

Developing a business process management maturity model: A study of 300 Iranian superior companies

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Abstract— The present research is aimed to develop a comprehensive maturity model for business process management (BPM) based on previous research analysis and then to apply the developed model to assess BPM maturity of 300 Iranian superior companies in the year 2013. For this purpose, meta-synthesis, expert judgment and fuzzy analysis approaches were deployed. The BPM maturity model was developed by implementing meta-synthesis approach and was examined and verified with experts' judgment and AHP fuzzy analysis. Finally, the assessment tool was developed and 300 Iranian superior companies BPM maturity level were investigated. The maturity model developed consists of five levels and ten dimensions which may be classified into four groups named process, tool, organizational and operational. According to the results obtained from experts' judgment, process and tool groups as well as process architecture and methods dimensions are of the highest importance in determining BPM maturity. Results of field data analysis indicate a meaningful positive relationship between the BPM maturity level and organizational performance (organizations under study are among Iranian superior organizations). The results also showed that the average level of the BPM maturity in the surveyed organizations is below the average one.

Index Terms— Business process management, Business process management maturity model, Fuzzy-AHP, Meta-synthesis.

I. INTRODUCTION

Adopting the BPM approach, organizations are about to make business benefits via increased efficiency, and agility. In the recent years, there have been a lot of studies carried out on the BPM concept, stating its benefits and suggesting it as a dominant approach for organizational success in today's business environment. (Weingartner, 2010; Lusk, 2005; Hill, 2008; Garimella, Lees & Williams; 2008; Liu et al, 2009; Bititci et al; 2011). On the other hand, there have been other studies indicating the lack of efficiency and effectiveness as well as high rate of failure of BPM projects is several organizations (Karim et al., 2007; Abdolvand et al., 2008).

Given the organizations' accelerating movement towards the BPM approach and developing their BPM capabilities, the important point (issue) in BPM studies is the shortage of empirical evidences which support BPM benefits and capabilities and express the relationship between BPM and organizational performance. However, these evidences may increase organizations' awareness, and decision making efficiency while leading them to take logical actions in order

to implement this approach. In addition, there are only few studies carried out to identify the BPM maturity indicators, whereas identifying the key factors for successful implementation of the actions and movement towards higher maturity levels may be working as a guide for organizations. .

In order to fill this gap, we decided to present a BPM maturity model for process management by referring to the literature and studying them systematically. Using the just mentioned model, we developed a tool for assessing the maturity level. Then, we studied the relationship between BPM maturity and organizations' performance. Finally, we presented some empirical evidences regarding the impact of BPM on an organization's performance and empirically supported the studies carried out that on the advantages of BPM so as to achieve the research purpose.

In other words, the key questions of the research we are seeking to answer are as follows:

- (1) What is the status of BPM in the 300 Iranian superior companies?
- (2) Is there any relationship between the BPM maturity level and position of the companies in the list of 300 superior companies in the year 2013?

The main hypothesis of this study is: "There is a significant positive correlation between BPM maturity level and the organization ranking".

Continuing it is explained that how the BPM maturity model was developed using the study of literature and meta-synthesis, expert judgment and AHP fuzzy approaches.

II. RESEARCH LITERATURE

A. Business Process Management

Although there are three items in definition of the term BPM (management, process, and business), the definitions and approaches attributed to it range from IT-based viewpoints such as those regarding business process automation (Harmon, 2003) or process analyzing and improving (Zairi & Sinclair, 1995) to comprehensive approaches (Rosemann & de Bruin, 2004). According to Gartner (2005), BPM means designing, implementing and improving intra-task activities which link information systems and business partners (Hile and Sinur, 2012). The road towards BPM is a difficult one resulting from successes and failures of several other acts, all of which have been created, improved, and enhanced so as to gain a process-based organizational efficiency (Jeston. & Nelis, 2008). BPM is a comprehensive managerial approach which focuses on aligning all aspects of an organization with its customers' needs (vom Brocke & Rosemann, 2010). According to the reports published by IT sector, as a result of using service-oriented-architecture (SOA), business management has become more popular and is being replaced by great organizational resources planning systems strategies

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(Bielowski, 2010). Redesigning and empowering an organization's processes, BPM leads it to be efficient and operationally agile (Garimella, Lees and Williams, 2008). As a result of agility, efficiency, and visibility, business value is created (Weingartner, 2010) and the organization will be wholly optimized through the alignment of the processes with the business strategy (Lusk, 2005).

The assessment of BPM maturity model in organizations aims to investigate the success rate of these actions, to identify the organization's strengths, weaknesses, and dimensions as well as to determine certain fields on which improvement actions should focus and efforts and investment should be made. Maturity model is a roadmap for organizations which are implementing process management actions or trying to take the first step towards this way. It will determine organizations' current BPM maturity status and at the same time, help them move towards the next stages of maturity, increase their effectiveness, and make their process management actions efficient.

B. Business Process Management Maturity Models

There are a large number of studies presenting maturity level and investigating maturity level in the relevant research literature. In the field of process management, there are two types of maturity models: process maturity models and BPM maturity models (Rosemann & vom Brocke, 2010, Smith & Fingar, 2004). The former refer to the overall status of organization's processes or processes of some certain aspects of it (Rosemann & De Bruin, 2006), and the latter addresses BPM capabilities in connection with (e.g., Rosemann & de Bruin, 2005, Lee et al., 2007, Hammer, 2007, Weber et al., 2008) discovery, design, deployment, and implementation of a process (Smith & Fingar, 2004), strategic alignment (Rosemann & vom Brocke, 2010) as well as user and system participation (Smith and Fingar, 2004).

A few models present a combination of process maturity and business management practices maturity (Smith & Fingar, 2004) not considering them separate from each other.

Given the description a model presents for each of its levels, it is possible to find whether the model shows the status of management practices, processes or both. Although many of the level descriptions are the same, they have different concepts of the term process management. Some models (e.g. BPRMM) focus on the idea of business process reengineering (BPR) that states a fundamental and radical innovational project. Many of the other maturity models (e.g. PML, BPMM-OMG) consider process management as a gradual and evolutionary approach whose purpose is to improve a process in a continuous manner (Röglinger, Pöppelbuß & Becker, 2012).

In the present research, only models those which involve the status of BPM practices in addition to processes, were considered to be studied. These explain organizations' status from immature and preliminary procedures to highly advanced ones of process management and the best process conditions.

C. An Overview of the BPM maturity models used in the present research

Table 1 shows an overview of the BPM maturity models used in the present research (including scope of each maturity model as well as a short description of the lowest and utmost maturity levels).

III. RESEARCH METHODOLOGY

In terms of how to achieve the required data, the present study is of descriptive type. In terms of the specified goal, it is of fundamental and practical type as its initial purpose is to identify the dimensions and indexes of measuring the maturity level of business process management as well as to develop a maturity model which helps organizations more efficiently implement this approach. The data gathering methods used in this research are as followings: literature review (to study the theoretical basics of the research), Meta synthesis approach (to identify key dimensions and indicators of BPM maturity), experts' judgment and fuzzy AHP (for verifying and giving weight to the maturity groups, dimensions and indicators) and field study (to determine the BPM maturity level).

The present study includes three statistical populations: the first is related to BPM studies and literature that were analyzed using the meta-synthesis approach. The second was BPM academic experts (some professors as well as some Master and PhD students having studies in this field from Tehran, Shahid Beheshti, and Alzahra universities) who were assessed surveyed in order to verify and give weight to dimensions and indexes measured by the maturity assessment model. Given the judgment-based nature of the sampling method used in this research and considering the normal limit of the fuzzy hierarchical analysis technique, 15 sample members were selected and provided with the expert questionnaire (Questionnaire One: Identifying the relative importance of the dimensions and indicators). Of these, seven persons participated in the study. The Third statistical population was the organizations under study, which are among the 300 Iranian superior Companies in 2013. The most knowledgeable person in each organization BPM was asked to answer the second questionnaire (the questionnaire for evaluating the BPM maturity level in each of the organizations under study). Finally, 144 of them participated in the study.

Three methods (meta-synthesis, fuzzy AHP, and Spearman test) were used for data analysis in this study. First, using meta-synthesis method, the BPM maturity dimensions and indicators were identified among the 27 initial articles. Second, the fuzzy AHP method was used to deal with the uncertainty and ambiguity existing in the nature of BPM maturity factors as well as to determine the relative importance of identified factors (i.e. expert questioner data analysis) given that the phenomenon in question is considered as a multi-criteria analysis problem, in order to determine. The AHP analysis divides a complex problem into a hierarchy of components in which decision alternatives are at the lowest level and the main target at the highest. Intermediate levels are associated with major and minor criteria. In the present study, sub criteria are BPM assessment indicators, including the criteria, groups, and categories to which each maturity assessment indicator belongs. Third, to measure the organizations' BPM maturity, the Microsoft Excel software was used and formulated based on the verified weight factors.

The data gathered were multiplied by the weights obtained from the AHP method causing the maturity level of each organization to be calculated. Finally, the relationship between the superior organizations' BPM maturity and place was investigated with the help of Spearman test and the SPSS software

Table 1- An overview of the maturity models used in the present research

Maturity Model	Scope	Lowest Maturity Level	Upmost Maturity Level
Process Performance Index (PPI) (Rummler & Brache, 1990; Rummler-Brache Group, 2004)	BPM	<i>Initiation of Process Management</i> <i>Actions: the organization acts on BPM in a too elementary manner. There is a strong desire to learn about the BPM.</i>	Process Management Mastery: assessing performance; process owners are rewarded based on the process performance. All employees have good understanding of the processes.
BPR Maturity Model (BPRMM) (Maull et al., 2003)	BPM	<i>Group 1:</i> the Organization is in the early phase of business process reengineering (BPR) project planning.	Group 5: Use of the knowledge gained from BPR projects in order to re-engineer the whole business.
Business Process Maturity Model (BPMM-Fisher) (Fisher, 2004)	BPM	<i>Siloed:</i> Individual group's efforts to optimize their own performance. Island-type and inconsistent storage of information.	Intelligent Operating Network: Optimal efficiency throughout the end-to-end value chain and consistent and timely flow of information.
BPM Maturity Model (BPMMM) (Rosemann & de Bruin, 2005; Rosemann et al., 2006)	BPM	<i>Initial level:</i> BPM actions have not been taken, or are highly uncoordinated and unstructured.	Optimized level: BPM is the main part of strategic and organizational management.
Process and Enterprise Maturity Model (PEMM) (Hammer, 2007)	BPM & process	Designing processes on an unlinked basis. Doing processes by using old-fashioned and inconsistent information systems.	Process design is consummate with customers' and suppliers' processes. There is a modular architecture for information technology.
Process Maturity Ladder (PML) (Harmon, 2004, 2007)	BPM & process	<i>Initial:</i> Processes have not been defined.	<i>Optimal:</i> Processes are measured and managed. There are some process-improving teams.
Business Process Maturity Model (BPMM-Lee) (Lee et al., 2007)	BPM & process	<i>Initial:</i> Improvising management of processes	<i>Optimal:</i> Processes are pre-actively monitored and controlled. Process performance data is systematically used to be improved.
BPO Maturity Model (BPOMM) (McCormack, 2007, McCormack et al., 2009)	BPM & process	Improvising: Processes are unstructured and ill-defined. No process actions exist. The organization structure is functional.	Integrated: There is process cooperation between the organization and vendors and suppliers. Process-based structures and institutionalizing process-based actions within the organization.
Business Process Maturity Model (BPMM-OMG) (Weber et al., 2008)	BPM & process	<i>Initial:</i> Success depends on individual duty-based competences, not on use of tested processes	<i>Innovation:</i> Existence of "change management". Existence of approaches to preventing problems, along with innovative and continuous improvement.
Process Management Maturity Assessment (PMMA) (Rohloff, 2009a, b)	BPM & process	<i>Initial:</i> Processes are not defined; success depends on certain specialists' performance; costs are not temporally and qualitatively predictable	<i>Optimal:</i> Processes are analyzed, optimized and modified systematically. Among the organizational plans is comparative assessment.

A. Extracting the BPM maturity dimension and indicators using meta-synthesis approach

The aim of the present research is to identify the BPM maturity assessment factors (dimensions and indicators). Since the process management maturity assessment is a relatively new field of study, only a small number of articles have focused on it as their main topic. On the other hand, articles written in this field include qualitative studies without quantitative data. So, in the present research, the meta-synthesis approach, as a suitable method for achieving a comprehensive combination of process management maturity assessment dimensions and indicators, is limited based on the translations of the qualitative studies.

In this research, Sandelowski & Barroso seven-step method (2007) was used. Since the dimension in question in maturity models (i.e. maturity dimensions) is formed by

critical success factors (CSFs), to identify the business process management maturity factors, it is necessary to review the researches carried out on critical success factors in the implementation of the business process management, in addition to investigate the maturity models proposed in this regard as well as the dimensions used in them. So the keywords considered to be used in this study include: BPM, BPM implementation critical factors, BPM maturity, BPM maturity model and BPM maturity assessment. As a result of searching and investigating different databases, journals and various search engines using the keywords just mentioned, 136 articles were found and reviewed based on such parameters as title, abstract, content and article details (name of the author, year of publication, etc.). Those which were not consummate with the purpose and question of the study (109 cases) were eliminated. The total number of the final articles is 27 in the present research. The procedure used is shown in Figure 1.

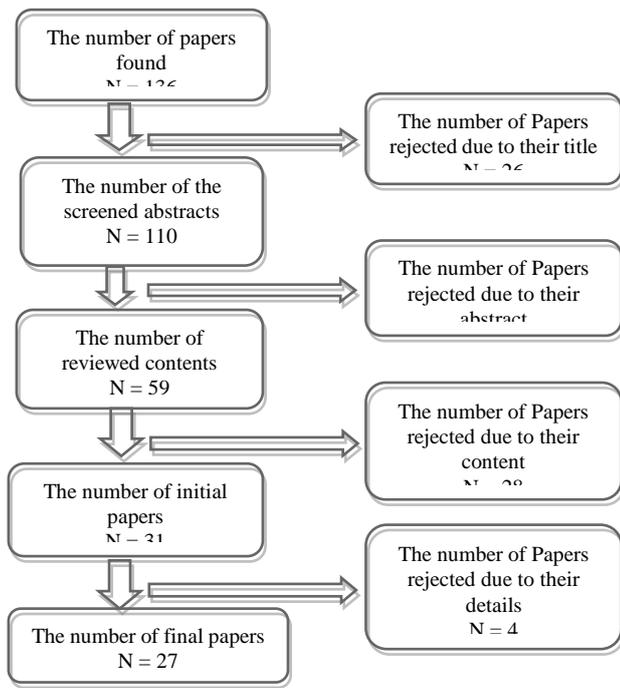


Fig. 1- Summary of the search and selection process

After identifying the final papers, the Critical Appraisal Skills Program (CASP) was used in order to evaluate their quality. After assessing the quality, the key domains and indicators identified in these studies were extracted from the results. These are our input for the development of a conceptual model concerning the business process management maturity. Given the nature and concept of the indicators, we have classified them in the respective key domain. Table 2 shows the key domains and indicators identified in this table, studies carried out on these key domains and indicators are listed.

Table 2. The key domains and indicators identified

DIMENSION	Researchers
strategic alignment	Zairi & Sinclair, 1995; Elzinga et al. 1995; Pritchard and Armistead, 1999; Juran & Godfery, 2000 ; Puah and Tang, 2000;; Spanyi, 2004, Rummmler Brache ,2004, Lusk, 2005, Hung, 2006; Sarang, 2006, Rosemann & De Bruin, 2005, Thompson, Seymour & O'donovan, 2009, Ravesteyn, 2006, Melenovsky & Sinur, 2006, Hill, 2008, Der Westhuizen, 2008, Rosemann & De Bruin, 2009, Mckinsey, 2009, Bandara at al, 2009, Boots, 2010, Schnägelberger, 2010, Trkman, 2010, Bai & Sarkis, 2013.
People	Zairi and Sinclair, 1995; Elzinga et al. 1995; Pritchard and Armistead, 1999; Zur Muehlen, 2004, Rummmler Brache ,2004, Spanyi, 2004, Lusk, 2005, Sarang, 2006, Hung, 2006Thompson, Seymour & O'donovan, 2009, Ravesteyn, 2006, Ravesteyn & Versendaal, 2007., Hill, 2008; Nelis & Jeston, 2008, Vollmer, 2008, Der Westhuizen, 2008, Kerremans, 2008, Bandara at al, 2009, Rosemann, 2009, Rohloff, 2009, 2010; Boots, 2010, Schnägelberger, 2010, Burlton, 2011, Sinur & hill, 2012.

culture & leadership	Zairi & Sinclair, 1995; Elzinga et al. 1995; Pritchard and Armistead, 1999; Parkes, 2002, Spanyi, 2003, 2004; Rummmler Brache ,2004; Rosemann & De Bruin, 2005; Lusk, 2005, Sarang, 2006; Zur Muehlen, 2004, Melenovsky & Sinur, 2006, Ravesteyn, 2006, Sadiq at al, 2007, Ravesteyn & Versendaal, 2007, Hill, 2008, Vollmer, 2008, Nelis & Jeston, 2008, Kerremans, 2008, Žabjek, 2009 ; McCormack et al., 2009, Stemberger & Skrinjar, 2009, Bandara at al, 2009, Rosemann, 2009, Thompson, Seymour & O'donovan, 2009, Trkman, 2010, Burlton, 2011, Bai & Sarkis, 2013.
information technology	Gulledge and Sommer, 2002; Rummmler Brache ,2004, Rosemann & De Bruin, 2005, Sarang, 2006, Hill, 2008, Thompson, Seymour & O'donovan, 2009, Ravesteyn, 2006, Melenovsky & Sinur, 2006, Ravesteyn & Versendaal, 2007, Der Westhuizen, 2008, Vollmer, 2008, Kerremans, 2008, Mckinsey, 2009, Bandara at al, 2009, Žabjek, 2009, Rohloff, 2010, Trkman, 2010, Schnägelberger, 2010, Boots, 2010, Sinur & hill, 2012.
Methods	Kettinger et al., 1997; Pritchard and Armistead, 1999; Rosemann & De Bruin, 2005, Melenovsky & Sinur, 2006, Hill, 2008, Sadiq at al, 2007, Nelis & Jeston, 2008, Kerremans, 2008, Thompson, Seymour & O'donovan, 2009, Rohloff, 2009, 2010, Boots, 2010, Burlton, 2011, Sinur & hill, 2012.
Monitoring	Rummmler Brache ,2004, Spanyi, 2004, Lusk, 2005; Rosemann & De Bruin, 2005, Sarang, 2006, Ravesteyn, 2006, Ravesteyn & Versendaal, 2007; Sadiq at al, 2007; Der Westhuizen, 2008; Ravesteyn & Jansen, 2009; Bandara at al, 2009, Mckinsey, 2009, McCormack et al., 2009 ; Stemberger & Skrinjar, 2009, Rohloff, 2009, 2010; Trkman, 2010; Schnägelberger, 2010, Boots, 2010; Sinur & hill, 2012.
stakeholder management & communication	Parkes, 2002, Zur Muehlen, 2004, Rummmler Brache ,2004, Sarang, 2006, Rosemann & De Bruin, 2005, Rohloff, 2009, Bandara at al, 2009, Rosemann, 2009, Mckinsey, 2009, Boots, 2010; Trkman, 2010; Burlton, 2011; Sinur & hill, 2012.
Governance	Juran & Godfery, 2000; Gulledge and Sommer, 2002; Rosemann & De Bruin, 2005, Harmon, 2005, Lusk, 2005, Sadiq at al, 2007, Thompson, Seymour & O'donovan, 2009, Zur Muehlen, 2004, Ravesteyn, 2006, Hill, 2008; Ravesteyn & Versendaal, 2007, Nelis & Jeston, 2008, Vollmer, 2008, Melenovsky & Sinur, 2006, Rosemann, 2009, Bandara at al, 2009; Žabjek, 2009, Mckinsey, 2009, Rohloff, 2009, 2010; Boots, 2010, Schnägelberger, 2010, Burlton, 2011, Bai & Sarkis, 2013.
process architecture	Zur Muehlen, 2004, Spanyi, 2004, Rummmler Brache ,2004, Sarang, 2006, Ravesteyn, 2006, Ravesteyn & Versendaal, 2007, Sadiq at al, 2007, Der Westhuizen, 2008, Vollmer, 2008, Kerremans, 2008, Nelis & Jeston, 2008, Stemberger & Skrinjar, 2009, Ravesteyn, 2009, Rohloff, 2009, 2010; Boots, 2010, Schnägelberger, 2010, Trkman, 2010, Burlton, 2011.
scope of implementation	Rummmler Brache ,2004, Sarang, 2006., Thompson, Seymour & O'donovan, 2009, Boots, 2010

IV. FINDINGS

This section is divided into four parts. In the first part, the final result of the meta-synthesis is expressed. In the second part, the final result of the meta-synthesis is sent to experts in form of a questionnaire, and the result is stated. In the third

Part, the BPM maturity model is presented and finally in the fourth Part, the field data will be analyzed.

A. Meta-synthesis results

According to the research methodology and given the BPM maturity studies and models, and also the critical success factors for the BPM implementation, a maturity model can be developed having dimensions and key domains and indicators shown in the figure 2. In other words, figure 2 displays our proposed model through which the experts' judgment test is done. Given the context and similarity of the key domains identified, they can be classified based on the following categories. Overall, the major and general categories of business process management defined after implementation of the meta-synthesis process are as follows:

Organizational category indicates organization' and required organizational factors' readiness to implement and take advantage of this approach". It implies all the factors existing in or referred to the organization. The category includes the following dimensions: strategic alignment, culture and leadership, and individuals. The dimension "strategic alignment" includes mutual collaboration indexes between organizational units and BPM unit (process collaboration and communication) as well as the alignment of process design strategy with individuals' priorities (key stakeholders, superior management, shareholders, governmental organizations, etc.). The dimension "individuals" includes process learning and education (type of process management consistency within cultural activities, type of skills development and individuals' capabilities) as well as knowledge, expertise and skills of BPM (process management capabilities and skills among individuals). Finally, the dimension "culture" includes "reaction to change in process as well as in its value, beliefs, attitudes and behaviors, leadership's attention to BPM and BPM social network";

Tool category represents the tools required to take advantage of this approach. It includes three dimensions: Information technology, methods, and monitoring. The dimension "Information Technology" includes the indexes of process management information technology and process automation. The index of process management information technology itself has a sub-index that is "the range of technologies used for process automation and simulation as well as how to apply and manage them. The dimension "Methods" includes indexes of "quality of standards and BPM methods, domain of standards and BPM methods, as well as how to manage and deploy BPM methods and standards. The dimension "Monitoring" includes the major indexes "measurement and its indexes, and process improvement". The major index " measurement and its indexes" itself includes the sub-indexes "definition (involving the criteria for comparing performance with objectives and standards (type of value assessment), determination of amount of the gap between process design and implementation), and use (including prediction of potential outcomes of changes before and after implementation them). The other major index "process improvement" includes the sub-indexes "" methods and techniques for process improvement and related proceedings, and how to identify and choose improvement opportunities (process improvement plan);

Process category expresses how to take advantage of process management approach and includes dimensions of process architecture and scope of implementation. The dimension "Process architecture" includes the indexes "characteristics of the process architecture outputs, architecture(s) outputs ownership, and type of making use of them". The dimension "implementation" includes the indexes "scope of the managed processes (i.e. documentation, measurement, assessment, and improvement) and type of the processes automated within a business section or unit";

Eventually, **operational category** indicates those actions important for managing and organizing this approach. It involves the following dimensions: informing and managing the stakeholders and BPM governance. The dimension "informing and managing the stakeholders" involves the indexes "identification of influential stakeholders and key individuals in process management projects, methods used for managing them, and status of informing the stakeholders and giving the key individuals opportunity to contribute", and the dimension "governance" includes the indexes "consistency and responsibility". The index consistency itself includes the sub-index "type of specifying and describing governance structure and processes". The index "responsibility" includes the sub-index "type of specifying and describing roles".

B. Results of the Experts' judgment test (fuzzy AHP results analysis)

At the beginning, we are seeking to answer the first research question: "what indexes can be used for BPM maturity assessment (identification of measurement dimensions and indexes)". In order to validate and verify the results of the meta-synthesis approach, (key dimensions and BPM maturity indexes), a questionnaire entitled "experts' questionnaire" was prepared according to Table 2. After clarifying the research subject and explaining how to fill the questionnaire, the categories, dimensions and indexes identified for the maturity were incorporated into the questionnaire. Then, the experts were asked to compare the categories, dimensions and sub-factors in a couple-based manner. At the end, an explanation for type of identifying the categories, dimensions, indexes and their definition was presented. Among the 15 experts to whom we referred in this research, only seven organizations participated in the study. The respondents' demographic information was as following:

Table 3: Demographic information related to the respondents to the first questionnaire (survey of expert)

Education level (scientific status)		
Master	Doctorate	
%28.6	%71.4	
Familiarity and work experience in field of BPM		
6 to 10 years	1 to 5 years	
%57.17	%42.83	
Major (Field of study)		
Industrial engineering	Management	IT and computer engineering
%25	%50	%25

After carrying out data analysis using fuzzy AHP method, the relative weights of BPM maturity dimensions and indexes were finally presented in the following tree-type diagram.

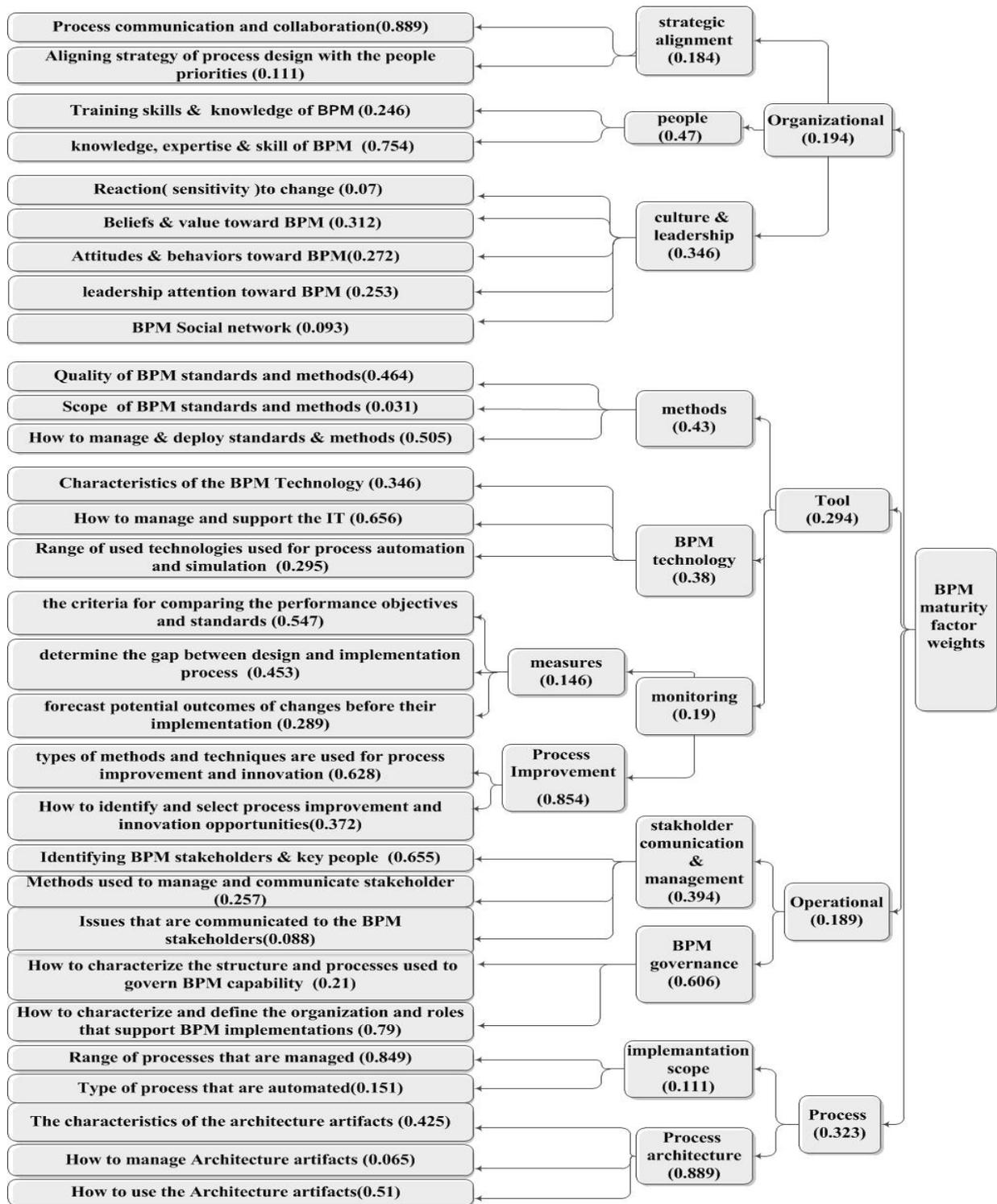


Fig. 2- The relative weights of BPM maturity categories, dimensions and indexes)

As shown in the figure, based on the assessment carried out, the process category with the weight of 0.323 (including the dimensions process architecture and scope of implementation) is the most important category, and the tool category having the weight of 0.294 (including the dimensions monitoring, information technology, and methods) is ranked second in this regard. Having the weight of 0.194, the organizational category (including strategic alignment, individuals, and culture) is ranked third and the operational category (including the dimensions process

management governance, informing and managing the stakeholders) fourth in this regard.

In order to determine the importance of the dimensions (i.e. weight of each dimension in the category), its weight is multiplied by the weight of the corresponding. Table 4 shows the weight of each dimension in the category as well as the rank of that dimension among the others.

Table 4: Weight and rank of each dimension in the corresponding category

Category	process		operational		Tool			organizational		
Category weight	0.323		0.189		0.294			0.194		
Dimensions of the category	Scope of implementation	Process architecture	Stakeholder communication and management	BPM governance	methods	BPM technology	monitoring	culture	people	Strategic alignment
Dimension weight	0.111	0.0889	0.0394	0.606	0.43	0.38	0.19	0.346	0.47	0.184
Dimension weight in its category	0.036	0.287	0.074	0.114	0.126	0.112	0.056	0.067	0.091	0.035
Dimension rank	9	1	6	3	2	4	8	7	5	10

According to the table above, in terms of importance, the ten dimensions are ranked as follows: process architecture (the most important), methods, process management governance, information technology, individuals, informing and managing the stakeholders, culture, monitoring, scope of implementation, and finally strategic alignment (the least important).

V. DEVELOPMENT OF BUSINESS PROCESS MANAGEMENT MATURITY MODEL AND ITS ASSESSMENT TOOL

According to the results of the experts' judgment (figure 2), none of the weights of the factors and sub-factors identified was negative. Therefore, the weights were considered as normal and all of the factors and sub-factors were verified. Considering the identified factors (the four categories organizational, process, operational, and tool, and their dimensions), a five-level BPM maturity model was developed (fig. 3). In fact, level-making process in the presented maturity model have been performed according to BPM capability maturity model, Gartner model and the other BPM models noted in table 1. Figure 3 shows these four groups. BPM Maturity models are created with the aim of guiding organizations toward higher levels of maturity. The Developed BPM maturity model proposed in this research includes five BPM maturity improvement level. The levels are in a logical order as the result of each level is a foundation for the implementation of the following level. In other words, higher levels have the characteristics of the lower levels, in addition to their own specifications. Actions taken in the previous levels often increase the competencies required in the next level. This means that higher levels are a promoted form of the lower ones. The strategy to progress to higher levels represents BPM continuous improvement. At each level, organizations develop new business skills displaying a higher-level business culture. Moving towards higher and more advanced levels requires more effort as well as return of higher value. Status of each maturity dimensions is different at various levels, and they are assessed based on the level to which they belong. In other words, indexes belonging to a level describe the characteristic of that level. In the following, the five levels of the model are discussed as follows: 1- Initial (enlightenment), 2- Repeatable (stability), 3- Standardized, 4. Managed (systematic), and 5- Optimal (continuous improvement).

A. Business process management maturity levels

Level 1: Initial (Enlightenment)

If managers are not aware of how important process management and improvement are, the enterprise is in an apathy phase. At this level, the organization lacks consistent practices for performing its business activities. At this level, even if some of managers are aware of the importance of process management approach, there will not be any actions taken to manage and improve the processes, processes will not be defined, and there will be an improvised or no measurement for process performance. The main characteristic of the first level is incompatibility between achievements, activities, and processes. At this level, the organization is like task islands as the processes have not been defined. At this level, process management is not done in its actual meaning. Decision to create fundamental operational change through focusing on processes management is a drive for moving towards the next level. Increasing managers' awareness and investment on some of such actions, the organization would take a step towards the next phase and business improvement.

Level 2: Repeatable (Stability)

The main characteristic of the second level is identifying and carrying out process management actions on key processes. Although managers are aware of the importance of process management, such an understanding does not exist at the organizational level. Activities and proceedings related to management and consistency carried out at this level are local and limited to task fields. At this level, business leaders find that reaching task-oriented purposes may undermine the consequences of boundary processes. So, the need for a continuous wider view as well as focus on boundary processes is recognized at this level. A "process" wide view is also created. Continuous processes management is counted as a drive for the organization in order to move towards the level 3.

Level 3: Standardized

In this stage, a large number of organization's processes have been defined and standardized clearly. Implementation of them is frequently evaluated, and methods and instructions for realization of the process have been coordinated. At this level, the organization seeks to make its sub-processes consistent with each other and potentially with its business partners, suppliers, and customers so as to better manage the process results. Also, the competencies relevant to design management and implementation of the whole process as well

as efficient management of the process throughout the boundaries (geographic boundaries, software system boundaries, value chain boundaries or physical facilities boundaries) will be increased making the business leaders

become more informed of the dependency and relationship among the processes. At this level, various activities of several units processes become consistent.

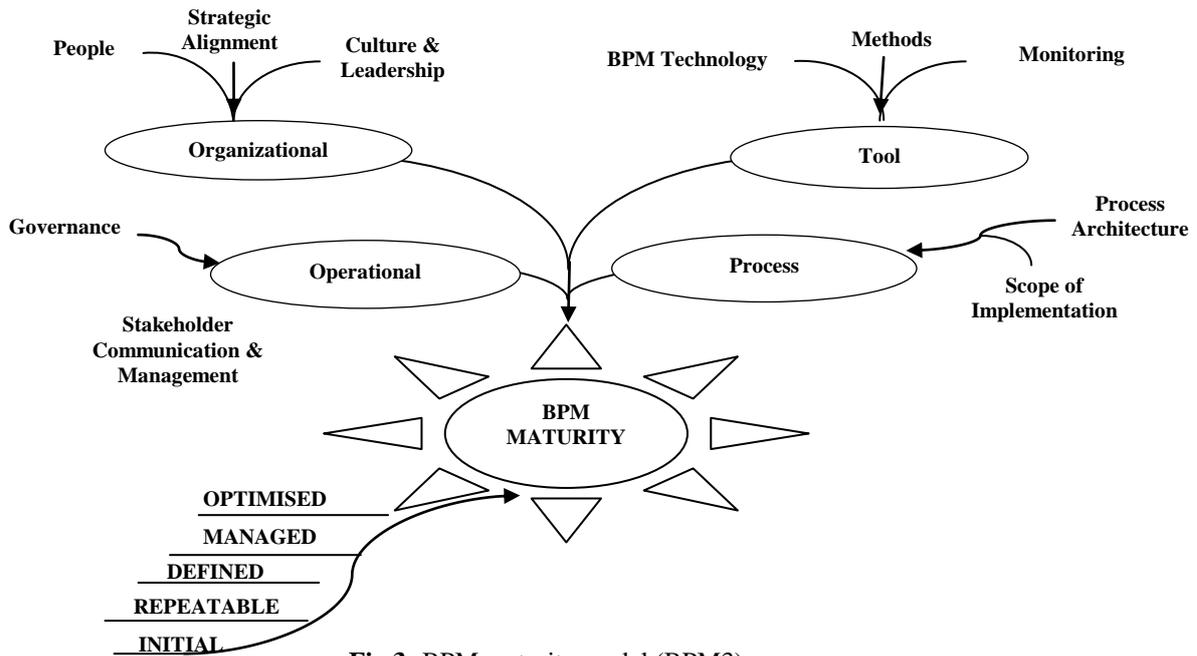


Fig 3: BPM maturity model (BPM3) groups

Level 4: Managed (Systematic)

At this level, the organization is characterized by expertise in process management, and all of the major and supportive processes are defined well. The organization has a hierarchy of process measurement indexes, regularly collects data and shares them with the stakeholders. The main characteristic of this level is quantitative assessment and regular control of process performance where the data obtained from the assessment is used to improve the processes. In addition to quantitative assessment actions, non-financial systems and statistical tools are used at this level. As a result, the business would be able to optimize the process results as well as to balance the several purposes across all of the processes more easily. At this level, the sub-processes belonging to several task units become consistent.

Level 5: Optimal (Continuous improvement)

At this level, the organization increases its capability to continuously re-optimize the processes so as to meet the frequently-changing international market's demands and domestic business's dynamics. At the level 5, the organization is characterized by competency, culture, and technology needed to re-optimize and frequently invest its resources in respond to variable tactical and strategic needs. It is not vital for the organization to reach the last stage of maturity. Instead, the purpose is to reach a suitable stage well enough to reach the macro-purposes determined.

VI. BUSINESS PROCESS MANAGEMENT MATURITY LEVEL IN 300 IRANIAN SUPERIOR COMPANIES

In this section, the relationship between organizations' BPM maturity and their rank will be discussed. But first, we provide a background by determining process management maturity level in the organizations under study. Using the results obtained from the meta-synthesis and experts'

judgment methods (fuzzy hierarchy analysis), a maturity questionnaire was developed based on capability and Gartner questionnaires including personal information questions as well as 30 research-based questions. The questionnaire was then distributed among the 300 superior Iranian companies in 2013. Each question included 5 choices, and each choice included the characteristics covering the verified maturity indexes. Of these organizations, finally 144 participated in the present research. A questionnaire was completed by a relevant expert (the person who was well-informed of the status of process management assigned by the organization, who, in most cases, acted in the units quality, productivity, systems, or process) in each organization. In this section, we first describe the respondents' demographic characteristics, and then analyze the organizations' process management maturity data in order to respond the third question of the research.

Table 5: Demographic characteristics for the second questionnaire (BPM maturity assessment)

Education level (degree)			
Bachelor	Master	PhD	
%25	%70.1	%4.9	
Work experience			
1-5 years	6-10	11-15	15-20
%40.3	%46.5	%11.1	%2.1
Major (Field of study)			
Industrial engineering	Management	IT and computer engineering	
%32.6	%41.7	%25.7	
Respondents' participation history in the BPM projects			
Participation		No Participation	
%57.8		%42.2	
Extent of Familiarity with the research subject			
Very high	High	Medium	
%9.1	%44.4	%46.5	

In order to determine the maturity level of each organization and to determine the value of each dimension, we multiplied responses relevant to each of the dimension indexes by its weight, and then added the results together. Then, to determine the value of each category, we multiplied the value of each dimension by its weight, and added the dimension values of each category together. Finally, we

multiplied the value of each category by its weight, and added the results together in order to define the business process management maturity with respect to the weight specified to the dimensions at the maturity level. The follow diagram shows the status of the average of business process management maturity in the organizations under study.

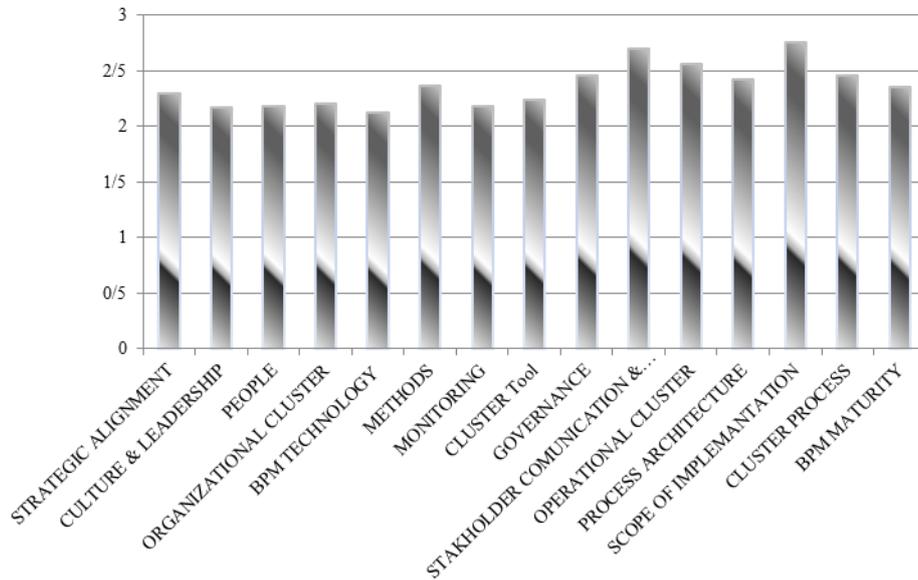


Fig. 4- status of categories and dimensions of BPM maturity in the organizations under study

As shown in the figure, the average of BPM maturity in the organizations under study is lower than the average level (2.36) located between the second (repeatable) and third level (defined). Operational category (2.56) has the highest level of maturity and process cluster (2.46) is placed after it. The lowest level of maturity average and the process category is ranked second in this regard. These statistics indicate that the least maturity levels exist, with a little difference, in tools (2.24) and organizational (2.2) categories, respectively.

VII. THE RELATIONSHIP BETWEEN 300 IRANIAN SUPERIOR ORGANIZATION BPM MATURITY LEVEL AND THEIR RANK

Now, after considering the BPM maturity level in the organizations under study, the relationship between organizations' BPM maturity and their rank will be discussed. Based on the main hypothesis of the research, BPM maturity level has a positive meaningful relationship with its rank. Due to the high number of organizations under study (144), it is not possible to show this relationship in the form of a diagram. So, the Spearman correlation test was used to prove the hypothesis, as shown in Table 6.

As seen in this table, the decision statistic in the correlation test is 0.000 that is less than error level (0.05). This indicates positively correlated between BPM maturity and studied organizations ranking by 0.343 Spearman's correlation. As a result, the main research hypothesis is confirmed. Also based on the correlation test results, there is a significant relationship between organizational cluster (0.325), operational cluster (0.351), process clusters Maturity level (0.282) and tool cluster Maturity levels (0.312) and surveyed organizations ranking by Significant coefficient of 0.000 and confidence coefficient of 0.95 percent.

Table 6- Results of the Spearman correlation test between all of the organizations under study and their rank, as well as between their BPM maturity level in each of BPM maturity assessment category and their rank

Spearman correlation	Significant coefficient	correlation coefficient
Correlation between levels of BPM maturity and companies ranking	0.000	0.343**
The correlation between the BPM maturity level of organizational cluster and companies ranking	0.000	0.335**
The correlation between the BPM maturity level of operational cluster and companies ranking	0.000	0.351**
The correlation between the BPM maturity level of process cluster and companies ranking	0.000	0.282**
The correlation between the BPM maturity level of tool cluster and companies ranking	0.000	0.312**

As shown in the table, the decision statistic in the correlation test is 0.000, which is less than the error level of 0.05 indicating the positive meaningful relationship between BPM maturity and rank of the organizations under study, with the Spearman correlation coefficient of 0.343. So, the main hypothesis of the research is confirmed. On the other hand, according to the results of the correlation test, there is a meaningful relationship between the maturity level of the organizational category (0.325), operational category (0.351), process category (0.282), and tool category (0.312) in the organizations under study with their rank, at the confidence level of 0.95 percent and meaningfulness coefficient of 0.000.

VIII. DISCUSSION AND CONCLUSIONS

Given that most of the studies have discussed the concept of business process management and its advantages in an academic and promotional manner, we have carried out an study to show that to what extent use of process management has managed to help organizations' performance by studying the relationship between BPM maturity level of the 300 superior Iranian organization and their rank.

According to the ranking presented by the Industrial Management Organization based on profitability and performance indexes, organizations' size and growth, exports, liquidity, debts and market, and verification of the research hypothesis (existence of a positive meaningful relationship between the BPM maturity level in the organizations under study and their rank), the role of BPM maturity in offering further value and innovative and high-quality products and services to customer and reaching efficiency, effectiveness, operational agility and productivity is verified. The results are in accordance with some studies which focus on the effect of business process management on organizations' performance (Brynjolfsson, 1993; Carr, 2003; Scheepers, 2008; Naidoo, 2009; Liu et al, 2009; Bititci, 2011).

The fact that the average level of BPM maturity in the organizations under study as well as in all of the categories is below the normal rate (between the second and third level) indicates the lack of enough attention to the BPM practices and the required efforts for making infrastructure. Organizations need to pay more attention to the domain of implementation and process architecture, and invest more on information infrastructure, process measurement indexes, and business process management methods. According to Karim, Samarz, and Batcherji, information technology is based on organization's performance, but it is required to be aligned with the organization's processes in order to obtain its positive effect. It is also necessary to have a comprehensive approach to business process management so as to increase the organization's performance beyond the information technology capabilities (Karim, Samarz, and Batcherji, 2007). This emphasizes the importance of process and tool categories and the need to have a comprehensive approach to the implementation process. In other words, business process management has a significant role in organizations' success, and they are recommended to invest on all of the categories and dimensions of the process management aforementioned as their appropriate investments on each of these dimensions are counted as pre-requirements for current and next maturity levels.

The average rate of BPM maturity level in the organizations under study is between the second and third levels. This confirms Hill and Sinior's opinion who have stated that most of the organizations which are doing process proceedings today are at the level 2 or 3 of process management maturity. In their study, they have identified organizational policies as the largest obstacle to the movement towards the third and higher levels. They also consider the role of the obstacles related to human behavior, motivations, and organizational structure as being more important than obstacles to technology. According to the results of this research, of course, the role of information technology, as a dimension of the tool category, has been evaluated to be more important (even with a very small

difference) than organizational factors. It is better for process-oriented organizations to be placed at least at the third level of business process management level (Ruževičius, Milinavičiūtė & Klimas, 2012).

The position of BPM maturity level in the organizations under study, which is between the levels 2 and 3, indicates the creation of a wide "process" view and information of the undermining of the boundary process-based purposes as a result of focus on obtaining task-oriented purposes. Considering the measurement actions and movement towards process improvement, that is to say, creation of a balance between task-oriented performance or one between local activities, definition of process managers' responsibilities and how to improve their performance, modification of implementation designs, and coordination between those contributing to them as well as supporting activities, efforts to provide enough resources for implementing the required actions, defining responsibilities, and controlling implementation actions. However, the control process is limited to certain activities, and information on improvement is not enough in this regard. Also, there is no continuous and sustainable control, and despite managers' awareness of the importance of business process management, there is not such an understanding at the organizational level, and activities and actions taken at this level are locally consistent and limited to task-based fields. So, on average, some actions are being taken to define and standardize and continuously evaluate the most part of the organization's processes, as well as to integrate the sub-processes with each other and even potentially with commercial partners and customers, and to develop the competencies relevant to design management and implementation of the whole process and efficient management of the process throughout the boundaries (geographical, software system, value chain, and/or physical facilities boundaries).

As shown in the table 3, process (including process architecture dimensions and implementation domain) and tool (including the dimensions monitoring, information technology, and methods) are the most important among all the categories. This suggests that organizations should pay more attention to these two categories trying more to improve them. According to the figure 1 showing the status of the categories and dimensions of business process management among the organizations contributing to the present study, however, less attention is paid to the tool and process categories compared to the operational category. So, the organizations are recommended to pay more attention to the dimensions of these categories, and establish strategies to get more success of process management in them.

The main limitation of the present study was the high number of organizations under study and the lack of any strong support to attract and motivate them to participate in it. On the other hand, considering the 48% participation of organizations in the research, the relationship is meaningful only in the corporations under study in the industry, and care should be taken to generalization of the results or general conclusion.

Assessment of BPM maturity, identification of the organization's status in this range, and implementation of these actions require a model which includes key indexes and dimensions in implementation and success of business process management. One of the important results obtained from the present research is the development of a

comprehensive model for business process management maturity and identification of its key indexes. In addition to indicating the organization's current situation, directing it towards implementation of the future actions, and assessing its performance in this regard, the proposed model is able to provide professors and students in fields of information technology, industrial engineering, as well as organizations with a suitable understanding of business process management, and a starting point for the future researches in this regard (identification of dimensions, indexes, and development of a specific assessment tool for business process management maturity for each industry, and development of a practical and systemic plan for assessment of business process management maturity and its implementation).

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