Model for selection of business process improvement methodologies

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Abstract

Purpose. Business process improvement (BPI) is one of the important themes in the literature, and is of top-priority for companies that strive to gain competitive advantage. However, evidence shows that many BPI initiatives are unsuccessful. Out of several reasons for BPI initiative failures, one of the most significant ones is inability of companies to select the appropriate BPI methodology. The paper aims to address this problem by proposing a model that should facilitate the selection of appropriate BPI methodology.

Methodology. A critical review of existing approaches to BPI methodology selection is combined with empirical research. A number of criteria for BPI methodology selection were identified though literature review and their significance were tested through survey that involved 207 BPI expert from around the world. Criteria were grouped and their number was reduced through factor analysis.

Findings. The results show that a limited set of criteria can be used for selection of BPI methodology. The criteria were translated into a model for selecting the appropriate BPI methodology.

Practical implications. Proposed model should facilitate the selection of appropriate BPI methodology, and decrease the chance for BPI initiative failure, thus enabling companies to exploit the full potential of BPI and improve the overall performance of the entire company.

Originality/value. This study presents the original attempt to systematize the existing knowledge on BPI methodology selection, and to translate it to a BPI methodology selection model that is easily applicable and understandable to practitioners.

Keywords
business process; process improvement methodology; selection model

1. Introduction

Business process and process approach are very popular topic in literature and practice and authors such as Roeser & Kern (2015) and Tomašević et al. (2014) emphasize ever growing number of paper related to business processes in the last ten years. Company's profitability is higly dependable on its processes (Lientz & Rea, 2001), and solving the process problems can lead to the increase of customer satisfaction, and reduction of lead time and cost (Madison, 2005). Business process improvement is a good basis for business enhancement (Siha & Saad, 2008). Processes should be executed efficiently and effectively, and they should be managed in effective way (Rummler et al., 2010). Business process management (BPM) is approach to achieving organizational goal through imrpovement, management and control of core business processes (Jeston & Nelis, 2006). BPM has a central role in creating competitive advantage (Broadbent et al., 1999; Niehaves et.al, 2014), and empirical research confirms positive correlation between BPM and business success (McCormack et al., 2009). Although, BPM is important practice for enhancement of organizational operational competitiveness, surveys shows that high percentage, even up to 60-80%, is deemed to be unsuccessful (Trkman, 2010; Bai & Sarkis, 2014). Škrinjar & Trkman (2013) state that the main challenge with implementing process intitiatives is choice of the practices which will improve process orientation of the company, and stress the necessity to formalize those practice with clear guidelines for BPM implementation. Business process improvement (BPI) is the important part of BPM, which is why it is necessary to develop a systematic approach to BPI implementation in order facilitate the success. BPI includes two important tasks: (i) prioritizing processes that should be improved (Bandara, 2015); and (ii) to select an appropriate methodology for BPI. In the last few years, many organizations have implemented different BPI methodologies, which can be systematized as either process reengineering, process redesign or continuous process improvement (with the most prominent examples of continuous process improvement initiatives being Lean, Six Sigma, theory of constraints etc.). Considering the large number of BPI methodologies, organizations might have a problem with select the appropriate one.

After introduction, the review of BPI methodologies is given, where criteria for selecting BPI methodology have been identified. Identified criteria from the literature were used as a basis for empirical research, where results of the research were used for reducing the number of criteria, and grouping them. Reduced and grouped criteria were used for devising a model for selection of BPI methodology, which is presented in the last section.

2. Theoretical background

BPI approach is a systematic approach to help an organization optimize its underlying processes in order to achieve more results in a more efficient way (Harrington, 1991). The basic BPI approaches and methodologies are explained in the remainder of this section.

3.1. Business process improvement methodologies

Business process reengineering (BPR) is BPI methodology often used for achieving dramatic results. It gained in popularity after seminal book "Reengineering the Corporation" by Hammer & Champy (1993) has been published, where the basics of the approach have been explained. Organizations should reorganize their activities according to their processes in order to survive in global economy, and BPR is a business strategy for overcoming problems in crossfunctional processes, which represent the main challenges in business systems (Hammer & Champy, 1993; Hanafizadeh & Osouli, 2011; Radović et al., 2012). BPR

is "*fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary modern measures of performance, such as cost, quality, service, and speed*" (Hammer & Champy, 1993) Reengineering frequently involves fundamental redesign of crossfunctionall business process or end-to-end process (Petrović & Slović, 1998), but can also be focused on processes within one business unit (Madison, 2005). In addition, process should be medium in duration and to some extent repetitive (Bogdanoiu, 2012).

Business process redesing is used when existing business process should be improved through reduction of birocracy, cycle time, often through heavy IT utilization (Harrington, 1998). The main difference between process redesign and process reengineering is that process redesign heavily relies on existing processes as a basis, while process reengineering starts with a "white piece of paper", building new processes from scratch. There is usually a top down approach to redesign, because initiative starts form top management, and consultants give the solution which employees can consider imposed. As the changes are larger, significant antagonism towards proposed solutions might occur among employees.

Organizations are often struggling with the challenge to create better results with less resource. Due to the lack of resources (both financial and intelectual), organizations are trying to optimize the use of existing resources in order to achieve better results. Organizations have a difficult task to be adaptive - in terms of adapting to changes in the market, but also efficient and effective, and one of the ways that those goals can be fulfilled is the implementation of continuous process improvement (CPI) (Tadić et al., 2014).

Petrović & Slović (1998), Sahin (2000) i Gershon (2010) state that CPI has its origins in Total Quality Management and Japanese Kaizen approach. CPI is based on the fact that everything can be better, no matter how good it already is, and represents widely used philosophy in modern business. Page (2010) state that CPI represents a "new way of thinking, where improvements are natural way of doing business instead of one-time event". CPI is based on principles of kaizen approach which promote joint effort of all employees. CPI project are usually short in duration while changing the way that employees work on (Vasiljević & Slović, 2015).

Processes that are appropriate for CPI usually have following characteristics: they have well-defined borders, there are usually a sub-process confined within one organizational unit, and they use simple technology and are short in duration and often repetitive (Davenport, 1993; Petrović & Slović, 1998; Madison, 2005; Bogdanoiu, 2012).

3.2. Approaches to continuous process improvement methodologies

CPI methodologies are much in demand in todays business. As a confirmation of this stance, we are whitnessing the development of a significant number of process improvement methodologies being developed that are continuous in their nature, such as Lean, Six Sigma, Theory of constraints, etc.

Six Sigma is aimed at reducing defects to 3.4 per million parts, which is significant improvement having in mind that has their sigma level at about 4σ, i.e. 6,200 defects per million parts, (Siha & Saad, 2008). However, Six Sigma is a program that implements a wide range of tools to improve productivity and profitability (Siha & Saad, 2008). Organizations focus their efforts on reaching Six Sigma level to improve the quality of products and services, where the biggest problem that hinders high level of quality are variations in the process, statistically measured by sigma (Gershon, 2010; Payzdek, 2003). This is why variations in the process must be identified and eliminated. Processes which are suitable for application of Six Sigma are usually executed within one department, are of short duration, and to some extent are repetitive. These characteristics might not be enough to decide whether

process is suitable for Six Sigma improvement, but they can certainly used as some form of guidelines.

Lean and Six Sigma are among most popular CPI strategies for achieving operative and service excellence in any modern organization (Corbett, 2011). The root of Lean and Six Sigma are in manufacturing, but today both methodologies can be implemented in service organizations with positive results (Bicheno, 2008; Tomašević et al., 2010). Among several CPI methodologies, Lean is one of the most spreaded and sucessful approach.

Lean manufacturing or Lean thinking (Womack et al., 1990; Womack & Jones, 1996) has its roots in the philosophy of achieving improvements with a special focus on reducing waste. Lean can be defined as a

"system approach to the identification and waste elimination through continuous improvement, with a product that runs on the requirements of consumers in achieving perfection." (National Institute of Standards and Technology, 2000).

Waste concept (muda) has become one of the most important concepts in quality improvement activities, and is described in the popular philosophy of Taichi Ohno(Dahlgaard & Dahlgaard-Park, 2006). Lean requires a very clear focus on the value element in the provision of goods and services, and detailed understanding of operations and processes through which the product or service are being provided (Bendell, 2005).

Theory of Constraints (TOC) is a concept developed by Elyahy Goldratt 80s, and is described in his book *"The Goal - A Process of Ongoing Improvement"* (Goldratt et al., 1992). It is based on the idea of managing bottlenecks (refered to as constraints) in the process that limit the throughput of the system (Nave, 2002). It is considered to be CPI methodology, since the approach propagates continuous efforts in lifting one constraint after the other. Although TOC has been developed in manufacturing environment, it has been used in other areas, such as services, public administration, etc.

According to the review of BPI methodologies, it can be conluded that processes with different characteristics are in the focus of each methodology. Thereforefirst step of a successful BPI initiative should be to identify the business process that should be improved, while the second one should be to choose the appropriate process improvement methodology.

3.3. Criteria for selection of BPI methodologies

Advocates of each BPI methodology argue that it can solve all process related business problems, if properly implemented (Nave, 2002). Each BPI methodology has its strengths and weaknesses, and a large number of methodology points to the complexity of the problem of selecting the BPI methodology in organizations (Rashid & Ahmad, 2013). Yet there are many examples of the application of these methodologies being unsuccessful.

It is significant to mention the concepts of integration methodologies for improving business processes. In the context of integration, most of the literature suggests a hybrid Lean Six Sigma (George, 2002) and there are developed concepts of integration with the significant results of practical application. It is also important integration of BPM with BPI methodologies. Authors who are integrating the largest number of methodologies were Moura (2004) and Goldratt (2010). What they have in common is that the theory of constraints can be used to determine the focus of improvements, and then depending on the problem in the process, they suggest choosing between Lean or Six Sigma methodology. Bearing in mind the concepts of integration, one can notice that they just assume the possibility of applying the methodology, but again the problem boils down to the choice of methodology to the specific problem in the process. In various combinations of methodologies, reengineering is often neglected, and even Davenport & Stoddard (1994) state that most companies have a portfolio approach to organizational change including reengineering, continuous improvement, incremental approaches and techniques of restructuring, and they said that the BPR shoul be

integrated into other methods change; combined with the quality and other process-oriented approaches to improve the integrated approach to process management.

Therefore, it is necessary to formalize a selection of BPI methodology, so that the organization can determine which methodology is best to implement in its terms and characteristics of the operations and processes. In order to formalize a selection of BPI methodology, it is needed to create a list of criteria for selection.

This raises the following research question:

Which methodology is best suited for a particular process, and what are the criteria to select the one that will give the best results?

Based on a literature review, the list of criteria for selecting BPI methodology is identified (Table 1).

Table 1. Review of criteria for selection of business process improvement methodology

Criteria	Authors
Type of problem in the process (time, quality, costs, failure…)	(Nave, 2002); (Bendell, 2005); *Madison* (2005); (Novak,2005); (Salah, Rahim, & Carretero, 2010); (Harris, 2012);
Discrepancy between measured and expected process performance	*Harrington* (1991); Kettinger et. al. 1997; (Pereira & Aspinwall, 1997); *Lee & Chuah* (2001); *Madison* (2005); (Novak,2005); Forrest Breyfogle (2009);
Process performance based on efficiency or effectiveness	Kettinger et. al. 1997;
Process scope (Process is contained within one business unit or is cross functional)	Kettinger et. al. 1997; (Siha &Saad, 2008);
Structural process complexity and knowledge and skills needed for process execution	(Brock, Finedore, & Davis, Business Process Reengineering Assessment Guide, 1997); (Pande, Neuman, & Cavenagh, 2000); (Sarkar, 2010)
Process type (core, support, management)	Kettinger et. al. 1997;
Process impact on company's goals	Kettinger et. al. 1997;
Level of availability of resources for process change	Kettinger et. al. 1997; (Novak,2005); (Harris, 2012); (Siha &Saad, 2008)
Possibility for IT to partially or fundamentally change the process	Kettinger et. al. 1997;
Level of process maturity according to CMMI (Capability Maturity Model Integration) model	(Harris, 2012);
Level of organizational structure flexibility – rigid or change enabling	Kettinger et. al. 1997;
Management readiness to support process change	Kettinger et. al. 1997; (Harris, 2012)
Readiness to support active employees involvement in process change	Kettinger et. al. 1997; (Cagliano & Spina, 2000); (Nave, 2002); (Novak,2005);
Company support changes based on thorough analysis or visible changes and immediate results	Kettinger et. al. 1997; (Harris, 2012)
Management readiness to change company culture	Kettinger et. al. 1997; (Cagliano & Spina, 2000)
Management readiness to take risk	Kettinger et. al. 1997;
Market or competition impose methodology	(Cagliano & Spina, 2000)
Business partners request for a specific methodology	(Cagliano & Spina, 2000)
Pressure of stakeholders for fast improvements	(Harris, 2012)
Previous experience in application of specific methodology	(Cagliano & Spina, 2000)

3. Research methodology

Reasearch was conducted between spetmeber and December of 2014. The research goal was to reduce and group the critera for selecting BPI methodologies. In the literature, many diverging criteria can be found, which make selection very difficult. Therefore, authors decided to analize whether it is possible to reduce number of criteria in order to facilitate their use. Criteria are also grouped in order to make easier their operationalization. Than, model that should provide simple practical application of the criteria in the selection process was created.

The research was explorative, because the question was "what" apropos "which" criteria are used. Fot these types of research questions, Yin (2003) recommend use of questionnaire. In practice, the requirements of the experts are to identify assessment criteria and their significance, so it was expected that they have the experience and knowledge in this area. All variables in this case were ordinal type with Likert scale of 1 to 5, which is in line with similar research in the field (Jae et al., 2012; Coronado & Anthony, 2002 Ravensteyn & Batenburg, 2010). Questionnaire consisted of questions about the significance of criteria, as well as general questions about respondents that are taken from similar surveys in the field (Wolf & Harmon, 2012; Process Excellence Network, 2012). Pilot testing of the questionnaire was carried out with 6 experts, where 3 were from the universities who are engaged in consulting in the field of improving and managing business processes and 3 experts who are formally engaged in BPI and BOM in their companies. . After pilot testing, the final version of the questionnaire was made, where certain questions have been modified according to experts' suggestions. The questionnaire was available on the Internet, with link to it posted to potential respondents. The possibility that one respondent fills out the questionnaire more than once was exluded.

Given the aim of the research, population consisted of experts who are working to improve and manage business processes, where database was created by searching *LinkedIn* professional social network. Respondents were selected by searching for their skills profile. The ones with skills and experience related to BPI and BPMwere selected as potential respondents.

When the survey was completed, data were transfered and ceded to the SPSS20 software package. The variables were tested through frequencies and their minimum and maximum values, and it was concluded that there are no errors or missing values.

3.1. Sample description

The questionnaire was sent to 671 experts in the field of BPI and BPM.The total of 207 responses was received, and all of them are included in the research. The response rate was 30.84%, which represents a remarkable response rate. In the context of general information, respondents were asked about their job position, years of experience and knowledge and skills in the field of BPI and BPM, the number of BPI projects they participated in and their performance in these projects. General information about respondents is presented in Table 2.

The largest number of respondents were business process specialists or consultants (84.00%), while 10.5% state that they are researchers or business process managers. Only 5% responded with "something else" as their position, e.g. member of the process team, quality manager, CEO or director. In respect of the experience of participants in research, the smallest number of respondents (3.9%) has the experience of less than 1 year, while nearly 50% of respondents having experience of more than 10 years in the field. Regarding the knowledge and skills of respondents, the smallest number of respondents (8.7%) have the initial level of knowlegde, while 91.3% of respondents have advanced knowledge and can learn others in the field of research. The situation is simillar with BPI projects, where over 51% of respondents

participated in over 11 projects, 27.5% participated in the 5-10 projects, 17.4% in 2-4 projecta and only 3.4 % in one project. The position of the respondent provides assurance that they understand the issues highlighted in the questionnaire. Bearing in mind the described pattern of research, where over 50% of respondents have over 10 years of experience in the field, and can learn others and participated in over 11 projects to improve over the past decade, it can be concluded that the respondents were very competent to answer the questions, so the sample can be considered as representative. Their position and years of experience are in accordance with the skills and knowledge and the number of BPI projects they participated in, indicating the reliability and consistency of answers. High expertise of respondents was necessary because of the assessment od evaluation criteria significance.

Table 2. Review of criteria for selection of business process improvement methodology

Elements	**Value**	**Number of respondents [1]**	**Percentage [%]**
Job position	Research Scientist/ Academic in the field of BPI	14	6,76
	Consultant	90	43,48
	Process specialist	84	40,58
	Business process manager	8	3,86
	Other	11	5,31
	Total	207	100,00
Years of experience	Less than 1 year	8	3,9
	1-3 years	27	13,0
	4-6 years	33	15,9
	7-9 years	37	17,9
	10 years and more	102	49,3
	Total	207	100,0
Knowledge and skills	Beginner	18	8,7
	Advanced	47	22,7
	Professional	53	25,6
	Can learn others	89	43,0
	Total	207	100,0
Number of BPI projects	1	7	3,4
	2-4	36	17,4
	5-7	34	16,4
	8-10	23	11,1
	11 and more	107	51,7
	Total	207	100,0

3.2.Results

We used factor analysis for analyzing the responses from the participants. Factor analysis is carried out through several steps, as described by Milanović & Misita (2008). First step is to check whether the data are appropriate for factor analysis, i.e. if the sample size and intensity of the relationship between variables are appropriate. *Yong* & *Pearce* (2013) suggest that the factor analysis is usually performed on ordinal variables with the Likert scale or continuous variables. This renders variables in this study to be appropriate, since they are measured through Likert scale. Sample included 207 respondents, which is more than it is necessary for factor analysis (150 respondents) (Yong & Pearce, 2013). In addition, acoording to ratio of the number of factors and sample size, this relationship should be 10 cases per variable (Yong & Pearce, 2013), and even 5 cases by variables (Tabachnick & Fidell, 2006). This condition is also fulfilled. Correlation between variables is checked before the application of factor analysis was performed. The correlation between Influence of the

process on the critical success factors and Impact on process goals is identified, and variable Influence of the process on the critical success factors was excluded from the factor analysis.

In order to test the strength of relationships between variables, as the prerequisit for the application of factor analysis, several different tests can be performed (Table 3). *Bartlett's* test of sphericity was applied where significance should be less than 0.05, and the value of KMO *(Kaiser-Meyer-Olkin*) the adequacy of the sample rate which ranges from 0 to 1 and where the minimum value is 0.6 for the application of factor analysis (Pallant, 2011).

Table 3. KMO and Bartlett test of sphericity

Kaiser-Meyer-Olkin adequacy of the sample rate		.835
Bartlett test of sphericity	*Chi-Square*	1323.720
	Df	190
	Significance	.000

Value of KMO is 0,835 with significance of 0,000, meaning that sample is appropriate for the factor analysis. The second step is the separation of factors which are determined by the least number of criteria that can best represent the relationship between the variables (Pallant, 2011). Tabachnick & Fidell (2006) recommend experimenting with a number of factors, until the satisfactory solution is reached. The 4 factors with *Eigen* value greater than 1 were extracted, which included 52,881% of the variance of variables. The third step is the factor rotation and interpretation, which makes it possible to easily identify the pattern of factor loading. The most common rotation methods in practice are *varimax* and *direct oblimin* (Pallant, 2011). In this case, since the correlation matrix showed value of less than 0.32 the *varimax* rotation has been applied. The final rotating matrix for the variables is presented in Table 4.

Table 4. Final rotated matrix

Code	**Variable**	**Factors**			
		1	**2**	**3**	**4**
F1.1	Management readiness to support process change	**.829**	.031	.121	-.015
F1.2	Readiness to support active employees' involvement in process change	**.817**	.143	.119	.005
F1.3	Management readiness to impact on emloyees during the process change	**.692**	.097	.132	.294
F1.4	Company support changes based on thorough analysis or visible changes and immediate results	**.576**	.313	.025	.230
F1.5	Level of availability of resources for process change	**.547**	.317	.108	-.047
F2.1	Structural process complexity and knowledge and skills needed for process execution	.127	**.751**	-.010	.101
F2.2	Level of process maturity	.136	**.629**	.088	.192
F2.3	Process scope	.053	**.627**	.007	.185
F2.4	Previous experience in application of specific methodology	.169	**.568**	.388	-.094
F2.5	Possibility for IT to partially or fundamentally change the process	.184	**.551**	.256	.022
F3.1	Business partners request for a specific methodology	.189	.082	**.788**	.001
F3.2	Pressure of stakeholders for fast improvements	.022	.035	**.772**	.087
F3.3	Market or competition impose methodology	.137	.229	**.703**	.162
F4.1	Process performance based on efficiency or effectiveness	.193	.067	-.048	**.806**
F4.2	Type of problem in the process (time, quality, costs, failure…)	.006	.071	.082	**.763**
F4.3	Discrepancy between measured and expected process performance	.059	.228	.179	**.652**

Code	Variable	Factors			
		1	2	3	4
	Extraction method: *Principal Component Analysis*. Rotation method: *Varimax with Kaiser Normalization*.				
a.	b. Rotation converged in 5 iterations.				

In order to confirm the internal consistency between variables within a single factor, Cronbach's alpha coefficient has been used. The recommended value of the coefficient is at least 0.7, and for a new scale, as is the case in this research, the limit is set to 0.6 (Pallant, 2011). Table 5 presents the Cronbach coefficient *alpha* for each factor.

Table 5. Cronbach alpha

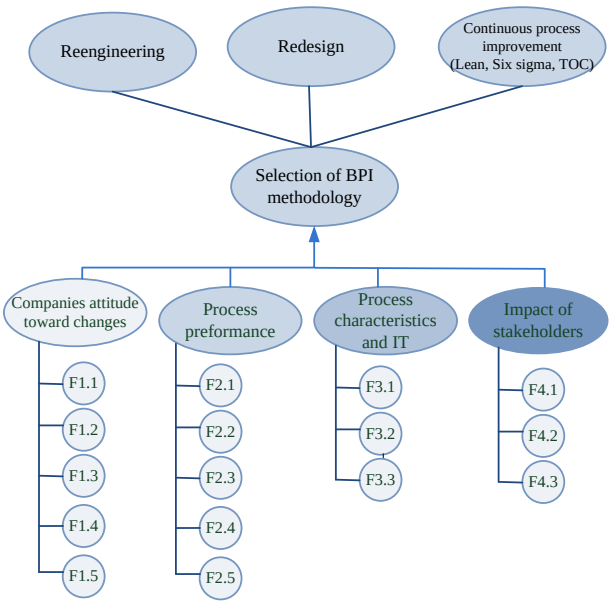
Factor	*Cronbach alpha*	*Cronbach alphabased on standardized items*	Number of elements	Mean	Standard deviation
I	0,789	0,791	5	19,94	3,600
II	0,692	0,695	5	16,80	3,463
III	0,697	0,698	3	9,271	2,517
IV	0,670	0,671	3	11,70	2,074

Based on value of the *Cronbah alpha* coefficient, it can be concluded that criteria are reduced and grouped in appropriate way. Besed on the criteria analysed through previous survey, model for selction of BPI methodology is designed.

4. Model for selecting BPI methodology

Figure 1 shows the model for selction of BPI methodology. Criteria on the first level and second level are presented, so as BPI methodoliges as altervatives.

Figure 1. Model for selection of BPI methodology



In this model, processes are evaluated according to the 16 criteria grouped into 4 factors. Factors Companies attitude toward changes and Impact of stakeholders are in regard to the whole company, while factors Process performance and Process characteristics and IT are in regard to individual process.

Evaluation of each criteria is based on the description of specific situation in a companie or in the business process. Description of criteria Companies attitude toward changes with sugested marks is presented in Table 6.

Table 6. Description of marks and elements for criteria Companies attitude toward changes

Code of element	Description	Mark
F1.1 Management readiness to support process change	Management is not interested for process change	1
	Management is interested for process change, but doesnt want to be actively involved in it	2
	Management is interested for process change and it is ready to to be actively involved in it	3
F1.2 Management readiness to influence the emloyees during the process change	Management in not ready to influence the employees nor to deal with distrubing influences during the process change	1
	Management tolerates moderate distracting influence on employees and is ready to react in case of major disruptions to processchanges	2
	Management is ready to influence the employees and to deal with disruptions to process changes	3
F1. 3 Readiness to support active employees involvement in process change	Management does not support the active involvement of employees in the change process	1
	Management supports the employee's involvement in process change, but is not willing to introduce the appraisal system	2
	Management supports the active employees' involvement in process change through adequate appraisal system	3
F1. 4 Company support changes based on thorough analysis or visible changes and immediate results	The organization appreciates visual changes and results in the process change that are visible in a short period of time	1
	Organization support changes in business processes that are based on the analysis without the pressure for results visible in a short amount of time	2
	Organization supports changes in business processes that are based on fundamental analytical studies	3
F1. 5 Level of availability of resources for process change	Minimal resources for process change are available	1
	Available resources for process change are limited and insufficient to moderate changes in process	2
	Available changes are limited but sufficient for a radical process change	3

If competition is not engaged in process change, or if information about their engagement in process change cannot be obtained in the appropriate amount of time, it is necessary to exclude this element.

Based on the average rating of the process according to the criteria, it can be decided whether it is necessary to work on reengineering, redesign or continuous improvement of business processes. If the average value is between 1 and 1.5 is recommended to focus on minor changes to the process. If the average value is between 1.5 and 2.5 it is recommended to focus on business processe redesign. If the average value is greater than 2.5 it is recommended to focus on business process reengineering.

In addition, popular continuous process improvement methodologies have been analyzed, i.e. lean, six sigma, and TOC, and guidelines for their selection have also been included in the

model. The guidelines have been designed according to relationship between the types of process problems, as presented by Stojanović et al. (2013), and they have been adapted from Novak (2005) iand Castaneda-Mendez (2013), and are presented in the Table 7. Problems on the 1st level are decomposed on the possible problems on the 2nd level. Besides CPI, in this table, Material requirements planning (MRP) system is included as the solution for the production planning and scheduling.

Table 7. Connection between problems and methodologies (adapted from Novak, 2005; Stojanović et al., 2013)

Problem I level	Problem II level	Continuous BPI methodology
Inventory	Demand satisfaction	Lean, TOC
	Overstock – problem of demand and sales forecasting	MRP
Delivery time	Throughput time	Lean, TOC
	Production plan	MRP
Demand satisfaction	Delivery time	Lean, TOC
	Available capacity	No capacity – Lean, TOC
Cumulative cycle time	Purchasing time	Lean, TOC
	Production time	Lean, TOC
	Delivery time	Lean, TOC
Defects and first pass yield		SPC, six sigma, Lean
Costs	Material costs	Lean
	Production costs	Plan in not stable – Lean and TOC, plan stable – Lean
	Delivery costs	Plan is ready- Lean, TOC; no plan - MRP
Flexibility and customer rate		Lean

Considering problem on the first or second level, inventory problems (1st level) leads to unfullfilled demand in case of no inventories (2nd level), or poor demand forecasting in case of large inventories (2nd level). When demand cannot be satisfied, cause can be inability to meet delivery time, or insufficient capacity to make the required quantity. Therefore, inventory problem and demand satisfaction problem can be reduced to time problem, or capacity problem. Problems with long cumulative times and flexibility can also be attributed to time. Defects and first pass yield are quality problems, while costs can also be attributed to time, and, in this case, to high capacity utilization. All mentioned problems can be reduced to time or quality problems. Table 7 shows that for time problems, lean or TOC initiatives should be used, while for quality problems, six sigma initiatives should be used.

5. Conclusion

BPM is a very important concept for achieving competitive advantage. In order to be successful in BPI, company must carefully select processes that should be improved, as well as methodology that will be used for process improvement… Literature review resulted in the initial list of criteria for the selection of BPI methodology. Exploratory factor analysis was conducted in order to reduce and group the criteria. Selected critera have been used for designing the model for selection of BPI methodology. Four factors have been recognized: Companies attitude toward changes, Process performance, Process characteristics and IT, and the Impact of stakeholders and competitors. These factors are divided into 16 criteria. For

each criterion descriptions marks were defined, indicating specific situation the organization or process might encounter. In addition, the proposition on how to make a final decision regarding the metholodogy for a particular process improvement is given.

The difference this model and other models proposed in the literature is that the proposed model takes into account three options for BPI, i.e. process reengineering, process redesign, and CPI as an alternative, and represents a formalized process of selection of BPI methodology, with clearly defined criteria, as well as the method used for assigning ratings within the criteria, which is seen as a deficiency in existing approaches. Model provides a simplified assesment, with marks defined for each criterion, where each criterion has well defined way of evaluation.

In the context of further research, it is necessary to evaluate model through practical application, in a variety of industries, in order to determine the elements that need to be adapted or improved.

Proposed model should facilitate the selection of appropriate BPI methodology, and decrease the chance for BPI initiative failure, thus enabling companies to exploit the full potential of BPI and improve the overall performance of the entire company.

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