered a portfolio of service activities requiring very diverse levels of customer participation and CCI, to characterize service quality dimensions.
Results – The study distinguishes three dimensions of service delivery quality: a dimension related to the providers' direct performance; a second dimension relative to the performance of customers' own participation in service activities, and a third dimension relative to the interaction with other customers. The work extends service quality literature by identifying new dimensions which affect service quality in service settings with active customer involvement.
Conclusion – Service providers have been developing very diverse delivery processes, frequently inviting customers to have active roles in service production. Often, customers also interact with other costumers in service delivery. The paper provides a contribution to foster the debate about service quality frameworks, and aims to inform the design and the management of services where customer participation and CCI have a key role.

Keywords: service quality, customer participation, customer-to customer interaction

1 Introduction

Customers assess the quality of a service by evaluating various outputs in a delivery process. Johnston and Clark (2005) distinguished a direct result (the core output of a service, such as a meal in a restaurant) and an experience outcome (the way the customer is dealt in the delivery). Other authors, such as Roth and Menor (2003) identified dimensions of explicit and implicit service outputs. Research results also evidenced that when service results are difficult to assess (e.g. because of their intangibility, such as in education services), customers often rely on service process clues for inferring about service quality (Rosenbaum and Massiah, 2011; Baker and Lamb, 1994).

Extant quality models capture such multidimensional nature of service outputs (Martínez and Martínez, 2010). Seminal conceptualizations include the work of Gronroos (1993), which distinguishes dimensions of technical and functional quality, and SERVQUAL (Parasuraman et al. 1991,1988) which identified five quality dimensions: tan-

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gibility, responsiveness, assurance, reliability and empathy. These models have been successfully applied across the diverse universe of service industries (Ladhari, 2009). They seem, however, less fit to describe service quality for delivery processes which have distinct operational characteristics.

Quality models typically address service processes with substantial volume of customer-employee interactions and customer contact with tangible elements (e.g. service facilities). Yet, service providers have been developing very diverse delivery processes, frequently inviting customers to have active roles in service production (e.g. adopting self-service technologies), and therefore affecting service quality (Payne et al., 2008). Often, as well, customers interact with other costumers in service delivery (e.g. customers frequently provide instructions and assistance to each other in service settings). Both customer participation and customer-to-customer interaction (CCI) can have substantial impacts for service results (Frei, 2006; Nichols, 2005, 2010) and consequently for customers' quality perceptions (Bendapudi and Leone, 2003). Nevertheless these aspects are not explicitly integrated in the prevalent quality frameworks, which are used to support service research and management (Kelley et al., 1992).

We need to expand service quality frameworks, in order to meet the diverse service delivery processes offered by providers. In particular, we need to look at service processes involving distinct degrees of customer participation and CCI, to understand its influence for service results and customers' quality perceptions. Our work aims to provide a contribution to this field. We are conducted a case study with a leading provider of educational, and science, events, targeted to both adult and children audiences. The organization conducts service activities requiring very diverse levels of customer participation and CCI, therefore providing a rich portfolio of service delivery processes for our study.

The primary goal of the study was to investigate how the operational characteristics of the service delivery (e.g. customer participation and CCI) contribute to inform customers' quality assessments. The study sets out to identify service quality dimensions associated to the characteristics of providers and customers which influence service outputs and quality.

The paper is structured as follows. We first provide the conceptual background of our study, reviewing the conceptualization of quality service literature, notably the multidimensional nature of the service quality construct. We also provide a review of the characterization and implications of customer participation and CCI in services. In the methodology section we describe the objectives of the study and the data collection and data analysis methods. Finally we provide a discussion of the results of the work, and we draw some managerial implications and directions for future research.

2 Conceptual background

2.1 Service Quality

The outputs of a service process are considerably more difficult to specify and evaluate than those of pure manufacturing processes (Goldstein et al., 2002). The results obtained in many services can involve intangible components, which can be difficult to specify and assess (Lovelock and Wirtz, 2001; Grönroos and Ojasalo, 2004). Moreover, as customers participate in the service process, they evaluate both the final outcome of service delivery and how the service was delivered and how good their personal experience was (Mohr and Bitner, 1995, Grönroos and Ojasalo, 2004).

Service process experiences can be positive when customers enjoy some of the process participation itself, for example, because of fun elements and socialization aspects related to the interaction with other customer or employees (Burke, 2002). But it may also be perceived negatively because it will involve some personal time and effort to reach or contact the service facilities and for completing the service delivery. In many cases, the process experience can dominate the overall value perception of the customer and be even more important for the customer than the service direct results (Grönroos, 1998).

The definition of specific performance measures to evaluate the quality of the service delivery in each of these value dimensions is complex. The SERVQUAL model by Parasuraman et al. (1988) is probably the most widely accepted model to develop adequate measures of service quality. The model defines 5 dimensions to measure service quality: tangible elements, reliability (performing the service accurately and consistently), responsiveness (providing the service fast), assurance (delivering the service in a competent and credible manner) and empathy (offer care, courtesy and individualized attention). Other authors developed similar approaches adding new dimensions to address specificities of particular service contexts. For example, Parasuraman et al. (2005) developed ES-QUAL and E-RecS-QUAL for the specific case of electronic retail services quality and the quality of service recovery, introducing dimensions such as efficiency, fulfillment, system availability or privacy, to address specifi service attributes related to customer-technology interactions. Similar efforts can be found in the literature about retail services, with the retail service quality scale (RSQS) consisting of five dimensions: physical aspects, reliability, personal interaction, problem solving and policy Dabholkar et al. (1996). The RSQS measurement scale includes some general service quality items, inspired in SERVQUAL, as well as items related to specific aspects of retail services such as, the layout of the store its adequacy to customers' browsing and picking of products (in the physical aspects dimension), or the quality of the merchandise (in the policy dimension). Whereas customer participation and CCI have been acknowledged as

an important feature in many service settings, extant service measurement scale, don't include specific items or dimensions related to the performance of the customer actions or the interaction with others. The purpose of this study is to provide a contribution to this body of knowledge.

2.2 Customer participation

Customer participation has been acknowledged as a key distinguishing feature of service process (Sampson, 2000). Customers provide very diverse inputs for service production, notably the presence of the customer himself (as it in the case of healthcare or personal services); some material or immaterial customer possessions (personal objects to be transported, cleaned, repaired); and frequently, customer information (Lovelock and Gummesson, 2004; Sampson and Froehle, 2006). Consequently, service processes typically involve a great deal of interaction between the customers and the service employees, as well as the commitment of personal time and effort to engage in the service delivery (Mills and Margulies, 1980, Chase, 1981, Mills et al., 1983).

Customers have been progressively encouraged to perform more active roles in service production. Some authors have suggested long ago that companies can use customers to replace the employees in some operations as a source of productivity gains (Mills and Morris, 1986). More recently, the concept of co-production has been extended to consider customer contributions in more general instances. In the strategic management literature, this is often referred to as "value co-creation" (Prahalad and Ramaswamy, 2004). Building on previous work, Sampson (2007) defined seven possible types of generic roles a customer can perform in services: supplier, labor, design engineer, product, inventory, quality assurance, and competitor.

Increasing the extent of customer participation in services, however, does not come without a cost. The quality of the resulting service becomes, at least partially, dependent on the quality of the collaboration between the customer and the provider (Heinonen et al. 2013; Cheung and To, 2011). As Frei (2006) noted, customers can introduce substantial variability in service process operations and outputs, due, for example to their lack of capabilities to perform the service delivery operations required from them, or just because they don't have enough motivation of incentive to do so. As such, in services involving substantial customer participation, diverse types of customer failures, and low performance situations can occur (Ford and Dickson, 2012).

For service providers customer participation creates the need to design service processes in a robust way, to incorporate customer contributions in a seamless way which doesn't affect efficiency and customer value. Examples of these efforts include the creation of clear customer instruction and scripts to guide customer roles and actions in service delivery (Tax et al. 2006). Moreover, customer failure, or misbehavior will affect not only the quality of his own outputs, but also the results and the experience provided to other customer sharing the same service settings (e.g. smoking in the non-smoking area of a restaurant, talking in an overly loud voice late at night in a hotel hallway, talking on cell phones during a movie, etc.) (Huang et. al 2010). Customer participation has effects for customer service quality perceptions, particularly in the case of service failures, or when delivery fall below certain expected level. For example, in service settings which ask from customers a high degree of autonomy in the conduction of the tasks in order to obtain a service output, it has been observed that customers can show a bias in attributing the responsibilities to the company and the employees (Yen et al. 2004). In service settings with intense customer participation (e.g. retail, education, etc.), the service system evolves towards a production system where employees and customer tasks and instructions are linked and visible for these two actors. Customers will therefore also assess how well the service processes is design to accommodate their participation. As such, in such settings, service quality measure should reflect these aspects, and customer perceptions regarding their capabilities to perform as well as elements related to the sevrcie process operations (e.g. layout, information, etc.)

2.3 Customer-to-customer interaction

CCI is a broad concept used to refer to an ample range of interactions that take place between customers during service delivery. In retail settings, for example, customers often engage in conversations with each other to exchange information which facilitates the service process - e.g. asking for help in locating an item in the store, asking for advice or opinions about the suitability of an item for a specific purpose or occasion, etc. - (Harris et. al, 1997). Although CCI is present in a wide variety of service industries, it has been mostly addressed in settings such as retail (see for example Parker and Ward, 2000; Baron et. al, 1996) and travel and leisure services (von Lehn, 2006; Harris and Baron, 2004; Martin, 1997).

The literature documents well the diversity of forms that CCI can assume. McGrath and Otnes (1995) proposed a classification to capture the diverse social and informational exchanges that take place between unacquainted retail customers. Their work distinguished situations in which customers engage in explicit interactions – labeled as overt customer influences – from other instances in which, although customers exert influence over each other's behavior, some of them can be oblivious or even unaware of such interactions – labeled as covert customer influences. Their work documented situations in which customers respond to others facing a problem or a service difficulty (overt influences when customers act as proactive help-seekers, as well as covert influences observed in behaviors of followers and observers); it described also instances when customers presume to have a value or experience to contribute to another

(overt influences: reactive helpers; as well as covert: judges, accused, spoilers), and also cases where customers provoke some sensory stimulation that has the effect of catching others' attention (covert influences: admirers, complainers) and finally settings in which customers compete for limited resources (overt influences: competitors). Several other authors also contributed to the characterization of the differentiated possible customer roles in CCI, for example by: highlighting the need to distinguish proactive from reactive interaction (e.g. proactive vs. reactive helpers in Parker and Ward (2000)); identifying situations in which CCI results from customer incidents (e.g. Grove and Fisk (1997) distinguished protocol incidents, such as physical and verbal incidents in line, from sociability incidents such as ambiance incidents) and addressing also dysfunctional customer behavior (e.g. Harris and Reynolds (2004) proposed eight categories of misbehavior – property abusers, oral abusers, vindictive customers, etc.).

Customers' collaboration and socialization is very common in service encounters which take place in the presence of other customers (e.g. public transport, retail, etc.), and can be particularly stimulated when customers have to share time (e.g. wait for the service) or any service resources or utensils (e.g. using self-service technologies). Moreover, CCI is neither restricted to on-site customer interactions, or to the service encounter. Customers often seek for other customers inputs before, or after, a service encounter using a technology interface such as the internet (e.g. a priori searching for customers' opinions' and ratings about a service, or any other word-of-mouth behavior), (Georgi and Mink, 2013; Nicholls, 2005; Harris et. al, 2000).

In some services CCI is not restricted to short interactions between strangers such as the ones described above, but rather, it is one of the main sources of value creation. Examples include tourism and leisure services, such as adventure holidays, for which CCI is an integral element of the intended service experience, and is often planned in advance. The importance and the slightly distinct role of CCI in such services have been acknowledged by being specifically labeled as "CCI-driven services" (Nichols, 2007). The need for further investigation of CCI-driven services has been acknowledged by seminal authors in the field (e.g. Nicholls, 2010), and is further justified by the widespread presence, and importance, of CCI-driven services in our economies - CCI-driven services can be found in a wide variety of industries, such as tourism, education or leisure. Education services, like the ones addressed in this study, have characteristics of "CCI-driven services", as they are designed be provided to groups of customers and often require their participation and collaboration in the process. As such, the measurement of quality in such settings should contemplate items related to the perceived quality of attributes related to the specification and the management of customer groups and their interactions. In this study we will look specifically into these aspects, in order to understand if customers are aware of it being part of service design and specification decisions, for which the service provider is responsible and accountable.

3 Methodology

3.1 Data collection

The study builds on a preliminary review of the literature about service quality, customer participation and CCI to learn about the extant service quality models, as well as to identify attributes related to customer participation and interaction which could affect service outputs. The purpose was to specify a set of priory categories of service quality attributes to guide the conduction of focus groups interviews, and the subsequent data analysis, following Miiles and Huberman (1994).

Building on the literature review we distinguished three broad dimensions of service delivery performance which can have a determinant impact for service process and service outcomes. A first dimension was related to the direct performance of the service provider, i.e. the resources directly managed and controlled by the company (e.g. service facilities, personnel, etc.). A second dimension was linked to the performance of the customer in his actions and participation in service activities. A third dimension was

Table 1: Service process dimensions influencing service quality

	Service Process Characteristics		
	Provider	**Public**	**Personal**
Service Quality Dimensions	Tangibility Responsiveness Assurance Reliability Empathy	Time Space Behaviour Assistance	Arrivals Requests Capabilities Motivation Preferences
Key References	*Parasuraman et al., 1988, 1991*	*Nicholls, 2005*	*Frei, F., 2006*

considered to contemplate the performance of other customers, and their action an interaction during service delivery (See Table 1).

The proposed three levels of service process dimensions were adopted to analyze the portfolio of educational services offered by the organization addressed in the study - provider of educational, and science, events – in order to characterize service portfolio according to two criteria: the intensity of customer participation required; the number of customers involved in a service event. This classification led to the four process archetypes illustrated in Figure I.

Most of the services offered required substantial customer participation because the education and science labs involved a great deal of experimentation and interaction with the provider employees to analyze and comment the observed experiences or exhibition of scientific aspects (e.g. learning the chemistry involved in producing butter or bread, etc.). The provider offered diverse group activities, for example for school audiences which were monitored by professors and employees of the provider who were responsible for conducting the activities, and assuring the involvement and the engagement of all participants in the experiments. Individual experiences were also provided, where the customers interacted autonomously with the materials and technologies exhibited in the service space. A few services, requiring more modes customers' participation were also offered, such as small exhibitions, and movies and talks with invited guests from the partner university. The provider has a close collaboration with a partner university, located in the same town. Most of the staff involved in the design and conduction of the services (e.g. laboratories for kids, experiment with food and nature, etc,) were current or former researchers from the university.

The next step in the study involved the conduction of 7 focus groups, involving about 12 participants each, including users of the services (i.e. mostly groups of visiting students and professors) and employee, i.e. the monitors involved in the provision of services, for the service categories of Active/Groups and Passive/Groups. The group interviews follow a semi-structured protocol, including a set of guiding questions regarding the service experience, and the preparation undergone by customers and employees before a service experience. The purpose was to explore service delivery aspects found by each of these actors as relevant for the successful service experience. The interviews are recorded and subsequently transcribed for data analysis and coding.

3.2 Data analysis

Data analysis involved the identification of relevant quality attributes related to the three service dimensions specified ex-ante, from the exploration of the transcribed interviews. Relevant aspects were summarized into in an adequate display, an analysis strategy recommended by Miles and Huberman (1994). We built separate matrices for summarizing the service quality aspects mentioned by employees, and by professors and student customers, in an effort to categorize then under one of the three dimensions: provider's direct performance, customer performance, and CCI performance. We began by building a comprehensive list of quality attributes that were classified into those broader conceptual categories. This resulted in a comprehensive list of aspects supported by the literature and a few new aspects which were not found in the literature review

Number of customers involved in service delivery	Intensity of customer participation: Active	Intensity of customer participation: Passive
Groups	Snail belly; Laboratory with walls of glass; The kitchen is a laboratory; Robotics; Birthday party; Exhibitions, Mind-ball; Room with mathematical games; Studio C; Discovering Biodiversity; Impatience and Math's afternoon; Science at breakfast.	Performances and Theater plays to communicate science; Talks about books and science; 3D movies
Individuals	Laboratory with walls of glass; The kitchen is a laboratory; Robotics; Birthday party; Exhibitions, Mind-ball; Room with mathematical games; Studio C. (essentialy during weekends)	Periodicals; Perspectives, Art & Exhibitions.

Figure 1: Service process archetypes

(mostly linked with the customer participation and interaction issues, as expected). Staff members involved the focus groups involved the front-office people responsible for the reservation and hosting of visiting groups, as well as the monitors who were involved in the direct conduction of the service experiences. Most of these were young researchers that came from the partner university which collaborated with the service provider. It also included back-office staff involved in the management of the facilities and equipment and on the preparation of materials for service activities (e.g. chemicals or ingredients for the experiments).

4 Study results

In the interviews, the different groups expressed several aspects that were regarded with particular importance in order to assure the quality of the service that matched the proposed three levels of service dimensions. In Figure II we illustrate some of such aspects derived from the focus groups involving elements of the museum staff .

Some of them were linked to dimensions addressed in service literature, such as tangible elements or reliability

Service Quality Dimensions		Quotes	Relative Importance
Provider	Quality of the Scientific Content of the Service	"…often we prepare a general content f[for a service or activity] and then we adopt it to the level of the audience we receive.	++
	Tangible Aspects	"It's an old building which was recovered from other use and it's not very ready to be accessible. However it ends up to be warm and welcoming." "Lacks accessibility for people with reduced mobility and for some children."	+
	Promotion and Access	"People complain a lot about the difficulties they have in understanding the schedule for the various services provided. Usually there are doubts about what exactly is available in a given day."	+
	Reliability	"We make sure that the colleagues leave everything in place whenever a session ends, in order for everything to be ready for the next session or activity. We also check the type o audience that we are receiving before each activity starts in order to make any adaptations to peoples' age, for example."	++
	Responsiveness	"Each session is available at several different schedules throughout the day. This is a good solution for receiving people who arrive without prior reservation….we can find always activities for them."	+
Customer	Arrivals	"Sometimes some people arrive late and they miss the first activities scheduled for the group."	-
	Preparation	"Some students have come to experiment the same activity with accompanied by different professors, whereas there are many different activities that they could try of they could organize for it…" "Often, the person from the school who calls to make the reservation doesn't' have a clear idea of the service they're booking. Then when students come they just find out."	++
	Feedback	"The staff ness feedback from students during the activity in order to understand if its going as predicted." "If the students don't answer the staff, or are rude or just playful, it can become very hard to manage a session or an activity and keep it on track."	++
	Motivation	"In some ages students are very irreverent, by nature, so they're not always cooperative, and we need to handle this the best way in order to perform the sessions or activities."	-
	Effort	"The activities proposed are not difficult, but some might require some reading or other preparation effort before they can put hands on."	++
CCI	Assistance	"When students come in groups, they already know each other and this is good because they debate the issues being experienced between them."	+
	Number of Participants	"The activities work better with groups of 15-20 students." "…the number of participants should be reduced…to handle 25 people in a session is not easy."	++

Figure 2: Service quality aspects mentioned by staff in focus-group interviews

issues. However, the conversations also provided evidence that aspects related to the performance of the customers (e.g. their preparation for the visit, or their motivation to collaborate in the activities proposed by the provider) were key for the service experience. Likewise, aspects related to the dimension of visiting groups, and to the way they interacted during the service (e.g. mutually motivating by competing to the completion of activities) were also found to be critical to affect the quality of the experiences.

The groups of students and customers interviews revealed similar results, i.e. mentioning aspects related to the provider and to the customer performance as determinant for overall service outcomes and quality. Nevertheless, the distinct groups would place more emphasis in distinct dimension or items, depending on their profiles and previous experiences they had with the service. In Figures 3 and 4 we list the dimensions that emerged from the interviews with these groups, and provide some illustrative quotes from the conversations.

The professors expressed a great concern with the scientific content of the service experience, and the need to align it with the contents addressed in the school with the students. They understood the educational services of the provider as a potential important complement to the work done in school, but highlighted that in order for this to be effective the alignment and the preparation of the visit were essential.

In the student interviews, the aspects related to the individual performance and the quality of the participation of them became much more salient in the conversations. Students recognized the importance of having activities suited to their capabilities and, like professors and staff did, they highlighted the determinant role that some beforehand preparation for the activity could have for its outcome. They were particularly expressive when commenting about aspects related to the interaction with other customers. They referred to the impact that lack of control on the behavior of other groups could have for the experience (e.g. noise). Moreover, they brought to the discussion a whole set of new aspects, for example, issues related to the competition between groups and how it could impact the engagement in the conduction of the activities proposed by the provider. At the time of the study, the provider was not explicitly specifying competition or collaboration among groups in the design of the proposed activities. However, the results suggest that aspects like these can be key service process design issues, which have a determinant role for service outcomes.

5 Conclusion

In this study we proposed to explore aspects related to the design of service delivery processes involving customer participation, which are determinant for service outcomes and customer quality perceptions. Our research was driven by the observation that whereas there is some generalization of services involving customer participation and CCI, extant service quality models predominately address aspects related to customer-provider interactions, and the quality of service providers' resources (e.g. employees, tangibles,

Service Quality Dimensions			Relative Importance
Provider	Quality of the Scientific Content of the Service	"The scientific content of the activities proposed must be aligned with the participants school year."	++
Customer	Tangible Aspects	"The facilities are well organized and equipped."	+
	Promotion and Access	"It would be important to provide more information beforehand and documentation about the scientific content in order to better prepare the groups for the activities that they will engage during the visit."	-
	Capability	"Students have the capabilities to engage in the activities proposed."	++
	Motivation	"It is harder to motivate older students to be engaged and to participate actively in the activities."	+
CCI	Assistance	"Usually students organize themselves into groups to participate in the proposed activities." "Student groups engage into competition with each other in order to see who complete the proposed activities first."	+
	Number of Participants	"When the number of people in a group is very numerous it can become very difficult for them [staff] to help all student finish the proposed activities."	++

Figure 3: Service quality aspects mentioned by customers (professors) in focus-group interviews

Service Quality Dimensions		Quotes	Relative Importance
Provider	Reliability	"The activities give the opportunity to deepen the knowledge." "They [staff] explain things in a way which is easy to understand." "They [staff] are very patient."	++
	Tangible Aspects	"The facilities are well decorated." "…The learning spaces are well equipped and facilitate the communication of the scientific contents."	+
	Promotion and Access	"Honestly I was not aware of what this [service facilities] was. I didn't even know it existed. I believe that the promotion of the service should be better." "In my opinion it is not well signalled [service facilities]. One doesn't even see a sign saying [name of the provider] when we are approaching."	++
	Quality of the Scientific Content of the Service	"The contents are relevant." "We deepen the knowledge about scientific contents but also about our region and resources." "The contents and knowledge transmitted in the activities are aligned with the school programs and are useful to complement our work."	+
Customer	Capability	"The activities are simple and easy to understand." "…the learning experience provided is different from school because (…) is very practical."	++
	Motivation	"They [service staff] make us want to listen to them." "We feel at ease to participate and try the activities."	++
	Preparation	"…often the professors talk about the [name of the company] beforehand but we don't understand very clearly what it is."	-
CCI	Assistance	"When opinions differ they try to struggle to see who's right." "When there are other schools present we try to give our best to be better in the activities and experiences."	+
	Verbal Behaviour	"Usually there are comments when different schools are present in the same activity and are trying to compete with each other."	-
	Number of Participants	"For some activities it would be better to split the group in half." "Its easier when there are fewer people…we can do more activities and we can pay more attention to the monitors [staff employees) and to the details…" "If the group is smaller there's more interaction. If the group is bigger it is more organized as nobody wants to talk…"	++

Figure 4: Service quality aspects mentioned by customers (students) in focus-group interviews

etc.). We conducted focus groups with customers and staff of a leading education services provider, which offered a portfolio of scientific educational activities, a rich context of customer participation and CCI. Data analysis supported that both customers and staff are aware of the importance of issues related to the customer participation (e.g. motivation, capabilities, etc.), as well as of aspects related to the dynamics created by groups of customers sharing the same service facilities. The results support that customers are aware of the importance of such aspects for the quality of the service outcome, and that, to some extent they attribute its specification to the responsibility of the service provider. Service processes involve successive operations, during which the service setting and the providers' decisions (e.g. staff choices, target customers, customer group dimensions, etc.) are highly visible for customers, and therefore subject to their assessment. As such, the results support our research intuition that service quality approaches need to be extended to encompass aspects related to customer participation and interaction. This study therefore contribute to expand service quality frameworks and to inform the design and the management of services where customer participation and

CCI have a key role. The conduction of further exploratory analysis in other service settings would be useful to further develop this line of work, and to prepare adequate measurement tools to address service quality in such settings.

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Sodelovanje uporabnikov in interakcija z uporabniki pri zagotavljanju storitev: primer muzejev in izobraževalnih storitev

Namen: Članek raziskuje determinante kvalitete uporabnikovega dojemanja storitev v procesih, ki vključujejo sodelovanje in interakcijo med uporabniki. Izhajajoč iz že znanih večdimenzionalnih pristopov k kvaliteti storitev, članek raziskuje relevantne vidike kvalitete povezane s sodelovanjem in interakcijo med uporabniki.
Metodologija/pristop: Spremljali smo skupine zaposlenih in uporabnikov v vodilni organizaciji, ki nudi izobraževalne in raziskovalne storitve. Organizacija nudi širok spekter storitev, ki zahtevajo zelo različne ravni sodelovanja uporabnikov in sodelovanja med uporabniki.

Ugotovitve: V študiji smo razlikovali tri dimenzije kvalitete storitev: (1) dimenzijo neposredno povezano s storitvijo ponudnika, (2) dimenzijo povezano s sodelovanjem uporabnika v aktivnostih storitve in (3) dimenzijo povezano z interakcijo med uporabniki. Članek prispeva k literaturi o kvaliteti storitev, tako, da identificira nove dimenzije, ki vplivajo na kvaliteto storitev v okolju kjer uporabnik aktivno sodeluje.
Originalnost: Ponudniki storitev so razvili zelo različne procese ponudbe storitev, pogosto tako, da so povabili uporabnike, da prevzamejo aktivno vlogo v oblikovanju storitve. Pogosto tudi uporabniki sodelujejo med seboj. Članek spodbuja debato o ogrodjih kvalitete storitev, in informira načrtovalce in managerje storitev kje je sodelovanje uporabnikov in sodelovanje med uporabniki ključnega pomena.

Ključne besede: kvaliteta storitev, sodelovanje uporabnikov, interakcija med uporabniki

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An Application of Analytic Hierarchy Process (AHP) and Sensitivity Analysis for Maintenance Policy Selection

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Purpose: The purpose of this paper is to apply an analytic hierarchy process (AHP) for the evaluation/selection of maintenance policy.
Methodology/Approach: The paper adopts a case study approach of selecting most appropriate maintenance policy in the case of Slovenian paper mill company. Several steps of the AHP method are used in order to structure the decision-making process. Five possible alternatives are considered: failure based maintenance, preventive maintenance, total productive maintenance, reliability centered maintenance and total quality maintenance.
Findings: This paper proposes a framework for maintenance policy selection based on the AHP methodology. The framework was applied to select the most appropriate maintenance policy in a paper mill company. The results suggest that total quality maintenance is the most suitable concept for a paper machine. By performing a sensitivity analysis, it was revealed that the final outcome remained stable in all cases when the weights of the main criteria were increased for 25 percent.
Originality/value: The paper contributes to the literature by providing a framework for decision-making process regarding the maintenance policy selection. In addition, this paper utilizes an exponentially weighted moving average (EWMA) chart for performing a consistency test. Moreover, a sensitivity analysis also presents an important implication of this study.

Keywords: Analytical hierarchy process, decision-making, maintenance policy

1 Introduction

Increased competition has forced companies to improve the quality of their products, to increase efficiency as well as to revise their skills, methods and manufacturing practices, which is considered crucial to gain a good reputation and business success (Sharabi, 2014). Therefore, many companies are seeking ways to gain competitive advantages with respect to cost, service, quality, and on- time deliveries (Luxhoj et al., 1997). Manufacturing companies face a great pressure to reduce their production costs (Wang et al., 2007). The estimated cost of maintenance ranges between 15 and 40 percent of production costs (Dunn, 1987), or even higher. Bevilacqua and Braglia (2000) reported that maintenance costs can reach up to 70 percent of production costs. Thus, the potential impact of maintenance at the level of operations and logistics is considerable, and therefore the financial implications of maintenance can be substantial (Waeyenbergh and Pintelon, 2002). Given these facts, there is a need to select a proper maintenance policy. Several rationales behind this need are as follows. First, Löfsten (1999) stressed that proper management of maintenance

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offers many companies significant potential of improving efficiency, productivity and profitability. Second, Al-Najjar (2007) discussed the role of efficient maintenance in the enhancement of the company' internal effectiveness for achieving better competitive advantages. Author indicated that when maintenance contribution in the production profit is more than its cost is considered cost-effective. Moreover, in a study (Ljungberg, 1998) author found that the mean percentage of OEE within the investigated cases was 55 percent. Therefore, industry could increase its performance and production capacity without investing in new machinery if an efficient maintenance policy would be implemented (Al-Najjar and Alsyouf, 2004).

Within recent times, there has been also increased emphasis on the health, safety, security and environment (Parida and Chattopadhyay, 2007). With this respect, companies should produce high quality products at a competitive price in addition to showing concern for the environment and safety (Alsyouf, 2004). The extension of this claim is that companies may need to consider different aspect such as plant functionality, environmental safety and cost effectiveness in maintenance, in order to enhance their competitiveness. Therefore, it is important for decision makers to select a proper maintenance policy, which helps companies to achieve their objectives, and boost competitiveness.

A number of empirical studies that focused on maintenance policy selection have been reported in the literature. Azadivar and Shu (1999) proposed the effective methods of selecting appropriate maintenance strategies for just in time production systems. Okumura and Okino (2003) presented the maintenance selection method based on production loss and maintenance cost. Bevilacqua and Braglia (2000) used an analytical hierarchy process (AHP) for maintenance selection in an oil refinery. In their study four evaluation criteria (damages produced by a failure, applicability of the maintenance policy, added value created by the policy, and the cost of the policy) that influenced the primary goal were used. Many different multiple criteria decision-making (MCDM) methods were also adopted in maintenance strategy selection process. For example, Al-Najjar and Alsyouf (2003) assessed the most popular maintenance strategies using the fuzzy inference theory and fuzzy MCDM evaluation methodology. Authors identify the criteria using past data and technical analysis of processes machines and components. Wang et al. (2007) evaluated maintenance strategies based on the fuzzy AHP method. Authors used safety, cost, added-value and feasibility as main criteria. Bertolini and Bevilacqua (2006) proposed a combined goal programming and AHP for maintenance selection through the use of the classic parameters occurrence, severity and detectability. In a more recent study (Zaim et al., 2012) authors used AHP and ANP decision-making methodologies for the selection of the most appropriate maintenance strategy.

Literature search identified different research works that have dealt with maintenance policy selection. While drawing on prior studies related to the application of the AHP for maintenance policy selection (e.g. Bevilacqua and Braglia, 2000), this paper makes a contribution by utilizing quality control approach for consistency test. Moreover, this paper explores the applicability of this model in the case of industrial scenario. For this purpose a case study in a paper mill is conducted.

The remainder of this paper is structured as follows. Section 2 discusses on the maintenance approaches. Section 3 presents the brief description of the AHP method. Section 4 demonstrates a case study and illustrates the proposed framework. Section 5 concludes this paper with several major conclusions drawn from the research.

2 Critical reflection: a literature review on maintenance approaches

Several maintenance approaches, i.e. strategies and concepts, methodology or philosophy have been developed and implemented through the evolution of maintenance.

Failure based maintenance (FBM) prescribes activation of maintenance in the event of failure (Gits, 1994), and no action is taken to detect or to prevent failure (Al-Najjar and Alsyouf, 2003). In a situation where customer demand exceeds supply and profit margins are large, this was a feasible approach. However, today we face global competition, small profit margins, high safety awareness and strict environmental regulations. Therefore, more emphasis is placed on developing maintenance concepts (Arts et al., 1998). Nonetheless, it is always possible that a failure is allowed to occur and then repaired. This depends on the existence of secondary damage, redundancy and the ease to repair. In the case of technical feasibility of FBM for a critical component or a non-critical component, the economic feasibility must be determined (Waeyenbergh and Pintelon, 2002).

The main objective of carrying out preventive maintenance (PM) is to reduce the frequent and sudden sporadic failures by performing repairs, replacement, overhauling, lubrication, cleaning and inspection (Gits, 1992). Traditional preventive maintenance models are using policies such as age replacement and block replacement (Reineke et al., 1999). One of the disadvantages of the PM is that PM is only economical where the standard deviation of the failure population is small (Mann et al., 1995). The other critical aspects considering PM are the lack of decision support systems and insufficient historical data (see Dekker, 1996; Al-Najjar and Alsyouf, 2003).

Condition-based maintenance (CBM) is a maintenance program that recommends maintenance decisions based on the information collected through condition monitoring (Jardine and Banjevic 2006). CBM is considered as a management toolbox required for planning maintenance activities, such as data acquisition, analysis, scheduling and conducting maintenance actions cost-effectively (Al-Najjar,

2012). Vibration-based maintenance (VBM) is the most common technique under the CBM approach, especially for rotating components. According to Al-Najjar (1997) the implementation of VBM policy provides possibilities for acquiring early indications of changes of machine-state. Nevertheless, Al-Najjar (2012) indicated that there is a need to discuss how to establish and run cost-effective CBM. In his paper he developed the steps required for establishing and running cost-effective CBM exemplified for VBM.

Total quality maintenance (TQMain) is a concept to maintain and improve continuously the technical and economic effectiveness of the production process and its elements, i.e. it is not just a tool to serve or repair failed machines rather than a means to maintain the quality of all the elements involved in the production process (Al-Najjar, 1996). Al-Najjar and Alsyouf (2000) also describe what characterises TQMain and distinguish it from other maintenance concepts (e.g. RCM, TPM). In this context features can be summarized in the following: TQMain advocates the use of a common database, continuous improvement, implementation of CBM such as VBM, and it is based on intensive use of real-time data acquisition and analysis to detect causes behind deviations in product quality and machine condition (Al-Najjar and Alsyouf, 2000).

Reliability centered maintenance (RCM) was originally designed for the aircraft industry (Nowlan and Heap, 1978). There have also been several improvements to the traditional RCM methodology for different applications, e.g. RCM2 (Moubray, 1997). RCM combines several management techniques and tools, such as failure mode and effect analysis and decision trees, in a systematic approach, to support effective and efficient maintenance decision (Backlund and Akersten, 2003). It takes into account system functionality, and not just the equipment itself. Applying RCM helps to increase the asset's lifetime and establish a more efficient and effective maintenance (Pintelon and Parodi, 2008). However, Al-Najjar (1997) indicated that RCM does not fully exploit the use of condition monitoring (CM) techniques, and the progress of damage cannot be followed until just before failure. In addition, Pintelon and Parodi (2008) reported that within RCM available statistical data are insufficient or inaccurate, and that there is a lack of insight in the equipment degradation process (failure mechanisms) and the physical environment (e.g. corrosive or dusty environment) is ignored.

Total productive maintenance (TPM) is an approach to continuously improve the performance as well as efficiency of certain industrial activities, and in the first place of maintenance. To do so, the Overall Equipment Effectiveness (OEE) is used, which is the product of availability, speed and quality performance (Waeyenbergh and Pintelon, 2002). Nakajima (1989), a major contributor of TPM, has defined TPM as an innovative approach to maintenance that optimizes equipment effectiveness, eliminates breakdowns, and promotes autonomous maintenance by operators. According to the Nakajima (1988), the concept of TPM includes five elements: (1) TPM aims to maximize equipment effectiveness, (2) TPM establishes a thorough system of PM for the equipment's entire life cycle, (3) TPM is implemented by various departments in a company, (4) TPM involves every single employee, from top management to workers on the shop floor, (5) TPM is an aggressive strategy focuses on actually improving the function and design of the production equipment. The TPM concept is simple and obvious, but there are some reported shortcomings. First, TPM does not provide clear rules to decide which basic maintenance policy will be used, and second calculation of the OEE is not really a complete analysis. Cost and profits are not taken into account, and therefore it is not a complete measure (Waeyenbergh and Pintelon, 2002). Moreover, TPM also require changing the corporate culture, which is not easily to achieve. For instance, as reflected by the study of Tsang and Chan (2000), organizations that are not ready to change their culture will not be successful in implementing TPM.

3 Introduction to AHP

The AHP was developed first by Saaty (1980). AHP is a method for solving complicated and unstructured problems that may have interactions and correlations among different objectives and goals. AHP provides an effective method in order to deal with complex decision-making and can assist in identifying and weighing criteria, analyzing the data collected and advancing the decision-making process. It is designed to solve complex problem into different levels of hierarchy with objective/goal in the top, while the intermediate levels are the criteria and sub-criteria, and the lowest level represents alternatives (Saaty, 1980). The AHP is a theory of measurement through pair-wise comparisons and relies on the judgements of experts to derive priority scales (Saaty, 2008). AHP develops priorities among all the criteria and sub-criteria within each level of the hierarchy. Accordingly, AHP method received considerable attention among decision makers and has demonstrated its applicability in different fields, such as maintenance policy selection. The latter is more deeply illustrated in the introduction section. However, this method can also be utilized in many other fields. For example, in the study (Aslani and Aslani, 2012), the fuzzy AHP was employed to prioritize and select a suitable organizational structure.

4 A case study

An empirical case study was utilised aiming to evaluate and select the most appropriate maintenance approach. The case study was conducted at a Slovenian paper mill company. Maintenance is highly crucial for this company, considering the fact that processes are running 24/7. In order to extend

equipment life, improve equipment availability and maintain equipment in proper condition efficient maintenance is essential. Thus, the main aim is to ensure smooth running of a paper machine, mainly to provide on time delivery at low prices. The objective of this study is therefore, to propose the most appropriate maintenance policy that meets these objectives. In the following section, the AHP with a statistical quality control approach for consistency test is applied to the selection of maintenance policy for a paper machine.

4.1 An AHP based framework for maintenance policy selection

The AHP modelling process includes four phases, namely, outlining the problem, structuring the decision hierarchy, pair-wise comparison for each matrix, using the priorities obtained from the comparisons to weigh the priorities in the level immediately below, and continuing this process of

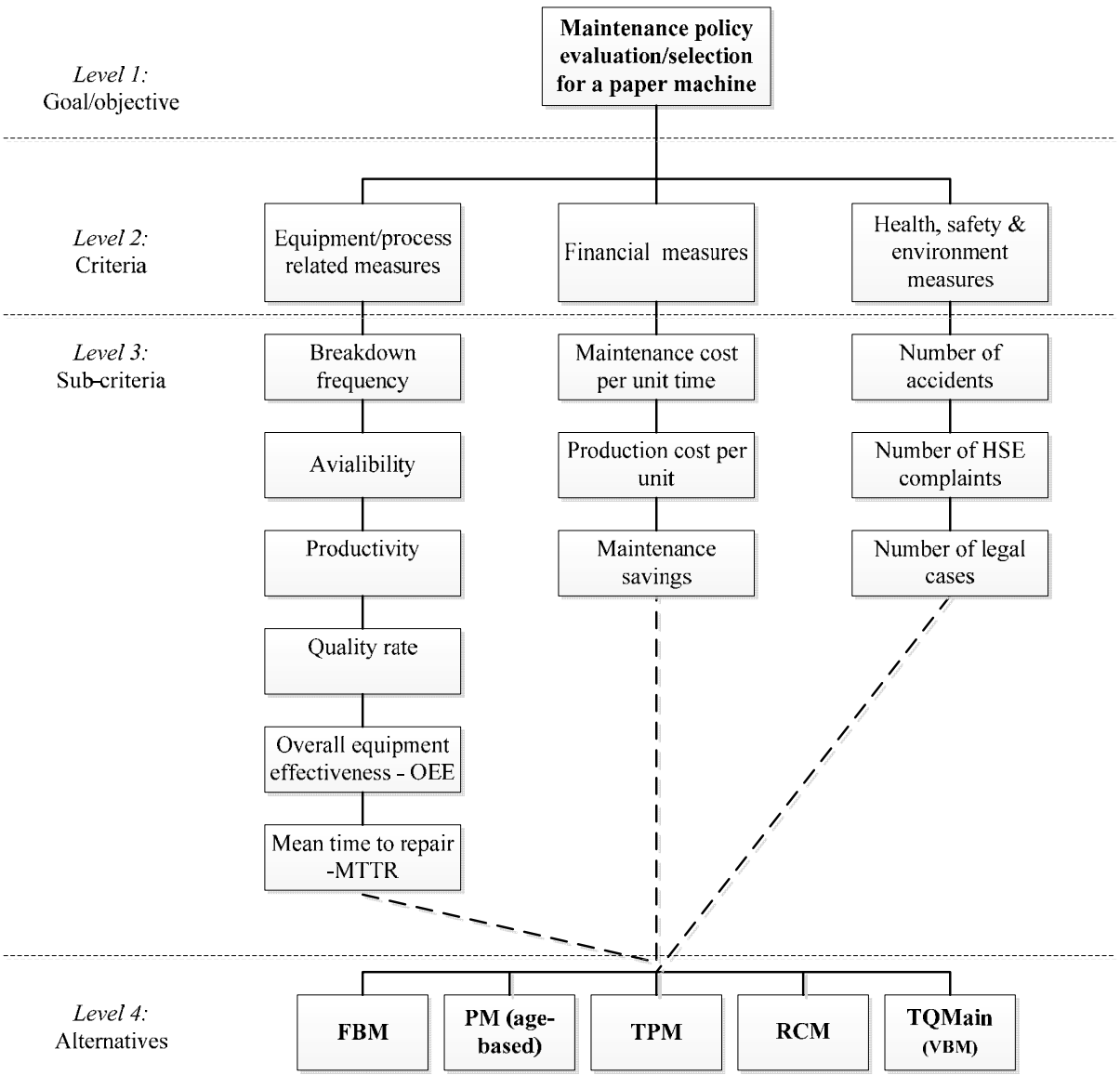

Figure 1: A hierarchy model for maintenance policy evaluation/selection

weighing and adding until the final priorities of the alternatives are attained (Saaty, 2008). Using these guidelines, an AHP framework was developed for facilitating the study. Therefore, we proposed the following steps:

Step 1: Define the objective or goal
Step 2: Identify criteria and sub-criteria for maintenance policy selection
Step 3: Determine the alternative maintenance approaches
Step 4: Construct a hierarchy framework for analysis
Step 5: Collect empirical information and data
Step 6: Perform pair-wise comparisons for each level of criteria and sub-criteria
Step 7: Perform the consistency test
Step 8: Calculate the global weights of each criteria and sub-criteria
Step 9: Synthesize the results
Step 10: Sensitivity analysis
Step 11: Final ranking of proposed alternatives

Step 1: Define the objective or goal

The objective of the study is to evaluate and select the most appropriate maintenance approach/policy for a paper machine in the observed company.

Step 2: Identify criteria and sub-criteria for maintenance policy selection

In this study equipment and process related measures, financial measures and health, safety and environment measures were applied as criteria for the maintenance policy selection. A literature survey was made using the databases such as Emerald, ABI/Inform and ScienceDirect. The search was done in different combinations of keywords such as maintenance performance, maintenance indicators, maintenance costs, maintenance savings and maintenance measurement. Results of the search show different works that have dealt with topics related to these keywords (e.g. Al-Najjar et al., 2004; Muchiri et al., 2011; Parida and Chattopadhyay, 2007). In this regard, various maintenance performance measures were identified from these studies. Finally, a group consisting of three decision makers involved in this case study selected measures for the purpose of this study.

Step 3: Determine the alternative maintenance approaches

Different maintenance approaches, i.e. strategies and concepts, methodology or philosophy, were used in this study. These are: FBM, PM, TPM, RCM and TQMain (using VBM).

Step 4: Construct a hierarchy framework for analysis

The criteria and sub-criteria were structured into a hierarchy descending from the overall objective or goal to the various stages and related sub-criteria in successive levels. The top level of the hierarchy represents the defined objective, while the second level of the hierarchy consists of three main maintenance criteria. These criteria are decomposed into various sub-criteria, as can be seen in Figure 1. Finally, the bottom level of the hierarchy represents the alternative maintenance approaches/policies.

Step 5: Collect empirical information and data

After building the AHP hierarchy, the next phase is the measurement and data collection, which involves forming a team of evaluators. In this study, a group of 3 evaluators were chosen for evaluating the selected criteria and sub-criteria. Two evaluators were chosen from academia having experience in the field of maintenance, and one from industry also experienced in the field of maintenance.

Step 6: Perform pair-wise comparisons for each level of criteria and sub-criteria

Before conducting the pairwise comparison, all members of the group were given the instruction on how to perform the comparison. As mentioned earlier, the pairwise comparison judgement matrices were obtained from three evaluators. Evaluators were requested to compare carefully criteria of each hierarchy level by assigning relative scales in a pairwise fashion with respect to the objective of the presented model. These judgements were then combined using the geometric mean approach at each hierarchy level to obtain the corresponding consensus. A relational scale of real numbers from 1 to 9 used in ranking is presented in Table 1. The purpose of this scale is to determine how many times more important or dominant one element is over another element with respect to the criterion or property with respect to which they are compared (Saaty, 2008).

Table 1: Scale of relative preference for pair-wise comparison

Scale	Judgement
1	Equal importance
3	Moderate importance of one over the other
5	Essential or strong importance
7	Very strong or demonstrated importance
9	Extreme or absolute importance
2, 4, 6, 8	Intermediate values between the two adjacent judgements

Step 7: Perform the consistency test

This step examines whether the created pairs of criteria are consistent or not (Talib et al., 2011). Usually, the consistency ratio (CR) is used to check whether a criterion can be used for decision-making. Saaty (1980) recommends consistency ratio (CR) should be below 10 percent. On the contrary if CR is greater than 10 percent, one should examine the possible cause. However, the standard consistency test has been criticized by a number of authors (see for example Lane and Verdini, 1989; Murphy, 1993; Karapetrovic and Rosenbloom, 1999). In this regard, we adopted a quality control approach for the consistency test,

proposed by Karapetrovic and Rosenbloom (1999). In their study authors suggested that quality control of consistency can be performed using the simple Shewhart Xbar–R chart or exponentially weighted moving average (EWMA) chart. However, we used EWMA chart in order to identify a small shifts in the consistency index (CI). CI is obtained by the following equation: $CI = (\lambda_{max} - n)/(n - 1)$, where 'n' is the number of criteria or sub-criteria of each level and λ_{max} is the largest eigenvector in the matrix. In place of dividing each CI by the "random index", we used an approach to plot the average (considering all decision makers) CI values on EWMA chart (Figure 2). A free software environment for statistical computing and graphics R was applied using the QCC (an R package for quality control charting and statistical process control) package. We used a default value of smoothing parameter (λ), which is set at 0.2 in the aforementioned R package. As can be seen from Figure 2 EWMA values are within control limits. This indicates that decision makers were consistent.

Step 8: Calculate the global weights of each criteria and sub-criteria

The following step includes a calculation of local and global weights. While local weights refer to the preceding hierarchical level, the global weights take into account the highest hierarchical level (Talib et al., 2011). The local and global weights as well as the corresponding ranks are presented in Table 2.

Step 9: Synthesize the results

In order to obtain final results, all alternatives are multiplied by the global weight of the single decision criteria. The results are summarized in Table 3.

As shown in Table 3, the global priorities are calculated for each of the alternative. The highest value (0.498) correspond to the TQMain, followed by TPM (0.207) and RCM (0.162). As expected the lowest value refers to the FBM.

Step 10: Sensitivity analysis

Finally, a sensitivity analysis is held to show the effect of altering different parameters of the model on the choice of the maintenance policy selection. First, the current values of the model are presented. Figure 3 demonstrates the current importance of each alternative considering all criteria used in this model. As can be seen from Figure 3 the highest value corresponds to TQMain (49.8 %). Additionally, Figure 3 also shows the values of the weights of all three main criteria from level 2 (C1 - Equipment/process related measures, C2 - Financial measures and C3 - Health, safety & environment measures).

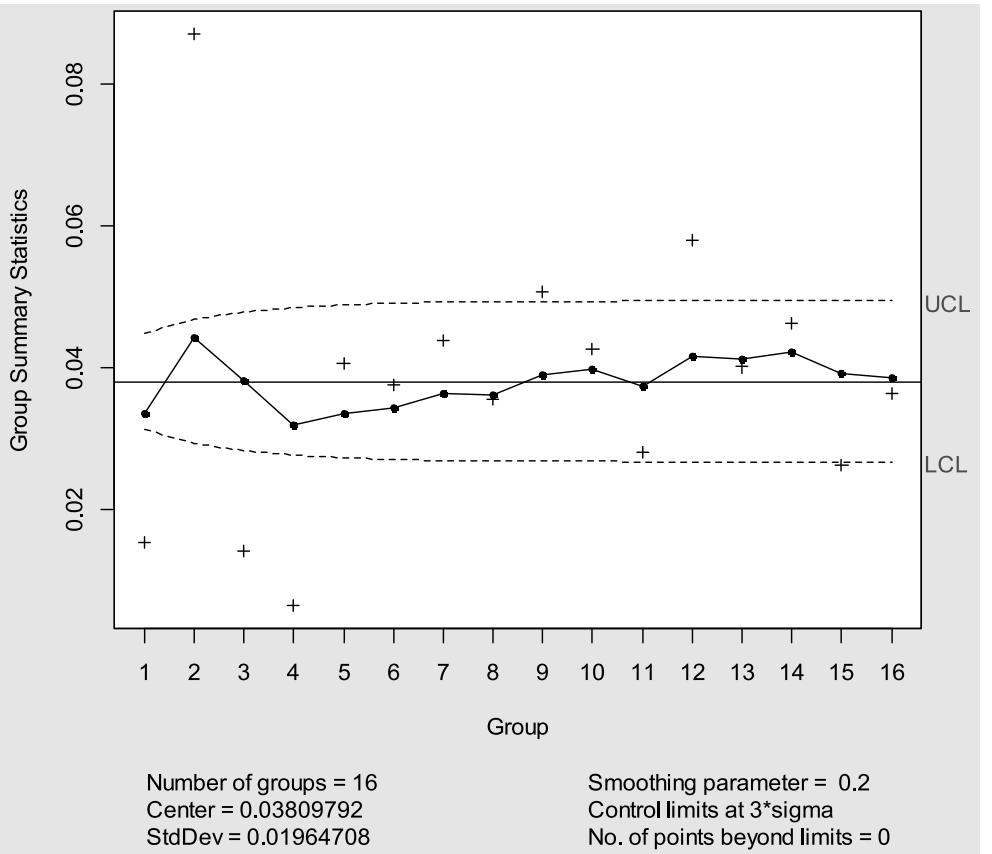

Figure 2: EWMA control chart - average CIs

Table 2: The local and global weights

Hierarchy level	Criteria	Local weights		Global weights	
		Weights	Ranking	Weights	Ranking
Level 2	*With respect to maintenance performance measures*				
	Equipment/process related measures	0.530	1	0.530	1
	Financial measures	0.270	2	0.270	2
	Health, safety & environment measures	0.199	3	0.199	3
Level 3	*With respect to equipment/process related measures*				
	Breakdown frequency	0.076	5	0.040	9
	Avialibility	0.181	3	0.096	5
	Productivity	0.183	2	0.097	4
	Quality rate	0.095	4	0.050	7
	Overall equipment effectiveness - OEE	0.422	1	0.224	1
	Mean time to repair -MTTR	0.043	6	0.023	12
	With respect to financial measures				
	Maintenance cost per unit time	0.127	3	0.034	10
	Production cost per unit	0.243	2	0.066	6
	Maintenance savings	0.630	1	0.170	2
	With respect to health, safety & environment measures				
	Number of accidents	0.626	1	0.125	3
	Number of HSE complaints	0.233	2	0.046	8
	Number of legal cases	0.141	3	0.028	11

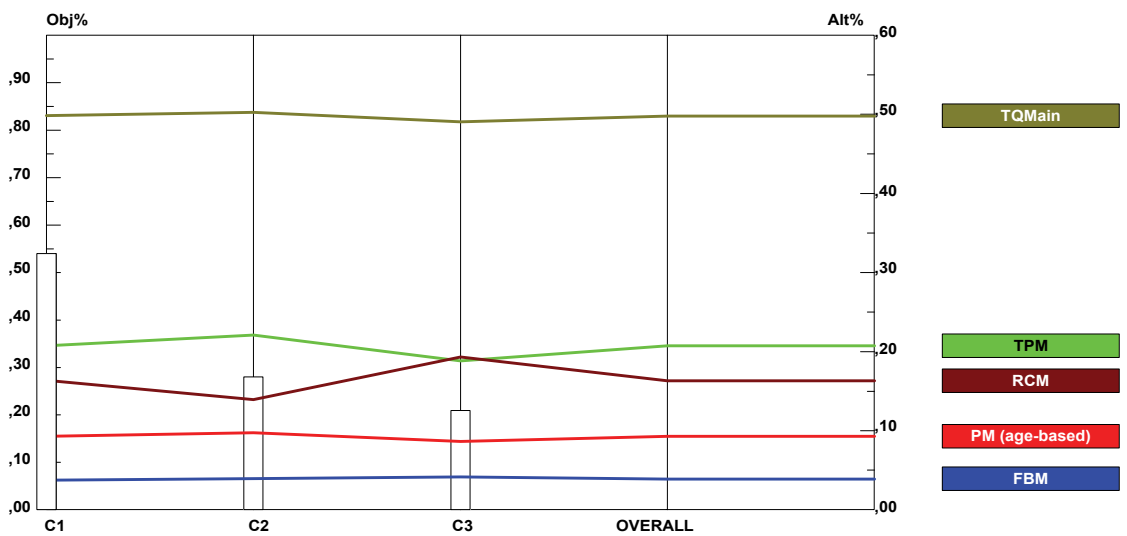

Figure 3: Sensitivity graph - the initial results with respect to the main goal

Table 3: The summarized matrix

	Criteria weight	FBM	Weight x FBM	PM	Weight x PM	TPM	Weight x TPM	RCM	Weight x RCM	TQMain (VBM)	Weight x TQMain (VBM)
With respect to equipment/process related measures											
Breakdown frequency	0.040	0.045	0.002	0.084	0.003	0.192	0.008	0.213	0.009	0.467	0.019
Avialibility	0.096	0.041	0.004	0.103	0.010	0.215	0.021	0.136	0.013	0.505	0.048
Productivity	0.097	0.036	0.003	0.087	0.008	0.198	0.019	0.191	0.019	0.487	0.047
Quality rate	0.050	0.039	0.002	0.080	0.004	0.156	0.008	0.214	0.011	0.511	0.026
Overall equipment effectiveness - OEE	0.224	0.034	0.008	0.095	0.021	0.219	0.049	0.148	0.033	0.504	0.113
Mean time to repair -MTTR	0.023	0.046	0.001	0.103	0.002	0.243	0.006	0.112	0.003	0.496	0.011
With respect to financial measures											
Maintenance cost per unit time	0.034	0.040	0.001	0.105	0.004	0.157	0.005	0.223	0.008	0.475	0.016
Production cost per unit	0.066	0.031	0.002	0.091	0.006	0.221	0.014	0.172	0.011	0.485	0.032
Maintenance savings	0.170	0.043	0.007	0.098	0.017	0.235	0.040	0.108	0.018	0.516	0.088
With respect to health, safety & environment measures											
Number of accidents	0.125	0.042	0.005	0.082	0.010	0.177	0.022	0.185	0.023	0.513	0.064
Number of HSE complaints	0.046	0.040	0.002	0.097	0.004	0.207	0.010	0.207	0.010	0.450	0.021
Number of legal cases	0.028	0.043	0.001	0.086	0.002	0.201	0.006	0.201	0.006	0.469	0.013
Σ			**0.039**		**0.093**		**0.207**		**0.162**		**0.498**

Furthermore, a series of sensitivity analysis were conducted to investigate the impact of changing the priority of the criteria on the alternatives' ranking. Dynamic sensitivity of Expert

Choice was performed to analyse the change in outcome caused by a change in each of the main criterion. The aim of sensitivity analysis is to explore how these changes affect the priorities of the selected alternatives. In the following three scenarios are presented. First, the criterion "equipment/process related measures" was increased for approximately 25 percent (from 53 to 66.2). The results are presented in Figure 4. This figure consists of two parts. The results presented on the left side of the Figure 4 are criteria and their corresponding weights, while the right side of the figure illustrates the ranking of the alternative as expressed by importance (in percentage). The results of the sensitivity analysis revealed that change in the first criterion has no significant influence on the importance of the alternatives. Therefore, one can see that the overall rank of the final outcome remained unchanged in comparison to ranking presented in Table 3.

Second, the criterion "financial measures" was increased for approximately 25 percent (from 27 to 33.8) (Figure 5). Consistently with previous findings, the change in this criterion also appears to have no substantial impact on the outcome. As shown in Figure 5 TQMain remains the best alternative.

Finally, the last criterion was also increased for 25 percent (from 19.9 to 25.1), and the model was tested for the change of the outcome. The results show (Figure 6) that the criterion "health, safety and environment measures" has no major impact on the final outcome as well.

Overall, the results of the sensitivity analysis showed that the ranks of the alternatives remained stable in all cases. Additionally, we performed sensitivity analysis in which main criteria were changed down by 10 percent. The results showed that the model is stable also when weights are decreased. This indicates that the proposed model is

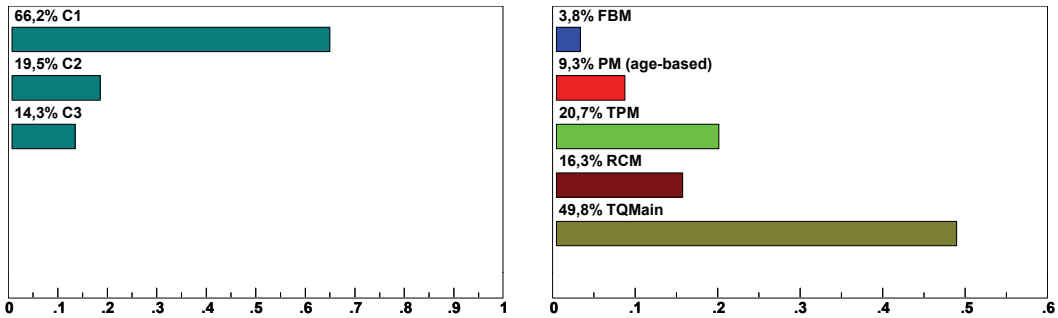

Figure 4: Scenario 1

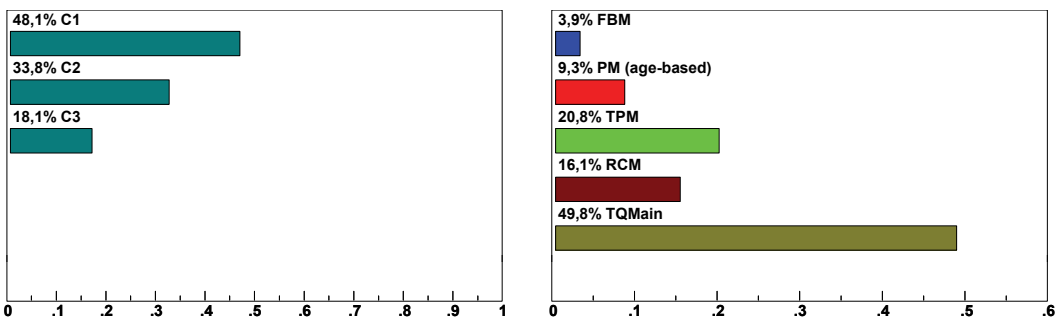

Figure 5: Scenario 2

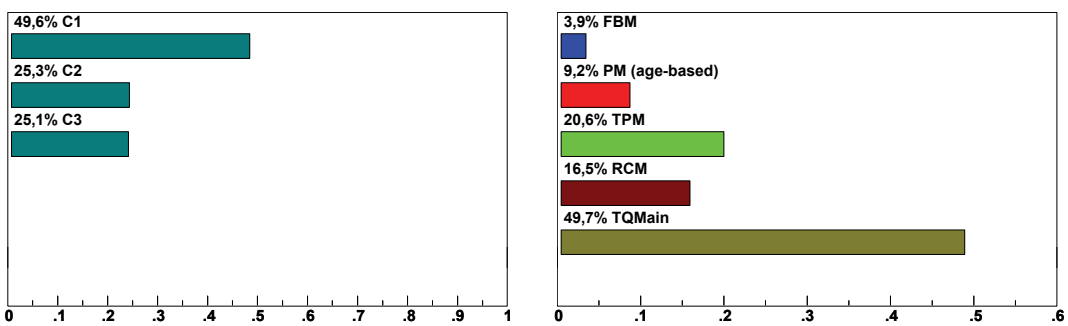

Figure 6: Scenario 3

stable and robust, and thus appropriate for decision-making process.

Step 11: Final ranking of proposed alternatives

Taking account the results of the 9th step and the results of the sensitivity analysis, one can determine the final solution of the AHP method. Therefore, with respect to the main objective of the proposed model, TQMain was selected as the most appropriate maintenance concept (Table 4).

Table 4: Final results of the AHP method

Approach	Importance	Rank
TQMain	0.498	1
TPM	0.207	2
RCM	0.162	3
PM	0.093	4
FBM	0.039	5

5 Discussion and conclusion

In this paper an AHP method was proposed to evaluate/select the most appropriate maintenance policy from the perspective of a paper mill company. By using the suggested framework the most appropriate maintenance policy can be selected. In this regard, the case study shows that the proposed AHP method is applicable as an evaluation technique, and the proposed framework certainly eases the decision maker's mission of choosing the most efficient maintenance policy. In addition, consistently with an approach used by Karapetrovic and Rosenbloom (1999) our study advocates that a consistency check should be tested in order to verify whether a decision maker has made a mistake in entering the pairwise comparison data rather than whether the decision maker has made random choices. For this purpose EWMA chart is proposed for identifying out-of-control situations which may be caused due to mistakes of a decision maker.

Different management practices can be adopted by manufacturing companies in an effort to improve organizational performance by continuously implementing small changes to the processes (Jaca et al., 2014; Jaca et al., 2012). Selecting a suitable maintenance policy is definitely one of the essential decision-making tasks in improving the cost-effectiveness of the production systems (Al-Najjar and Alsyouf, 2003; Zaim et al. 2012). Recent studies (e.g. Al-Najjar and Alsyouf, 2004) indicate that appropriate maintenance can prolong the life of an asset and prevent costly breakdowns that may result in lost production. Further, the growing importance of maintenance regarding improving company's profitability and competitiveness (e.g. Al-Najjar, 2007; Maletič et al., 2014), strengthens the need for selecting a proper maintenance policy (Bevilacqua and Braglia, 2000). Therefore, using the proposed AHP framework, the criteria for maintenance policy selection can be clearly identified and the problem can be structured systematically. More importantly, it can effectively support the decision makers in the process of selecting the most appropriate maintenance policy.

Three main criteria for the maintenance policy selection were used in this study, as follows: equipment and process related measures, financial measures and health, safety and environment measures. Furthermore, the following sub-criteria are considered to be the most important: OEE, maintenance savings, number of accidents, productivity and availability. The latter can be explained in the context of a production process which is operating 24/7. Seen in this context, used criteria play an important role, especially from the perspective of achieving production goals. Based on the selected criteria as well as on the decision makers' evaluations, the TQMain was selected as the most appropriate maintenance concept. Among others, the TQMain is focused on maintaining and improving continuously the technical and economic effectiveness of the process elements (Al-Najjar, 1996), which were indeed important criteria in our study.

To ensure that final solution is stable and robust, we additionally applied sensitivity analysis. With Expert Choice software, AHP enables sensitivity analysis of results which is very important in practical decision-making (Bayazit, 2005).

To sum up, the proposed framework appears to enable the structured and systematic way of selecting the most appropriate maintenance policy. By upgrading the traditional AHP method with a EWMA chart for consistency test, our proposed framework for maintenance policy selection represents a valuable tool for decision makers in the field of maintenance. However, we acknowledge the limitations of using the traditional AHP method. This method is often criticized because of its inability to adequately handle the uncertainty and imprecision associated with the mapping of the decision makers' perception to a crisp number (Wang, 2007). Nonetheless, Karapetrovic and Rosenbloom (1999) suggested that quality control approach can be used with any of the variations of AHP. Future studies could therefore consider different versions of AHP for maintenance policy selection in combination with quality control approach.

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Uporaba analitičnega hierarhičnega procesa (AHP) in analize občutljivosti za izbiro ustrezne politike vzdrževanja

Namen: Namen članka je prikazati uporabo metode analitičnega hierarhičnega procesa (AHP) na primeru evalvacije in izbire ustrezne politike vzdrževanja.
Metodologija/pristop: Članek temelji na študiji primera izbire najprimernejše politike vzdrževanja za slovensko papirniško podjetje. V okviru študije primera so uporabljeni in predlagani številni koraki AHP metode, katerih namen

je strukturirati odločitveni proces. V raziskavi so bili upoštevani naslednji koncepti vzdrževanja: kurativno vzdrževanje, preventivno vzdrževanje, celovito produktivno vzdrževanje, vzdrževanje na osnovi zanesljivosti, celovito kakovostno vzdrževanje.

Ugotovitve: Predlagan je okvir za izbiro ustrezne politike vzdrževanja, ki temelji na metodologiji AHP. Predlagani okvir je bil testiran na primeru izbire najprimernejše politike vzdrževanja za slovensko papirniško podjetje. Rezultati kažejo, da je celovito kakovostno vzdrževanje najbolj primeren koncept vzdrževanja za proučevani papirniški stroj. Z naknadno analizo občutljivosti je bilo ugotovljeno, da je končna razvrstitev ocenjevanih politik vzdrževanja ostala nespremenjena, kljub 25% povečanjem uteži vseh ključnih kriterijev.

Izvirnost/pomembnost prispevka: Članek predstavlja doprinos k obstoječi literaturi z vidika razvoja okvira, katerega namen je zagotoviti strukturirani odločitveni proces izbire ustrezne politike vzdrževanja. V članku je predlagana in prikazana metoda za preverjanje konsistentnosti na osnovi kontrolne karte, ki temelji na eksponentnem ponderiranem pomičnim povprečjem (EWMA). Pomembnost raziskave se dodatno odraža še preko analize občutljivosti, ki ravno tako predstavlja pomembni del predlaganega okvira za izbiro ustrezne politike vzdrževanja.

Ključne besede: analitični hierarhični proces, odločitveni proces, politika vzdrževanja

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The Concept of Communities of Practice on the Example of IT Sector

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Background: A growing interest in the concept of communities of practice (CoP) has been recently observed in several academic fields. They include organizational studies (the topics of knowledge management and organizational learning in particular) and education. However, the notion is used in various contexts. It is sometimes perceived as a social construct, but at some other times as a virtual community or informal group sponsored by an organization for the purpose of making it easier to share knowledge or learn.
Objectives: The main aims of the paper are: 1) to identify the main characteristics of the CoP in IT sector, 2) to identify and describe the knowledge management tools used by CoP, 3) and to identify and analyse customer knowledge of CoP.
Method: The research assumed an exploratory character. The case study and survey methods with application of structured questionnaire were used.
Results: The CoP is little effective form of stimulating business processes and market, despite application of a broad range of activities undertaken for the purpose of creation of the so-called knowledge communities by the entities of IT sector and internet activity declared by respondents.
Conclusion: Poor knowledge of CoP as well as the awareness of participation in its structures among the recipients, who are additionally active users of new technologies including mostly the Internet, may also be caused by the lack of experience in the sphere of studied knowledge-based relationships or priority character of ventures of directly measurable business results. Determinants of CoP creation and directions of its development may constitute an interesting area for further studies.

Key words: knowledge management, marketing knowledge management, community of practice

1 Introduction

As organizations grow in size, geographical scope, and complexity it is increasingly apparent that sponsorship and support of groups such as community of practice (CoP) becomes a method of increasing the effectiveness of business processes, including creation of target markets. Communities of practice become the object and the tool of knowledge management, and marketing knowledge management.

Thus, this article aims at defining CoP forms and their tools. The main sources of theoretical analyses are scientific literature and journals, specifically those publications devoted to CoP as knowledge management tool. Next section concentrates on a case study, based on the entities of IT sector, which have used a broad range of activities and tools for the creation of the knowledge communities. Intel company is one of the leaders in implementation of researched concept of community. The identification and grouping of the CoP's tools were the research goal, in this part. The method of critical analysis of Internet webpages of IT sector leaders in Poland and in the world, and the analyses of articles, particularly of sponsored interviews presented in specialist IT magazines, were applied. This article aims at identifying and describing the customer knowledge of CoP, too. This 'customer knowledge of CoP' is expressed, among others,

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by their addressees' level of knowledge about the tools, and their involvement in communities of knowledge. To reach this goal, the survey method with application of structured questionnaire was used. Finally, results of the study are discussed and some conclusions are drawn .

1.1 Community of practice in theory

Marketing knowledge resources are such intellectual assets that are the sum of knowledge of employees, teams of employees, cooperating entities, network partners and customers that an organization applies in its market activities which may determine the structural dimension of knowledge management. In structural approach, marketing knowledge management consists in managing people and their competences, and it is a database of knowledge about the customers and cooperating entities, as well as exchange of information between the enterprise and customer / cooperating entity, for the purpose of acquiring, satisfying and retaining them. It is a system of tools, processes and culture that is developed for the purpose of improving, creating, sharing and applying specific knowledge for the process of making decision by corporation, including the marketing ones (De Long and Seemann, 2000).

Formation of long-term integrator relationships with network partners, including the customers, for the purpose of involving them in the process of external co-formation of particularly tacit knowledge while transforming tacit knowledge of the network integrator into explicit knowledge for internal environment of the network, is very important in marketing knowledge management (according to the Japanese concept of knowledge management, see Nonaka and Takeuchi, 1995, pp. 44-45). People often talk about 'community' or 'collectivity' of entities that jointly perform research and jointly use and multiply knowledge resources (Sawhney and Prandelli, 2000, pp. 44-45) for synergic creation of values. In many organizations, communities of practice have become an integral part of organizational structure (McDermott and Archibald, 2010).

The notion of *Community of Practice* (CoP) was formulated for the first time in 1991 by Jean Lave and Etienne Wenger (Aubry et al., 2011, pp.42-56). They defined it as the major element of their theory of 'situated learning'. This theory referred to workplace learning as the one that takes place through participation in practice and interaction with colleagues and not through formal instruction or training. The community of practice is described here as a group in which we observe learning processes as occurring among its members naturally as individuals become competent in practice. Becoming a full member of such a community depends on competence in other members' view (Lave and Wenger, 1991). According to Bredillet (2004), community of practice members 'learn by participating in the community and practicing their jobs'. At the beginning, the concept constituted an analytic aid that let describe how learning occurred in the workplace and then it became the tool for businesses applied to increase the 'knowledge assets' possessed by the employees (Ranmuthugala, et al., 2011). Community of practice is the concept that has been evolving and we can find its multiple forms can be found in reality. Scarbrough and Swan (2008) opted for accepting diversity in the forms of communities of practice. They perceive the concept of the community of practice as representing historically specific expression of self-strengthening relationships between learning, identity, group formation and social practices, rather than a separate discrete social grouping. Duguid (2008) indicated that the community of practice is currently a management tool: 'We also get a theory that appeals strongly not only to business schools, but also to management consultants: it is instrumental, operational, and promises only beneficial results'. Thus primary approach to learning perceived as improvisation and autonomy is no longer functioning and it is replaced by something totally opposite: following principles and avoiding improvisation of any kind (Lave and Wenger, 1991; Wenger and Snyder, 2000). Duguid (2008) perceives this managerial approach to the community of practice as a traditional viewpoint in which any form of improvisation and autonomy are overcome by control. Therefore the community of practice may be understood as being rapidly domesticated (Duguid, 2008). Nonetheless, Duguid (2008) stated that just like any other construct, this one is proceeding according to its own path. Wenger and Snyder (2000) presented an example of managerial domestication of the community of practice. They supported the idea of communities of practice as a new management instrument aiming at business results that included helping to drive strategy, starting new business lines and others. It can be stated that research into community of practice was targeted at two separate areas that might be referred to as *organizational studies interpretation* and *knowledge management interpretation*. The first field highlights the theory development while describing new organizational communities of practice. The other group stresses the business value of communities of practice aiming at identifying, supporting and / or launching *strategic* communities of practice for the purpose of managing organizational knowledge (Murillo 2011, p. 5). In the article, the second interpretation of CoP as the knowledge management tool is dominant.

Etienne Wenger uses the three elements of engagement, enterprise and practices to join the concepts of community and practice into a unitary construct. She does this by describing three dimensions of practice as the source of coherence of a community (of practice), i.e., as what makes that particular kind of community coherent. She thus describes them as constitutive or defining dimensions of communities of practice (Wenger, 1998):

1. *Mutual engagement:* members build the community and the practice by conducting practice-related interactions with each other on a regular basis.

2. *Joint enterprise:* members collectively negotiate what their community is all about and hold each other accountable to this understanding.
3. *Shared repertoire:* over time, members develop a set of shared resources that allow them to get engaged more effectively.

The presence of these three dimensions in a group is a necessary and sufficient condition for the existence of a community of practice (Murillo, 2011, p. 5).

1.2 Virtual communities of practice in theory

Due to virtualization of the environment of functioning of entities, the concept of community of practice finds its place in the concept of VCoP (Virtual Community of Practice) that has been developed with reference to CoP concept. Virtual Community of Practice is a community of practice developed on the basis of Internet. According to CoP definition, in Lave and Wenger's opinion, VCoP must include active participants that are experienced people and experts in a specific area (Wenger, 2007). Community members must participate in the process of collective knowledge exchange and formation. They acquire knowledge in the process of learning and through relationships with the group, as a result of synchronic interactions (Wenger, McDermott and Snyder, 2002). CoP provides virtual space in which people participate without language, geographical or cultural barriers (Gray, 2004, pp. 20-35). Considering the level of activity of the participants, we can distinguish regular and peripheral activity of participants, consisting in information receiving and personal learning rather than co-creation of value (Riverin and Stacey, 2008, pp.45-58). Dubé, Bourhis and Jacob made a typology of virtual community of practice. According to their research they identified three major types: A, B and C (Hara, Shachaf and Stoerger, 2009, pp. 740-757):

- The intention of **VCoP A** creation is to offer its members a forum where they can share and discuss tacit knowledge and also develop a repertoire of the best practices in their specific area. The goal of an organization is to create the community of practice as a pilot project, to assess how successful it is and to evaluate the potential of tacit knowledge sharing tool. Possibly, they will apply this experience to establish other communities in other areas of professional expertise. Considering this specific orientation VCoP A is formed through a top-down process, however they are not integrated into formal structures of organizations, even though VCoP A members are all professionals in the same field of expertise.
- **VCoP B** is established deliberately by the management of an organization in the private sector. Facilitating environment for a VCoP B is constituted by the values of this organization that include knowledge management, continued development and employees' empowerment. VCoP B is viewed by the organization as a pilot project the goal of which is to assess whether such communities are adequate tools to increase collective learning among people and to report and share best practices. The communities are not really integrated into the organizational structure and are perceived as an experiment that is officially sanctioned and has a short life span. VCoP members regularly meet face-to-face and they communicate mostly through ICT.
- **VCoP C** is created by a large organization of public sector that has a high level of resources at its disposal. Managers establish this community in order to fulfil a clear mandate. They are supposed to share best practices for the purpose of (1) standardizing them across decentralized departments, and (2) making recommendations for improvement. Although VCoP C has rather narrow focus and short life span, it is clearly established within the organization the aim of which is to move towards knowledge sharing. Thus it allocates direct resources to the VCoP. All the community members are the organization employees from its various departments. They all have similar knowledge, experiences and areas of specialty. They all work in various regions of the same state and so geographic dispersion of the community is indifferent. They occasionally collaborate - before the community is established, however they do not have much community experience. As a result of their geographical dispersion they never meet face-to-face and mostly rely on technology while communicating.

The classification of VCoPs (Dube et al, 2006) is performed by using the following dimensions: demographics, organizational context, membership characteristics and technology. We can read about it in many recent articles (Tamjidyamcholo, 2013, pp. 416-421, Grabher and Ibert, 2014, pp. 97-123, Jaehong, Eunjung and JoongHo, 2012). Using this typology to scrutinize the three VCoPs, in further part of the article the application of one of the described forms and its effectiveness in practice is presented.

2 Methods

The two research methods of an in-depth case study analysis and field research with direct questionnaire were used, in this paper. The case study analysis consists in a comprehensive presentation of a real situation occurring in IT sector in regard to knowledge management tools used within the company which is treated as an individual case. It involves seeking for all necessary data enabling its in-depth analysis, formulating possible choice options and making the best possible decision, accompanied by a proper justification (Wiktor, 1996, p.11). The selected cases deliver both literal and theoretical replication (Perry, 2001, pp.314-315). Results of analyses of articles, particularly of sponsored

interviews presented in specialist magazine Computerworld and the results of monitoring of Internet webpages of IT sector leaders in Poland are applied in the article. Intel Company, that was selected for the research, is the leader of IT sector in Poland, by revenues from sales of products and services, as presented by the magazine Computerworld ('*The biggest IT firms in Poland in 2012*' Computerworld 2013). It is also one of the best known companies in market according to respondents.

Direct surveys were performed on a sample of 423 students from public universities in Poland who were studying in mural and extramural programs in Management Departments, during marketing management and global marketing lectures, in 2013 (September-October). The selection of respondents is justified by a high percentage of computer and Internet users in this group of people. It ought to be mentioned that an average Polish young person spends about 18 hours a week on-line. It is nearly twice as much the generation of his/her parents (about 10.7 hours) and three times more than the generation of his/her grandparents (6.1 hours). People with university education (17.1 hours on-line) and secondary education (12.8 hours on-line) are predominant here, by The Youth Report (World Internet Project Poland 2010, p. 34).

For the purpose of identification of VCoP tools, a critical quality analysis of Internet pages selected according to the key notion of 'VCoP tools' that were updated later than in 2010 was applied. Classification of tools is to a large

Table 1: The tools of VCoP

VCoP A	VCoP B	VCoP C
Social network aimed at specific social groups (i.e. such as former students – nk.pl is s a Polish example of such a portal)	Social networks with restricted access: • Blog • Microblog • Wikis • Chat • Collaborative document authoring tools • Social bookmarking • Text-based discussion groups	Narrated (PowerPoint) presentations
Social network aimed at sharing specific content e.g. YouTube	Tools of personalized online communication: • E-mail • Skype	E-learning tools, e-learning platforms
Social networks connecting closed groups, which can be joined through an invitation from another user (e.g. Grono.net)	Face to face tools: • Conferences, workshops, knowledge exchange forums • Educational programs and sponsoring education • Scientific clubs • Scientific competitions	Web conferencing and webcasts
Social networks that provide Internet users with the opportunity to manage their own profiles - sites (e.g. Friends.pl, Myspace)		Online meetings Online discussions
Social networking intended to present opinions and reviews (e.g., Filmweb, BilbioNETKA, nuta.pl, opiniuj.pl, dood.pl, Yelp.com)		Useful links to: • Keyword and full-text searches (site-wide and by section) • Structured databases and database tools • Digital stories • Idea banks
Industry catalogue: of companies and products with social panel added		Subgroup working spaces
		Announcements

Source: own case study, based on result of analyses of articles, particularly of sponsored interviews presented in specialist magazine Computerworld and the results of monitoring of Internet web pages of IT sector leaders in Poland and world

extent a consequence of subjective assessment of tools by their usability for particular forms of VCoP. They are described in chapter 3.

Apart from descriptive method, the method of simple statistical analyses was applied in the article. Size distribution by selected criteria was applied for analysis of quantitative data. The research results presented in the article are exploratory by nature.

3 Results

3.1 Knowledge management tools in communities of practice

The tools that convey specific character of particular VCoP in the author's view and that were declared by analysed firms, in sponsored articles, are presented in Table 1.

Online collaborative tools, presented above and used in VCoP A, are the means and mediums of working together on the Internet that facilitate collaboration by individuals who may be located in vastly different geographical areas. One of the possibilities to change the knowledge is using Social Network Services (SNS). Social networking services are spaces on the Internet where users can create their own profile. They are firstly used to increase the sense of belonging to a social group. These services are divided into two categories: external (external social networking ESN), that are the domain of Community of Practice Network and internal (internal social networking ISN) - closed / private communities composed of groups of people from one network, company, association, educational institution or another organization, but also an ESN-created closed group. The group can be created only through invitation from the present participant. The examples of tools are: YouTube, Grono.net, Myspace, Yelp.com and others. VCoP B type may combine the use of online and offline tools. It makes use of the tools used in the VCoP A, but is distinguished by the use of personalized forms of communication and direct communication (face to face), as the way to create and share knowledge. C type, while applying mostly ISN tools, constitutes a slightly different form. It is possible for the companies to use the tools belonging to various VCoP to achieve synergistic effects.

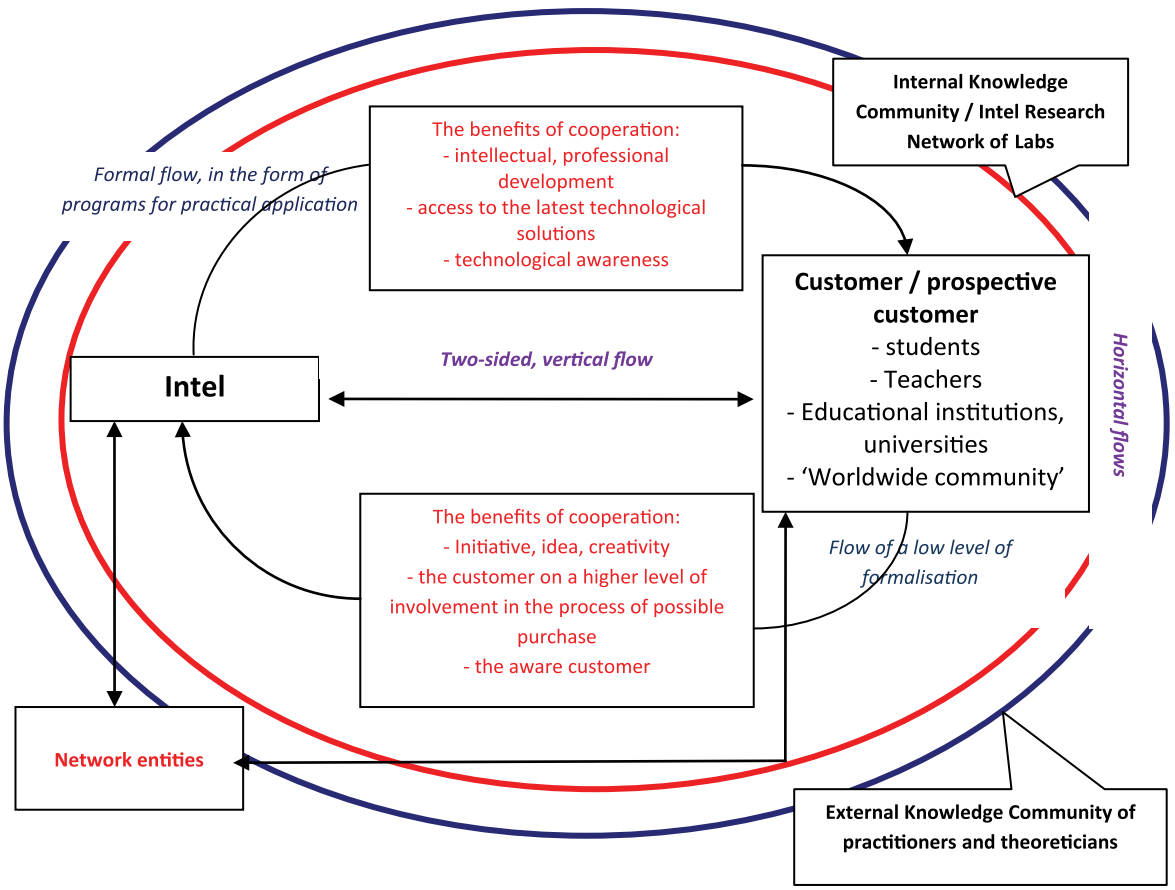

Figure 1: Network flow of knowledge in Intel community of practice. Source: Author

Table 2: Knowledge of community tools for target groups in the company Intel

Teachers in primary and secondary schools	- Conferences such as 'Moving Young Minds '(*Poruszyć młode umysły*) - 'Nauczanie ku przyszłości' ['*Teaching towards the Future'*], 'Odyseja innowacyjna' ['*Innovative Odyssey*'] programs, - direct training in the sphere of technology use in the classroom - 'Intel Edukacja' ['*Intel Education*'] - on-line educational programs for teachers
University lecturers and students	- workshops on global education strategy with participation of companies and government - forum of scientists, for example representatives of universities from EMEA region member states - sponsoring of university research and grants in the sphere of application, telecommunication architecture, communication, microprocessor technology and systems - programs for implementation of technological solutions, for example 'Otwarty program nauczania' ['*Open curriculum*'] - Intel lectures for students - Ph.D. studies at 12 European research and development institutes - Competitions for students, the aim of which is to increase interest in postgraduate and Ph. D. studies
Students	- Scientific competition - Intel International Science and Engineering Fair (ISEF) organization rewards the achievements of young scientists - increased involvement of students in initiatives such as for example International Science and Technology Fair
Society	- Intel company Computer Clubs - educational programs: 'designing and discovering ' - the expansion of broadband Internet access

Source: Author

3.2 Virtual Community of Practice in IT sector – Intel company case study

The investigated IT company is one of representatives of a convergent sector (telecommunication, IT, media) and offers various products for business, public, home, entertainment or universal purposes. Its common feature is strong engagement in creating knowledge communities and cooperating in this field. The studied company *Intel* can be classified into **VCoP B** category. Within created knowledge community, Intel implements Intel Education Initiative program, within World Ahead program (development of the world), that consists in formation of Society of Innovators (Intel Learn Program, Intel Computer Clubhouse Network). It is provided by financial and technological support for various social groups, including: teachers (Intel Teach Program), students (the Intel Science Talent Search, the Intel International Science and Engineering Fair, Intel Schools of Distinction) and Universities (Intel Higher Education Program) throughout the world, especially those specializing in innovative solutions for science, mathematics and technology (Figure 1).

The tools of program implementation in the sphere of strategy of formation and exploitation of community of knowledge in this IT case have social, cultural and also technological nature, with elements of financial support (table 2).

This method of acting is the expression of creation of global community of knowledge, a specific technology park, and thus, the educated target segments. In view of Intel Company, it is also a manifestation of implementation of Intel business ethics program.

Awareness and the level of customer engagement in a Community of Practice - example of Poland

The survey consisting of a questionnaire including 8 substantial questions and 2 others referring to respondents' particulars (place of living and living standards) was filled in by the respondents (Table 3).

Table 3: Place of living and living standards of respondents

Place of living: A municipality with	**No**
- more than 100.000 inhabitants	143
- 50.000 to 99.999 inhabitants	98
- 10.000 to 49.999 inhabitants	106
- 5.000 to 9.999 inhabitants	76
- with less than 5000 inhabitants	0
living standard	**No**
- 'severe hardship' for level 1	0
- 'significant hardship' for level 2	26
- 'some hardship' for level 3	97
- 'fairly comfortable' living standard for level 4	113 106
- 'comfortable' living standard for level 5	76
- 'good' living standard for level 6	5
- 'very good' living standard for level 7.	

The open-ended question: What do you associate the term 'community of practice with'? was most often responded in the following way:

- a group of people who share a common concern and goal
- a group of people who like the same things and buy similar products
- a group of people who is engaged in a process of collective learning
- a group of people that contact the company directly
- a process of learning in groups
- the program of knowledge diffusion
- some institutions and organizations like: universities, scientific groups, even the library.

Most of them have had really big difficulties with defining the term. Most of students answered the question, but the answers were frequently far from being related to the definition of 'knowledge communities'.

While answering the question: "Do you think that you are a member of a community of practice? If so, which one?" most of respondents said that they were not aware of being a part of any community of practice (73%). Some of them (nearly 50%) added that they were possibly the participants in the university community (students' community). Only 12% said that maybe they were but they could not give any name. 15 per cent of respondents said that they were a part of community of practice in the field of software (7%), fashion (5%), and education (3%).

On the other hand, the open-ended question: "What is reflected in your participation in a community of practice?" was responded by stating that the most popular forms of participation in communities of knowledge, in respondents' opinions, are:

- visiting websites
- exchanging opinions between participants
- active participation in classes at university and research groups, with participating practitioners.

The students who participated in the survey are mainly users of Facebook but also 'nasza klasa' and twitter (Table 4)

Table 4: Social media in use

Social media	No
Twitter	64
Facebook	148
Yelp	1
Nasza klasa	123
GoldenLine.pl	19
MySpace.com	26
Grono.net	14
Wykop.pl	42
Ask.me	1
Tumbr.com	3
vk.com	2

The students use forums, newsgroups, chat rooms, newsletters and blogs, listed in table 4.

Table 5: Internet tools in use

Other internet tools	No
e-mails	420
newsletters	311
blogs	213
forums, newsgroups, chat rooms	421
online questionnaires	19

Unfortunately, despite broad familiarity with Internet tools and declarations of their use, the knowledge of Intel Company projects created for the benefit of community of practice is very poor.

Table 6: Familiarity with the projects of Intel

Intel's' projects	No
'Nauczanie ku przyszłości' [*Teaching towards the Future*],	11
'Odyseja innowacyjna' [*Innovative Odyssey*],	9
Intel Education project	-
Intel International Science and Engineering Fair (ISEF)	9
Intel computer clubs	27
Educational program 'Design and discovery'	3
other	-

Only 14% students knew at least one example of the Intel projects. Familiarity with other IT companies aimed at sharing knowledge is also unsatisfactory. The students only indicated:

- IBM: Big data, what's all about? – 23 people
- Apple Support Community – 11 people
- Microsoft Support System – 9 people

The question: "Have you ever been invited to participate in any IT community of practice?" was not answered positively by any of the respondents. However, there were some negative answers and in some other cases the question was left unanswered.

4 Discussion and conclusion

The entities of the sector in which knowledge is the key resource, and such is the studied entity of the IT sector, apply intensive activities in the sphere of new ways of knowledge creating, acquiring and sharing. In this study, this is expressed by multiplicity of tools used by the studied companies. The tools can be shared into three groups. The most commonly used group of tools by IT firms, in their

declaration, is group B. It's illustrated by Intel case study, for example. But, the IT companies are aware of possibility to use the tools belonging to various VCoP, to gain synergistic effects, in most opinion.

We can observe noticeable computerization of society, expressed by the aforementioned number of hours spent online per week, particularly by people with secondary and university education. But, the awareness and involvement in community knowledge is marginal. Only 15 per cent of respondents are aware of being a part of any community of practice, despite broad familiarity with Internet tools. The social group that, as it seems, is most active with respect to using computer tools and techniques, does not know the concept of 'knowledge communities' that is intensely created by the IT entities. Only 14 per cent of respondents knew at least one example of the Intel projects. Even if the concept of CoP was recognized, it was perceived very broadly and generally as a group of people, a group of institutions, a process and program of knowledge diffusion, which altogether made the structure of the studied phenomenon. Declared use of social networking and online tools is rather not associated with participation in the knowledge communities or certainly it is not a conscious activity of the respondents, or a consequence of previous face to face relationships, that were based on the knowledge diffusion.

The results of research are not a consequence of the lack of knowledge of the projects selected to study the entities, because in general, the respondents are not able to name any programs of any company aiming at knowledge exchanging with broadly perceived environment or just the target market. The most of respondents do not show interest in participation in communities of knowledge either, while not consciously seeking this form of relationship with other entities.

This study has shown that despite increasing value of the parameters characterizing Polish Information Society and the involvement of business entities in the process of creating, capturing and expanding knowledge in a new way and according to new principles, the knowledge communities are still in the early stages of their life cycle in conditions of Polish market. This situation concerns a lot of companies, actually, regardless of their level of activity in the processes of conscious knowledge diffusion. It seems that still poor experience in the sphere of formation of the level of knowledge-based relationships result in this state of affairs. Besides, the period of economic crisis experienced by business entities, institutions and customers influence priority character of ventures that have direct impact on financial effects. Therefore, studies of determinants of creation of 'Community of Practice' constitute an interesting field for further studies of the author. This exploratory study is certainly a stimulus for continuation of the study, in field research, of a broader subject scope in international perspective and in a broader time perspective.

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Koncept skupnosti prakse – primer iz IT sektorja

Ozadje – Naraščanje zanimanja za skupnosti prakse se zadnja leta kaže na več področjih, vključno s področjema organizacijskih znanosti (še posebej na področju upravljanja z znanjem in organizacijskega učenja) in izobraževanja. Razumevanje izraza skupnost prakse pa je različno. Včasih pomeni sociološki konstrukt, drugič pa kot virtualno skupnost ali neformalno skupino pod pokroviteljstvom neke organizacije, z namenom podpirati širjenje znanja ali učenje.
Cilji – Poglavitni cilji članka so (1) poiskati glavne značilnosti skupnosti prakse v IT sektorju gospodarstva, (2) ugotoviti in prestaviti orodja za upravljanje z znanjem, ki jih uporabljajo v skupnostih prakse in (3) ugotoviti in analizirati poznavanje skupnosti prakse v izbrani populaciji
Metoda – Raziskava je preliminarnega značaja. Uporabili smo študijo primera in anketiranje z uporabo strukturiranega vprašalnika.
Rezultati – Skupnosti prakse so malo učinkovita oblika spodbujanja poslovnih in prodajnih procesov, čeprav je bila uporabljena vrsta aktivnosti na strani IT sektorja z namenom ustvariti skupnosti znanja, in intenzivni uporabi interneta v obravnavani populaciji.
Zaključek – Razlog za slabo poznavanje skupnosti prakse in pomanjkljivo zavedanje o vključenosti posameznikov, ki so sicer aktivni uporabniki novih tehnologij, predvsem interneta, je lahko pomanjkanje izkušenj na obravnavanem specifičnem področju upravljanja z znanjem ali značilnostih ravnanj, ki jih je mogoče neposredno meriti s poslovnimi rezultati. Determinante oblikovanja skupnosti prakse predstavljajo zanimivo za nadaljnje raziskovanje.

Ključne besede: upravljanje z znanjem, marketinško znanje, skupnost prakse

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The Relationship between Optimism, Pre-Entrepreneurial Curiosity and Entrepreneurial Curiosity

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Background: Entrepreneurship and entrepreneurs become more and more interesting fields for a scientific research. This paper addresses the relationship between optimism, pre-entrepreneurial curiosity and entrepreneurial curiosity as three determinants of entrepreneurial psychology. Literature review showed optimism is important for entrepreneurs and influence them mostly in a positive way. Although entrepreneurial curiosity is important determinant for entrepreneurs and it was connected with entrepreneurial self-efficacy, openness, and company's growth the connection with optimism remained unexplored until this research.
Methods: A multi-country empirical validation was conducted on a sample of entrepreneurs from Slovenia and USA. A structural equation modelling, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to develop a model, which complement theoretical predisposition and fit the data.
Results: The results of the study show that higher levels of optimism lead to higher levels of pre-entrepreneurial curiosity and higher levels of pre-entrepreneurial curiosity lead to higher levels of entrepreneurial curiosity.
Conclusions: The contribution of this study is manifold. From the theoretical view, a literature gap on the field of optimism and entrepreneurial curiosity combined is fulfilled and a structural equation model with optimism and entrepreneurial curiosity was established. Since openness, pre-entrepreneurial curiosity and entrepreneurial curiosity are related policy makers can test individuals according to their level of researched determinants and motivate more entrepreneurial perspective ones to become active in the entrepreneurship process. Thus, entrepreneurs can use these results to recruit more entrepreneurial oriented employees.

Keywords: Optimism; Entrepreneurial Curiosity; Pre-Entrepreneurial Curiosity; Entrepreneurship; Entrepreneur.

1 Introduction

Entrepreneurship matters. Although entrepreneurship in the informal economy receives very little attention in academic literature, there are several reasons why it cannot be ignored (Thai and Turkina, 2013). Beside entrepreneurship is the most powerful economic force known to humankind (Kuratko, 2013) it positively influences reduction of unemployment and contributes to GDP. The complex of entrepreneurship domain integrates many different but connected fields. The varied definitions in entrepreneurship literature reflect this complexity (Autio, 2007). However, the research on entrepreneurship and small businesses has started attracting the interest of scholars and policy makers and the importance of small and medium-sized enterprises is increasingly acknowledged in Academia as well as in the public debate (Ulhøi, 2005).

In today's world small business, and particularly new ones, are seen more than ever as a vehicle for entrepreneurship, contributing not just to employment and social and political stability, but also to innovative and competitive power (Wennekers and Thurik, 1999). Audretsch et al. (2001) argued that on the one hand, high unemployment rates may lead to start-up activity of self-employed individu-

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als (the "refugee" effect) and on the other hand, higher rates of self-employment may indicate increased entrepreneurial activity reducing unemployment in subsequent periods (the "entrepreneurial" effect). Since entrepreneurial activity is increasingly relevant to economic and labor employment in both developed and developing nations, new knowledge about entrepreneurship can speed the outcomes desired by enterprising individuals, firms, and societies (Busenitz et al., 2003).

Entrepreneurs often play vital roles in the early evolution of industries, examples of such (successful American) entrepreneurs include Andrew Carnegie, Michael Dell, Thomas Edison, Henry Ford, Bill Gates, Ray Kroc, and Sam Walton (Van Stel et al., 2005). The entrepreneur is not a fixed state of existence; rather entrepreneurship is a role that individuals undertake to create organizations (Gartner, 1988). Thus Henderson and Robertson (2000) suggest that the traditional view of the entrepreneur is as a »risk-taker« bringing different factors of production together.

There are many reasons why individuals decide to become entrepreneurs. For most management scholars and some psychologists, the difference lies less in attitudes toward risk than in the perception of risk: entrepreneurs typically overestimate the chances that their project will be successful (Pinfold, 2001). In this manner the strongest source of entrepreneurial optimism is likely to be selection combined with representativeness: people don't become entrepreneurs by accident but because they perceive that they have a project that dominates their other career choices although entrepreneurial projects are typically highly uncertain; because of their novelty, there is very little evidence on which to base future expectations (Landier and Thesmar, 2009). Thus recent studies on the field of entrepreneurial psychology show that also entrepreneurial curiosity (Jeraj and Marič, 2013a) is a good predictor for entrepreneurial intentions. This paper establishes a theoretical and empirical relation between two important psychological determinants influencing entrepreneurs in their professional life. Those determinants are optimism and entrepreneurial curiosity.

2 Influences on the entrepreneurship

Many factors influence entrepreneurs. Literature review from the field of entrepreneurship, management, organizational sciences, psychology and sociology revealed that researchers studied different aspects of entrepreneurship as: entrepreneurial intentions (Douglas, 2012); entrepreneurial motivation (Shane et al., 2003), entrepreneurial creativity (Amabile, 1997); family of entrepreneurs (Dyer and Handler, 1994); environment (York and Venkataraman, 2010); and other entrepreneurial related fields.

In line with diversified research on the field of entrepreneurs as written above it was found that many different factors influence entrepreneurship as a broader research discipline. For example, Dees (1998) researched the influence of social factors on entrepreneurship; Kreft and Sobel (2005) connected entrepreneurship with economic freedom; Doepke and Zilibotti (2013) founded the relation between culture and entrepreneurship; Román et al. (2013) argued that economic situation influence entrepreneurship; and others.

Different determinants influence entrepreneurs; they have different education, come from different environment, operate on different markets, and others. The fact is that starting a business is a very risky choice: depending on the country, between 40% and 60% of newly created firms die before their fourth birthday (Landier and Thesmar, 2009; Scarpetta et al., 2002). In spite of those facts, there are still individuals who become entrepreneurs and risk their money, time, and good name in relation to the thin line between success and fail.

Several authors claimed that optimism was associated with positive outcomes of entrepreneurship, success of entrepreneurs, and their contributions to the economies in which they operate. On the one hand, researchers in psychology have investigated optimism as an attribute of individuals that governs positive thinking and the outlook of the future, and perhaps relates to better outcomes, better performance, better personal well-being, and coping strategy (Liang and Dunn, 2010). On the other hand, Renner (2006) claimed curiosity refers to the desire to acquire new information. Thus, to be successful, entrepreneurs must be curious about different specific entrepreneurial-related topics (Jeraj and Antončič, 2013). Since entrepreneurs need many different data about market, marketing, HRM, different regulations, tax demands and others, it is necessary to gather this information and make the right business decisions in order to be successful on the long term. Base on that facts optimism and entrepreneurial curiosity are important determinants, which influence entrepreneurs.

Sarasvathy et al. (2013) find out according to a detailed review of four literatures, namely, (1) Industrial organization, (2) Population ecology, (3) Labor and microeconomics, and (4) Entrepreneurship, that entrepreneurial performance is usually confounded with firm performance. The positive and statistically robust link between entrepreneurship and economic growth has now been verified across a wide spectrum of units of observation, the enterprise, the industry, the region, and the country (Thurik and Wennekers, 2004). Thus, as suggested by Jeraj and Antončič (2013) motivated individuals with a relatively high level of entrepreneurial curiosity could be involved in the entrepreneurial process and contribute to the innovativeness and growth of the company.

3 Optimism and entrepreneurship

Many scholars studied how optimism influences people in different occasions (e.g. Wenglert and Rosén, 2000; Orejudo et al., 2012; Chang and Farrehi, 2001). Scheier et al. (1994) described optimists in general as people who tend to hold

positive expectancies for their future. Optimism, conceptualized and assessed in a variety of ways, has been linked to positive mood and good morale; to perseverance and effective problem solving; to academic, athletic, military, occupational, and political success; to popularity; to good health; and even to long life and freedom from trauma (Peterson, 2000). Accumulating evidence from variety of sources suggest that dispositional optimism is beneficial for physical and psychological well-being (Scheier et al., 1994). Furthermore, optimism has been linked also to entrepreneurs.

Bengtsson and Ekeblom (2014) suggested, based on existing empirical evidence that entrepreneurs are optimists, a finding researchers often interpret as evidence of a behavioral bias in entrepreneurial decision-making. Further several empirical papers have tested the expectation that entrepreneurs are optimists (Bengtsson and Ekeblom, 2014; Cooper, Woo and Dunkelberg, 1988; Busenitz and Barney, 1997; Camerer and Lovallo, 1999; Arabsheibani et al., 2000; Fraser and Greene, 2006; Puri and Robinson, 2006; Koellinger, 2008; Crane and Crane, 2007; Trevelyan, 2008; Ucbasaran et al., 2010; Cassar, 2010 etc.) and the main finding from existing works is that entrepreneurs hold beliefs about their own life or work.

Dushnitsky (2010) wrote different authors conjecture that individual disposition offers one viable explanation: entrepreneurship is attractive if individuals are optimistic about the probability of their survival. Literature has also discussed optimism and its relationship to other entrepreneurial characteristics, how optimism impacts on venture performance (success and failure) and decision making, and different levels of unrealistic optimism leading to various consequences in venture development (Schneider, 2005; Liang and Dunn, 2008a; Liang and Dunn, 2008b; Liang and Dunn (2010)). On the other hand, James and Gudmundsson (2012) stressed that the generally perceived positive emotions of passion and high levels of dispositional optimism within the entrepreneur pose a tension, and are potentially both a benefit and a burden for entrepreneurial success. Base on that it is positive for entrepreneurs to have optimism to be successful but it should not be a prevailing determinant to avoid negative consequences.

Therefore, positive psychological emotions such as optimism may be critical in providing the motivating behaviour to enable the individual entrepreneur to persist through the opportunity discovery, evaluation and exploitation phases of the new venture process (James and Gudmundsson, 2012). Question that appears here is if optimism is positive also for stimulating entrepreneurial curiosity.

4 Entrepreneurial curiosity and optimism

Entrepreneurial curiosity is a positive emotional/motivational system oriented toward investigation in the entrepreneurial framework to learn tasks related to entrepreneurship and incorporate new experiences in order to improve business (Jeraj, 2012; Jeraj and Antončič, 2013; Jeraj and Marič, 2013b). Entrepreneurial curiosity is an interest in novelties or observations of society and a tendency to search for answers that indicate which demands should be met and it represents guidance and competitive advantages for entrepreneurs relative to the competition (Jeraj and Marič, 2013a). Entrepreneurial curiosity is awake, when an entrepreneur is facing different stimulus related to the entrepreneurship in the environment (Jeraj and Prodan 2010).

Literature review revealed that entrepreneurial curiosity was connected with some determinants from the field of entrepreneurship. Study of entrepreneurial curiosity (Jeraj, 2014) conducted on a sample of entrepreneurs from Slovenia and USA showed that entrepreneurial curiosity was linked with openness and company's growth. The results of the study indicated that the higher level of openness leads to higher entrepreneurial curiosity and the higher levels of entrepreneurial curiosity effects the company's growth.

Another study of Jeraj and Marič (2013a) indicated positive relationship between entrepreneurial curiosity and entrepreneurial self-efficacy measured on an international sample of entrepreneurs from Slovenia and USA, where was entrepreneurial curiosity, as also entrepreneurial self-efficacy a good predictor for entrepreneurial intentions. Further, on the one hand Luthans and Youssef (2004) suggest that individuals possessing the combination of self-efficacy, optimism, hope, and resiliency tend to be endowed with high levels of psychological capital, on the other hand Jensen and Luthans (2006) studied the link between entrepreneurs' positive psychological capital and leadership approach (Černe et al., 2013; Marič et al., 2013), which was found as grounded.

Since entrepreneurs are one of the most important elements for the success of their companies and since the literature review revealed that both, optimism and entrepreneurial curiosity are important determinants influencing entrepreneurs it is necessary to empirically test the relation between these two entrepreneurial-psychological factors.

Based on findings from the literature review, the following hypotheses were formulated:

Hypothesis 1: Optimism positively influences Pre-Entrepreneurial Curiosity.

Since optimism was connected to perseverance, effective problem solving, to different kinds of success, and other determinants it is reasonable to predict that it could be connected also to pre-entrepreneurial curiosity measured on a sample of entrepreneurs. This hypothesis answers to a research question if there is the relation between this two entrepreneurship psychology related determinants.

Hypothesis 2: Pre-Entrepreneurial Curiosity positively influences Entrepreneurial Curiosity.

Activities from the pre-entrepreneurial curiosity construct are necessary before a company is open or before an

entrepreneur starts with a new project. Since entrepreneurial curiosity refers to active planning, defining and realizing of aims in the entrepreneurial process it is logical to predict that these two determinants should be connected. Hypothesis 2 answers to a research question if pre-entrepreneurial curiosity is connected to entrepreneurial curiosity.

5 Method

5.1 Sample and data collection process

For the purpose of data collection, the questionnaires were sent to entrepreneurs from Slovenia and the USA. The multi-country sample consisted from small and medium size enterprises and control questions in the questionnaire were if respondents are founders or owners who participated in the start-up process of their company.

For the Slovenian sample, the questionnaires were administered in the Slovenian language and for the US sample, the questionnaires were in English language. Slovenian and US entrepreneurs were chosen for current multi-country research because they are countries from the first world and present two similar countries according to current situation on the field of entrepreneurship where economies base mostly on a private ownership, freedom of entrepreneurial initiative and open markets for entrepreneurial activities. Previous research of entrepreneurial curiosity (Jeraj and Antončič, 2013) showed that entrepreneurs from Slovenia and USA are similar according to their specifics related to entrepreneurship, and also according to their entrepreneurial curiosity level. Current paper expands the entrepreneurial curiosity research area from Jeraj and Antončič (2013) who suggested that another future research goal could be to analyse entrepreneurial curiosity in a model: to research the determinants that influence entrepreneurial curiosity. Another reason for joining these two samples was the aim to create more generalized model of optimism and entrepreneurial curiosity on a sample from these countries where the construct of the entrepreneurial curiosity was conceptualized, developed and empirically validated.

Emails with a link to the survey and a specific token for each respondent were sent to 4,000 entrepreneurs in Slovenia and to 5,000 entrepreneurs in the USA who needed approximately 10 minutes to complete the survey. In both countries, email addresses were selected randomly from public registers[1]. The survey consisted from measures of optimism, entrepreneurial curiosity, some demographic questions, and questions of their companies presented more detailed in chapter 5.2 Description of measures. Respondents could not continue on the next page of the online survey if not all questions have been answered so all of the 331 questionnaires that were returned were fulfilled fully.

5.2 Description of measures

Optimism was measured using the *Life Orientation Test-Revised - LOT-R* (Scheier et al., 1994). Entrepreneurs were asked to indicate the extent of their agreement with each of the items; how strongly they agree or disagree with the statement on a five level Likert's scale (1974).

Table 1: Optimism measure

	OPTIMISM
1.	In uncertain times, I usually expect the best.
2.	It is easy for me to relax.
3.	*If something can go wrong for me, it will.*
4.	I am always optimistic about my future.
5.	I enjoy my friends a lot.
6.	It is important to me to keep busy.
7.	*I hardly ever expect things to go my way.*
8.	I do not get upset too easily.
9.	*I rarely count on good things to happen to me.*
10.	Overall, I expect more good things to happen to me than bad.

Italic: These items were reverse scored before scoring and analyses.

According to Jeraj (2014) *Pre-Entrepreneurial Curiosity measure* is composed of entrepreneurial curiosity items that focus to pre-business activities. These activities are necessary before a company is opened or before an entrepreneur starts with a new project. Entrepreneurs had to indicate for each of the statements related to pre-entrepreneurial curiosity how often does a particular activity occur in their life by circling the number of frequency of the occurrence from "1" - the activity never occurs to "7" - it always occurs.

Table 2: Pre-Entrepreneurial Curiosity measure

	PRE- ENTREPRENEURIAL CURIOSITY
1.	While doing market research, I focus on the work so much that I lose track of time.
2.	When I notice an abandoned building, I think about what business potential it represents for me.
3.	It bores me to always watch the same products; therefore, I think about improving and offering them to the market.

1 http://www.ajpes.si/; http://www.bizi.si/; http://b2b-databases.com/

Entrepreneurial curiosity measure in this research includes some other variables from an entrepreneurial curiosity measure (Jeraj, 2014). Entrepreneurial curiosity measure, which refers to active planning and defining of aims in the entrepreneurial process, was consisted from five items. For each of the statements related to entrepreneurial curiosity, entrepreneurs had to indicate how strongly they personally agree or disagree with the statement. "1" indicated that they strongly disagree, and "7" indicated that they strongly agree with the statement.

Table 3: Entrepreneurial Curiosity measure

ENTREPRENEURIAL CURIOSITY	
1.	I explore new things that could create additional profit.
2.	I am interested in other entrepreneurs' interests.
3.	In entrepreneurial work, I am mostly interested in competition.
4.	In my business, I must have information about marketing that is as complete as possible.
5.	I am able to create added value from my observations of the environment.

6 Results

The sample consisted of 237 (71.6%) male and 93 (28.1%) female respondents (one person did not give their gender, as it was possible not to provide an answer in that particular question). The average age of the respondents was 47.85 years. 47.7% of respondents came from Slovenia and 52.3% of them from the USA.

In the Table 4 is the sample structure regarding to the respondents' companies by sector, sample structure in regard to the age of the company is in the Table 5, number of employees is in the Table 6, and sample structure by total sales in year 2011 in USD in the Table 7.

Table 4: Sample structure in regard to the respondents' companies by sector

	Frequency	Percent
Banking, investment, insurance	29	8,8
Manufacturing industrial goods	31	9,4
Retail or wholesale trade	36	10,9
Construction	38	11,5
Engineering, research & development	17	5,1
Transportation or public utilities	9	2,7
Consumer services	25	7,6
Mining, extraction, oil	7	2,1
Tourism	21	6,3
Manufacturing consumer goods	12	3,6
Management consulting & business services	41	12,4
Other	65	19,6
Total	331	100,0

Table 5: Sample structure in regard to the age of the company (in years)

	Frequency	Percent
0-1	5	1,5
2-5	37	11,2
6-10	43	13,0
11-20	114	34,4
21-50	99	30,5
more than 50	33	10,0
Total	331	100,0

Table 6: Number of employees (full time equivalent)

	Frequency	Percent
0	1	,3
0-10	163	49,2
11-50	74	22,4
51-100	47	14,2
101-250	13	3,9
251-500	15	4,5
501-1.000	9	2,7
more as 1.000	9	2,7
Total	331	100,0

Table 7: Sample structure by total sales in year 2011in USD

	Frequency	Percent
0	1	,3
under $50.000	17	5,1
$50.000-100.000	27	8,2
$100.000-250.000	41	12,4
$250.000-500.000	46	13,9

$500.000-1.000.000	27	8,2
$1.000.000-2.000.000	39	11,8
$2.000.000-5.000.000	34	10,3
$5.000.000-25.000.000	55	16,6
$25.000.000 or more	44	13,3
Total	331	100,0

Exploratory factor analysis (EFA) was conducted for both, the Slovenian sample and the US sample together. With joined samples, I wanted to show the relations between all studied entrepreneurial determinants among entrepreneurs from two countries and not the differences between samples.

A method to test the model by applying structural equation modelling is present in continuation. This operation was made by building a model in Lisrel 8.80, which is an analytical statistics program. Results of structural equation modelling based on the whole sample (n=331) are displayed in Figure 1 and the T-test values in Figure 2.

For the purpose of finding results of multi-country empirical validation was used a combination of exploratory (EFA) and confirmatory methods (CFA – all the variables were included to the structural equation model) with the goal to develop a model which complement theoretical predisposition and fit the data (Černe et al., 2013; Marič et al., 2013).

Hypothesis 1 was: Optimism influences positively Pre-Entrepreneurial Curiosity.

As seen on Figure 1 higher levels of optimism lead to higher levels of pre-entrepreneurial curiosity; influence is moderate (0.30), positive and statistically significant (t = 3.76; as seen on Figure 2). This finding is in support of Hypothesis 1.

Hypothesis 2 was: Pre-Entrepreneurial Curiosity influences positively Entrepreneurial Curiosity

As seen on Figure 1 higher levels of pre-entrepreneurial curiosity lead to higher levels of entrepreneurial curiosity; influence is high (0.63), positive and statistically significant (t = 6.29; as seen on Figure 2). This finding is in support of Hypothesis 2.

The fit indices of the structural model (Figure 1 and Figure 2) present a good model fit, which is indicated by the values of $\chi 2/df = 2.949$, RMSEA=0.077, NFI = 0.81, CFI= 0.87, RMR = 0.091, and GFI = 0.88. The hypotheses were defined to test the relations between the constructs in this model; both two show a statistical significance according to the t-test values whereas the whole model shows statistical significance of P-value=0.0000.

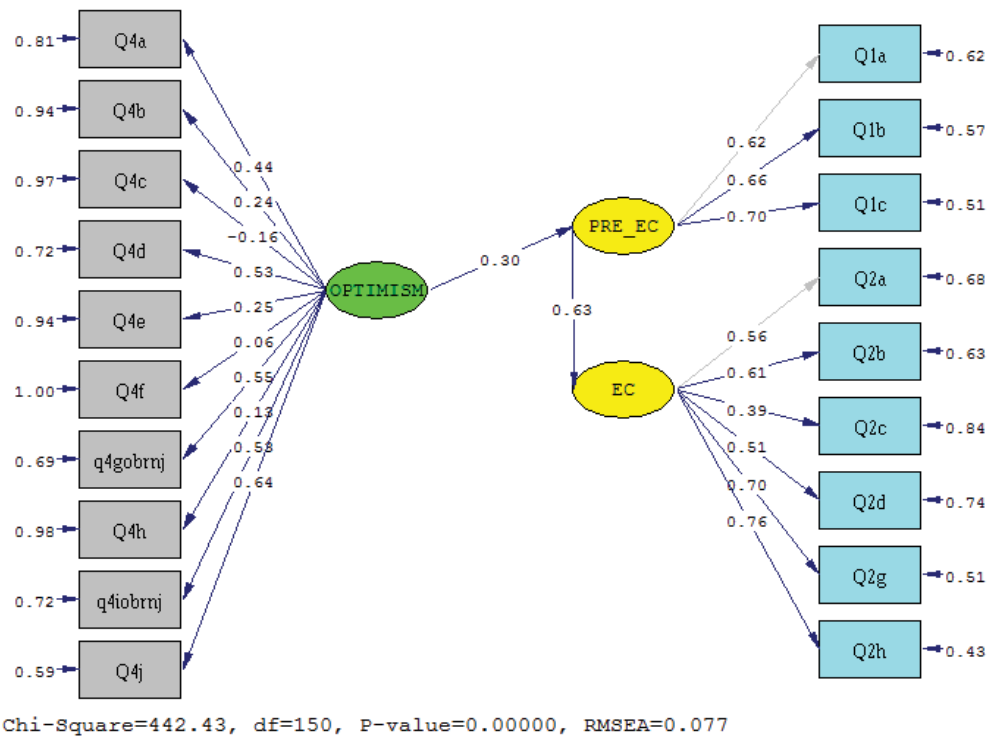

Figure 1: Standardized solution of the tested model

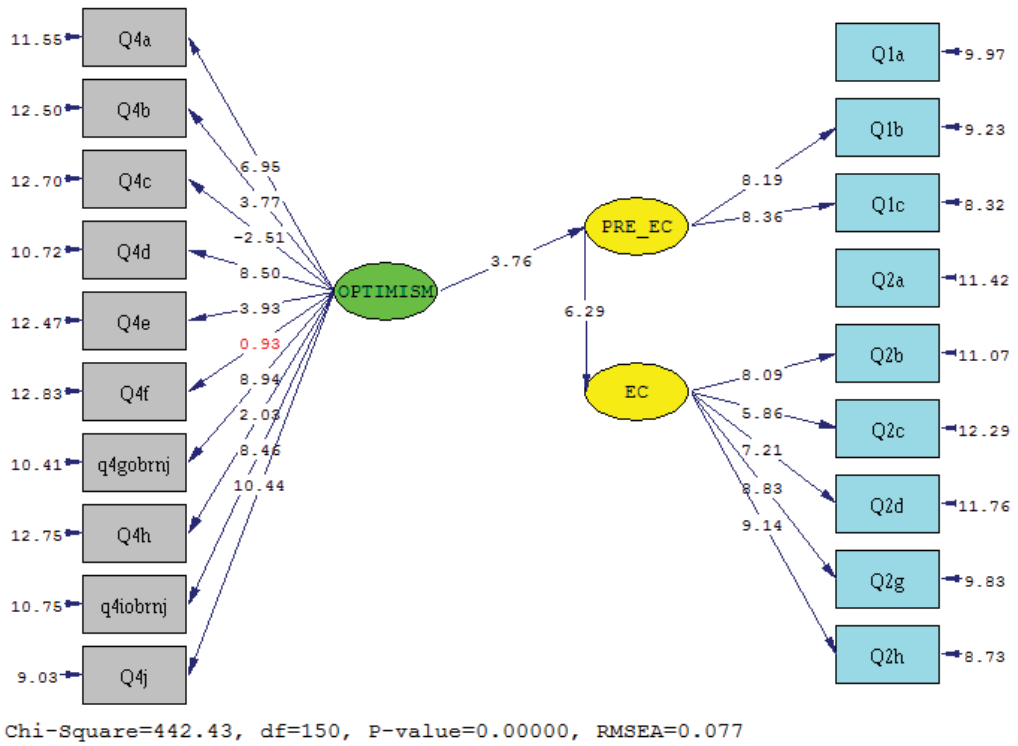

Figure 2: T-values for the tested model

7 Discussion

The results of this study indicate that at the frame of entrepreneurs, psychology optimism is important for pre-entrepreneurial curiosity and pre-entrepreneurial curiosity is important for entrepreneurial curiosity. This result is not surprising since already Hmieleski and Carr (2007) argued that the entrepreneurship literature on optimism has provided strong support for concluding that entrepreneurs tend to be, on average, more optimistic than other people are.

The fact is that not all entrepreneurs are optimistic all the time, especially given the volatile economic and financial situations such as we are dealing with today (Liang and Dunn, 2010). Since entrepreneurial curiosity is oriented to entrepreneurship investigation, to learn tasks related to entrepreneurship and incorporate new experiences in order to improve business; it is an interest in novelties or observations of society; and a tendency to search for answers that indicate which demands should be met it is important determinant affecting entrepreneurs (Jeraj, 2014). In that manner optimism is an important factor of entrepreneurial psychology for boost the level of pre and entrepreneurial curiosity in order to be more prepared for current entrepreneurial tasks and future strategic planning. When an entrepreneur fells optimistic, his effort in gathering data (entrepreneurial curiosity) is on higher level and that could represent a difference between success of his company in regard to the competition.

Particularly important within the context of entrepreneurship is the finding that optimists, as opposed to pessimists, often enjoy experiencing various forms of adversity (Scheier et al., 2001). From that manner, optimism on a too high level could be in some cases negative for entrepreneurs. I assume that the relatively high level of optimism is important and positive for entrepreneurs and for influence on their level of entrepreneurial curiosity.

8 Contribution, implications for theory, research, practice and economic policy

The contribution of this study is manifold. From the theoretical view, a literature gap on the field of optimism and entrepreneurial curiosity combined has been investigated and fulfilled. I established a structural equation model with optimism and entrepreneurial curiosity in two forms. To my knowledge, this is the first model combining these factors.

Another study can be done with new constructs in structural equation model and tested with optimism and entrepreneurial curiosity. Based on upper literature review and results of this study it is reasonable to predict that indi-

viduals with higher level of optimism and entrepreneurial curiosity will be more successful in entrepreneurship from those that lack these two constructs.

From the view of practice and economic policy implications of this study are seen as the platform on which the policy makers can test individuals according to their level of optimism and entrepreneurial curiosity and motivate more entrepreneurial perspective ones to become active in the entrepreneurship process. Entrepreneurs exhibit a stronger optimistic disposition compared to employed individuals (Dushnitsky, 2010) and individuals with higher levels of entrepreneurial curiosity are successful in the entrepreneurship, regarding to their company's growth (Jeraj, 2014).

With successful entrepreneurs and their enterprises, the society can invest money, time and other variables more efficiently and enable long-term growth and reduction of unemployment.

9 Limitations and future research opportunities

The first limitation could be the fact that the survey was made only on the sample of Slovenian and USA entrepreneurs. Since the entrepreneurial activity today is similar in Slovenia and USA (Kelley et al., 2013) there is a possibility that the results could not be applied to all countries where the entrepreneurial climate is different (countries in development and others). However, in the same point that limitation represent also future research opportunity. Next research could be done on a sample of entrepreneurs from countries in development to compare results from this study. The results from countries in the development could show that optimism and entrepreneurial curiosity are not connected and important for entrepreneurial success since entrepreneurs need other variables to succeed, as strong relations with the government, strong social networks and others.

This study reveals that both optimism and entrepreneurial curiosity are important for entrepreneurs. Based on reason findings optimism could be also negative determinant for entrepreneurs. Liang and Dunn (2010) summarized that optimism is also characterized as a negative factor in entrepreneurship: being over confident and unrealistically optimistic drive entrepreneurs to over-estimate the odds they will succeed (Baron and Shane, 2005; Hey, 1984).

Further Petrakis (2005) argues optimism has also been linked to the risk tolerance and high expectations. Optimists often deluded themselves into becoming entrepreneurs with high risks of failure (De Meza and Southey, 1996). Another experiment conducted by Coelho and De Meza (2006) discovered that irrational expectations (also interpreted as unrealistic optimism) led entrepreneurs to behave in ways that are contrary to their interests and resulted in a loss of well-being.

On the one hand, the theory describes optimism mostly as a positive determinant for entrepreneurs but on the other hand, also negative consequences could be found based on too high level of optimism among entrepreneurs. Future research opportunity here could be a research where the scientists would define the optimal level of optimism for entrepreneurs. That would be the level where entrepreneurs are open for entrepreneurial related activities but not to open to avoid unverified decisions.

10 Conclusion

This research revealed that both determinants optimism and entrepreneurial curiosity are important for entrepreneurs. Further, it was proven based on the results of structural equation modelling that optimism influences positively pre-entrepreneurial curiosity and that pre-entrepreneurial curiosity influences positively entrepreneurial curiosity.

Current results together with the literature review show that entrepreneurs use these two determinants by their activities to raise the rate of their success. Both determinants present promising research field for future studies.

Optimism is a positive influence on entrepreneurs but in some cases, optimism can be also a negative influence on them and on their entrepreneurial behaviour. Entrepreneurial curiosity on the other site is a psychology-entrepreneurial construct that influences entrepreneurs in the positive way. Based on those findings I think it is important to have both, optimism and entrepreneurial curiosity in a relatively high level in order to gain optimal results.

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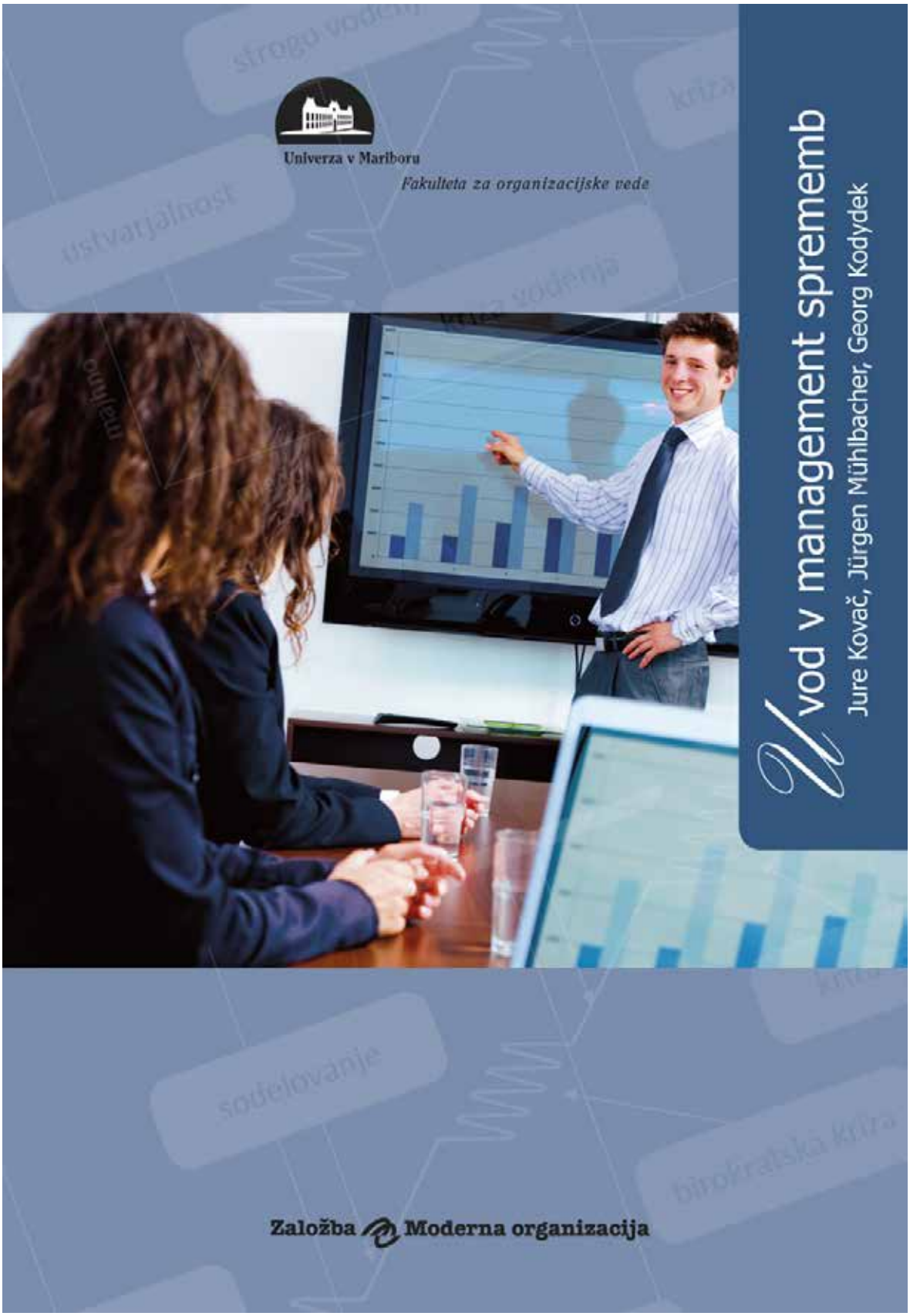
Mitja Jeraj, Ph.D. is a researcher in the field of entrepreneurship, management, and organizational sciences. His main research interests include entrepreneurship as a broad field of research, entrepreneurial curiosity and other entrepreneurial personalities, relations between entrepreneurship and economic growth, relations between entrepreneurship and unemployment, connection between entrepreneurship and development of sport etc. His research focuses also on management at small and medium enterprises, on cost management and on development of the organization over the time. He has authored and co-authored and present papers on conferences and published papers in scientific journals.

Relacije med optimizmom, pre-podjetniško radovednostjo in podjetniško radovednostjo

Ozadje: Proučevanje podjetništva in podjetnikov postajata vedno bolj zanimivi področji v znanstveni literaturi. Tako ta članek obravnava relacije med optimizmom, pre-podjetniško radovednostjo in podjetniško radovednostjo kot tremi dejavniki podjetniške psihologije. Pregled literature je pokazal, da je optimizem pomemben za podjetnike in vpliva nanje večinoma v pozitivni smeri. Čeprav je podjetniška radovednost pomemben dejavnik, ki vpliva na podjetnike in je bila v preteklosti povezana s podjetniško samo učinkovitostjo, odprtostjo in rastjo podjetja, je bila povezava z optimizmom neraziskana do te raziskave.
Metode: Meddržavna empirična validacija je bila izvedena na vzorcu podjetnikov iz Slovenije in ZDA. Za razvoj modela, ki dopolnjuje teoretične predispozicije in potrjuje ustreznost podatkov so bili uporabljeni strukturno modeliranje enačb, raziskovalna faktorska analiza (EFA) in konfirmatorna faktorska analiza (CFA).
Rezultati: Rezultati raziskave kažejo, da višje ravni optimizma vplivajo na višje ravni pre-podjetniške radovednosti in da višje ravni pre-podjetniške radovednosti vplivajo na višje ravni podjetniške radovednosti.
Sklep: Prispevek te študije je večplasten. S teoretičnega vidika, je bila zapolnjena vrzel literature na področju povezave optimizma in podjetniške radovednosti ter ustvarjen strukturni model enačb z optimizmom in podjetniško radovednostjo. Glede na dejstvo, da so odprtost, pre-podjetniška radovednost in podjetniška radovednost povezani, lahko oblikovalci politike identificirajo posameznike glede na njihovo stopnjo, v tem članku raziskanih dejavnikov in motivirajo bolj podjetniško perspektivne, da postanejo aktivni v procesu podjetništva. Nadalje lahko podjetniki uporabijo te rezultate kot pomoč pri zaposlovanju bolj podjetniško usmerjenih zaposlenih.

Ključne besede: Optimizem, podjetniška radovednost, pre – podjetniška radovednost, podjetništvo, podjetnik.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Call for Papers

Organizacija
Journal of Management, Informatics and Human Resources

Thematic Issue:
Future challenges and evolution of Human Resource Management issues

Guest Editors:
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Deadline for submissions: November 1st, 2014

Human resource management as a discipline today emerges from past, current and future influences and in diverse context around the world. Including different principles, models or action, human resource management is an eclectic field of research.

Consistent with Zupan and Kase (2005) and Aycan (2005), from an institutional perspective, it is posited that new practices occur and interact with contextual factors and actions of decision-makers. Hence, human resource practices are contextual and part of a process of institutional evolution. This is pertinent against the background of theoretical notions of human resource convergence and embeddedness of local context, not in a static sense but as a developmental process. Koleva et al. (2010), in reference to corporate social responsibility and associated employee relations practices, found considerable diversity, including regionally developed approaches with origins in the institutional evolution of organisations.

Theoretically, researchers have argued that human resources can be the source of sustainable competitive advantage for organizations (Dany et al., 2008). Empirically, a large number of studies have revealed positive relationships between high-involvement, high-commitment, high-performance work systems and firm performance (Dany et al., 2008).

Submissions are invited for papers which address the lastest development and key topics in the field of human resource management. The following broader topics may be covered:

- Creation of social, environmental, technological, personal and other determinants of human resource management;
- Methodological developments of employment relations in the field of human resource management;
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- Contribution of new models in human resource management.

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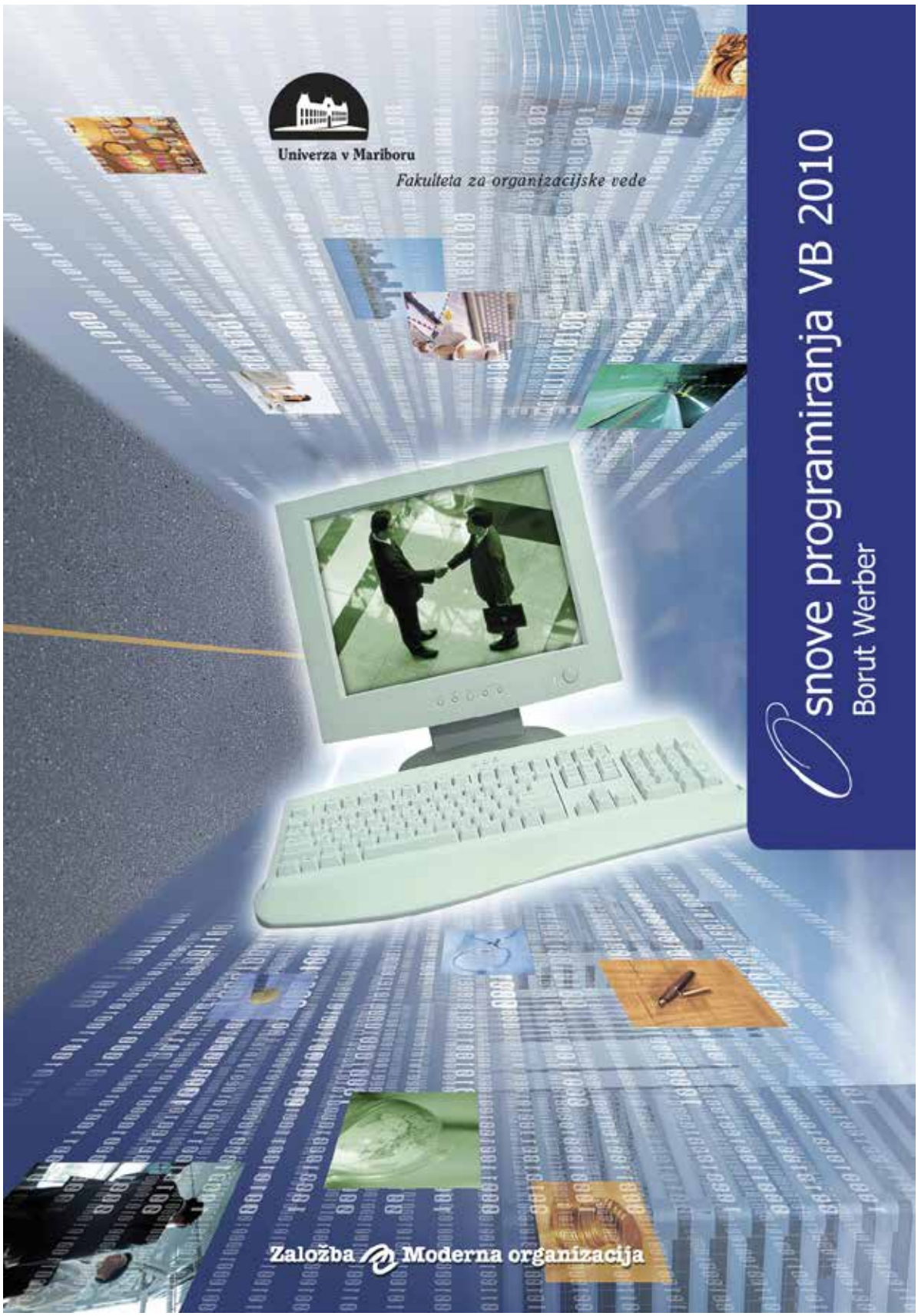
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Thematic issue:
Employee Share Option Programs and Employee-Owned Companies in Central and Eastern Europe

Deadline for Submission of Abstracts: December 15, 2014

The academic literature on employee share option programs (ESOP) and employee-owned companies (EOC) in Central and Eastern Europe (CEE) is characterized by at least two omissions. First, there is a remarkable silence about the relationship between EOC and ESOPs in CEE countries—with some exceptions that prove the rule (Mygind 2012)—though ESOP has been widely used as an instrument of mass privatization in several CEE countries and has led to majority employee share ownership (ESO) in a large number of firms (Aghion & Blanchard 1998). This neglect reminds us of the fact that despite close topical, theoretical, and empirical associations, the phenomena of EOC and ESOP have scarcely been discussed together in the academic discourse at all (Dow 2003). Ironically, while the EOC literature stresses some rather negative aspects of the specific employee ownership form, such as the degenerative tendencies and a principally limited viability of EOCs, the ESOP literature mainly propagates the positive aspects of ESO, such as the positive effects on identification with the firm or productivity gains.

Second, the academic discussion on the role of ESOPs and EOCs in the transformation process in CEE countries is rather disconnected from the long standing discourse about the potentially emancipatory role of ESOPs and EOCs in the Western world (Backhaus 1979). Moreover, there are hardly any references to the previously prominent debate about 'labor-managed-firms` in either 'labor-managed' or 'mixed' economies, which had had a very strong theoretical basis in terms of the "Illyrian Firm" (Ward 1958; Vanek 1970; Meade 1972) or the "pure rental firm" (Jensen & Meckling 1979) despite reflecting "some degree of ideological commitment" (Hansmann 1996: 7) during the Cold War. Moreover, the implications of the rather sharp and fast decline of ESO and EOCs in the CEE countries following privatization have not yet been systematically reflected in the Western literature (Kalmi 2003).

Thus, our current understanding of ESOPs and EOCs in CEE is not only limited by the lack of coherent empirical data, but also by the lack of a connection to the strong theoretical tradition, and by the lack of studies that compare the experiences made in CEE with the experiences made in Western countries. However, if one is interested in developing and experimenting with some alternative forms of organizing, with different forms of material and immaterial employee participation, and with democratic governance structures, the experiences with ESOPs and EOCs in the CEE countries can be analyzed more rigorously, thereby connecting them more strongly with the Western discourse and tradition.

Against this background, *Organizacija* aims to publish a Special Issue on ESOP and EOC in CEE. The aims of this Special Issue are (a) to advance our knowledge on the structures and processes at the individual, organizational, and societal levels that are germane to participatory types of organization; (b) to draw lessons from the CEE experiences for the western regions; and (c) to learn about the behavior of participatory types of organization and of individuals in such organizations in different institutional settings. For this purpose, we are looking for theoretical and empirical contributions from economics, history, industrial relations, management studies, political science, and sociology, amongst others.

We welcome both theory-based empirical studies grounded in any methodological tradition (qualitative as well as quantitative), and conceptual contributions that focus on micro, meso or macro levels of analysis. Moreover, we encourage both studies that extend current theories and those questioning or even disconfirming taken-for-granted beliefs about participatory types of organization on theoretical or empirical grounds. Papers may include, but are not limited to, the following topics:

- The influence of public discourse about EOCs and matters pertaining to the political legitimacy of privatization on the emergence and development of EOCs

- Traces of the Illyrian Firm or pure rental firm in a setting of free markets, private ownership, and political democracy
- Specific country studies and comparative studies on institutional conditions for EOCs in CEE countries and their outcomes with respect to the viability of EOC
- The influence of specific contexts of corporate governance in CEE countries on the ownership and control of EOCs
- The influence of industrial relations in the CEE context on the viability of EOCs in CEE and the influence of EOCs on industrial relations practices
- Efficiency and effectiveness of EOCs in CEE
- The influence of different (countries') experiences with worker's self-management on the viability of EOCs after privatization
- Comparative case-studies about the emergence of EOC during privatization and their development depending on institutional context, participatory culture, experiences with worker's self-management and individual ownership rights
- Transfer of EOC & ESOP models from West to East and vice versa; adaptation of models and learning barriers between East and West
- Comparative studies about EOC as a privatization instrument in East and West
- History, development, distribution, and outcomes of ESOP in CEE
- The impact of ESOP on the viability of EOCs in CEE

Procedures

The following deadlines have to be observed:

- 15th December 2014: Submission of abstracts (maximum 1000 words) to the guest editors (thomas.steger@ur.de or olaf.kranz@wiwi.uni-regensburg.de)
- 31st January 2015: Invitations to submit full papers sent out
- 31st May 2015: Submission of full papers (according to the journal's guidelines http://www.degruyter.com/view/j/orga, maximum 8000 words)
- 30th September 2015: Feedback to authors
- 31st December 2015: Submission of full papers with revisions
- 2016: Journal volume to be published

Any further questions may be addressed to the guest editors:

Thomas Steger / Olaf Kranz
Department of Leadership and Organization
University of Regensburg

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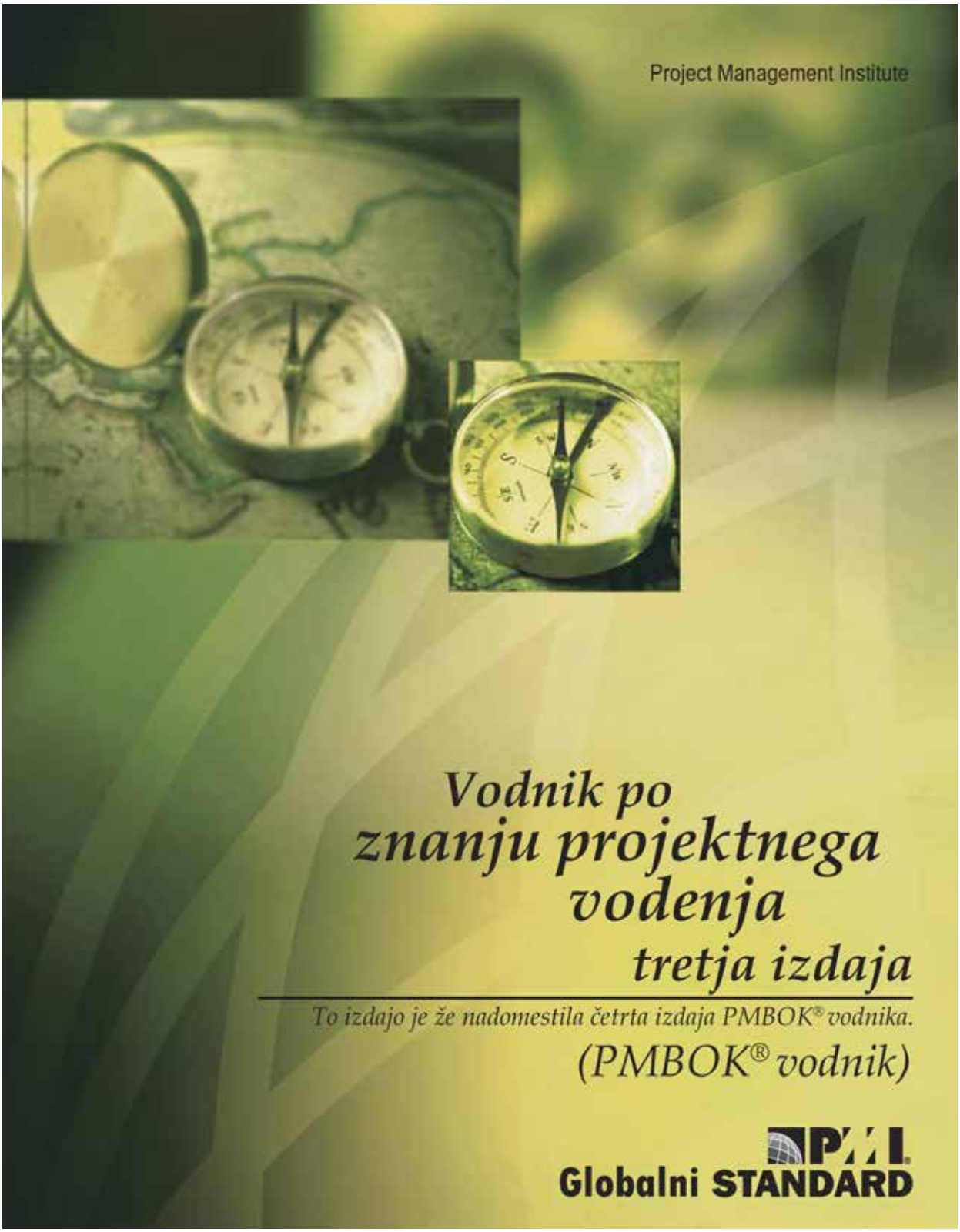
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