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Providing a framework to improve the performance of business process management projects based on BPMN

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Abstract

Modeling of business processes, based on Business Process Modeling Notation (BPMN), helps analysts and managers to understand business processes, and, identify their shortages. These models provide a context to make rational decision of organizing business processes activities in an understandable manner. The purpose of this paper is to provide a framework for better understanding of business processes and their problems by reducing the cognitive load of displayed information for their audience at different managerial levels while keeping the essential information which are needed by them. For this reason, we integrate business process diagrams across the different managerial levels to develop a framework to improve the performance of business process management (BPM) projects. This framework, which is referred to as "Business Process Improvement Framework Based on Managerial Levels (BPIML)" in this paper, considers three levels of management (Organizational level managers, Process /Departmental level managers and Activity level managers) for manager of an organization. Then, defines certain types of models based on BPMN, for each management level, by taking into the account the objectives and tasks of various managerial levels in organizations and their role in Business Process Management (BPM) projects. This framework will make us able to provide the necessary support for making decisions about business processes. The framework is evaluated with a case study in a real business process improvement project, to demonstrate its superiority over the conventional method. A questionnaire consisted of 10 questions using Likert scale was designed and given to the participants (three managerial levels). The results of this questionnaire suggested that, managers and senior experts of the organization considered utilization of the proposed framework improving for implementation of BPM projects and provide support for correct and timely decisions by increasing the clarity and transparency of the business processes which led to success in BPM projects.

Keywords: *Business Process Modeling Notation (BPMN), Business Process Management (BPM), Business Process Reengineering (BPR), business process optimizing*

1. Introduction

Business world is a space for competitiveness of organizations. Changing the market and customers, emergence of new competitors and changing the business rules of organizations, created the conditions that a need for a method and system for defining, managing, analyzing, and optimizing business process was coming into existence over time. Business process management provides an integrated approach to the definition, implementation and management of business processes of organizations and minimize the workload of information solutions development in organizations by using their own specific methods and tools. For modern economic enterprise, planning for changes is essential [1]. Continuous improvement and reengineering of business processes is a process that never ends. It is important to visualize the sequence of business process activities and their related information properly, or business process modeling in other words. The purpose of the modeling of business processes of an organization, is create a common conceptually and simple language (standard-based, in form of graphic shapes that have less volume and are also easily understandable by the user) between organization's managers, experts and analysts. Process modeling is an activity that used by analysts in all reengineering methodologies and strategies in order to extract current business processes and display new business processes. In this activity, analysts used modeling tools for model the current state (AS-IS) and the desired state (TO-BE) of organization[2]. Continuous improvement and management of business processes has become a critical strategy for organizations, due to the market competitive conditions and permanently changing of customer demands and technology [3]. Thus, there is a serious need to provide frameworks which support correctly making decisions by managers in business processes management projects.

The rest of this paper is organized as follows:

In the second part we will introduce Business Process Management (BPM), Business Process Reengineering (BPR) and BPMN. In the third part, we review related works and in the fourth part, the proposed framework will be introduced. Then, in the fifth part, we will evaluate and validate the proposed framework. Finally, the last section is the conclusions of this paper.

2. Literature review

Business Process Management (BPM), is an integrated approach to design, implementation and monitoring of business processes that staffs or softwares of organization may be involved in any part of these. Interactions between people, softwares and information flow of organization, gives life to it. The purpose of existence of BPM is management of organization's processes and provide tools to continuous improvement over time. BPM optimizes processes, efficiency and effectiveness of any organization with its business process automation [1][4].

Business process management, has been a development of workflow management, which began in the 90s and includes support for business processes with the use of methods, techniques and design software. BPM provides an opportunity for approval, monitoring and analysis of documentation and operational processes of staffs, organizations and applications [5].

The main purpose of business process management is to increase the ability of organizations in order to quickly respond to environment changes. Information technology plays a major role in support and control of today's business processes, and facilitates its management. Business process management has a long journey from analysis and design through implementation and deployment processes. BPM is a kind of t change and system deployment management that helps to continuous business process management [6][7].

Business Process Reengineering (BPR) means fundamental rethinking and redesigning of Business Processes in order to achieve significant improvements in critical measures of performance such as cost, quality, speed and services. BPR is an improvement philosophy which aims to achieve phased improvement by redesigning the process and in this redesign, the organization tries to maximize valuable activities and minimize other activities. This approach can be used at the single process level or entire the organization [8][9].

Business process modeling is one of the most basic steps in moving toward business process optimization. The purpose of business process modeling is documentation of activities implementation procedure in organizations. The existence of a common and standard language in order to business process modeling helps to maintain the effectiveness of this document in different time and place situation.

Business Process Model and Notation (BPMN) is a standard for defining business processes diagrams. Version 2.0 of BPMN that have introduced by OMG in 2011, includes a set of graphic shapes (geometric) that have been developed based on the flowchart[10].

The main feature of BPMN is the ability to convert it to executive languages that can be understood by the software systems. BPMN provides a chart, entitled "Business Process Diagram (BPD)" that has been used in order to design and management of the business process. BPD is actually a network of graphical objects that show the activities, control flow and how to arrange the implementation of activities [2][11].

3. Related Work

Continuous improvement and management of business processes has become a critical strategy for organizations, due to the market competitive conditions and permanently changing of customer demands and technology. Business processes improvement is challenging due to the complexity of make changes in processes. The organization may be get problems to choosing the starting point to begin changes as well as selecting the type of necessary reforms in the business process. The aim of complexity of business processes, include some matters such as: the dependencies between activities, business process stakeholder, the elements involved in the business process, business process characteristics, and finally the business process applications[12][13][14].

The nature of business process improvement and reengineering projects, impose extensive changes within organizations. These changes in the structure of the business processes in order to improve the performance of the organization. Implement such extensive changes require manager's serious and persistent support of BPM projects. The wrong decisions of managers about improvement of business processes, that mainly caused by incomplete and incorrect understanding of business processes and its problems is one of the important reason of business processes management and continuous improvement projects failure [11][15].

Research done on business processes improvement should provide an appropriate response to the concerns mentioned and propose a framework to support correct decisions in business processes improvement projects. We followed the theory of "pattern matching" for developing the proposed framework. Pattern matching includes an attempt to link a theoretical pattern and an operational one [16].

-Ref[11], proposed an alignment framework for business process management projects. They believed in order to overcoming on staffs resistance against business process continuous improvement projects, it is necessary to understand the existing organizational reality in order to chart a way for the creation of the new organizational reality aligned with business process reengineering. They believe that the successful BPM implementation need effective and structured participation of different levels managers in this project and therefore, they defined goals, measures and key tasks of all three levels as follows[11]:

3.1 Senior managers

Senior managers have been prepared and approved general policies, macro programs, long range and strategic plans of the organization and monitor and coordinate the all actions. Successful implementation of BPM in organizations requires effective participation of process and operational managers.

3.2 Process managers

Process managers are responsible for designing and monitoring of business processes and organizational structure based on strategic vision of the organization and existing resources and constraints. Therefore, the most important responsibilities of process managers to align the existing systems and process with the new design of the workflows and interactions.

3.3 Operational managers

The duty of operational managers is implementation of rules, roles, and determined procedures for business processes. They are the closest managerial level to implementation and operation of tasks and activities in the organization and report to process managers.
-Ref[13], have provided an extensions on the BPMN. They proposed a method to analysis activities in different dimensions by use of analytical data. They aimed that business objects can analyzed from various dimensions such as: time, cost, and quality. In evaluating and improving the business processes, only specific elements (business objects and entities) have considered. For example, in enterprise perspective, organization resources, such as: staffs and machines are considered as a dimension. Further, in literature, pools and lanes are used to illustrate organizational elements and their interaction within a business process. Lodhi et al. in their paper used pools and lanes to illustrate dimensions and different classes of these dimensions[13].

4. The proposed framework

One of the most important factor in the failure of the business processes continuous improvement is lack of manager's serious and persistent support of this projects and their wrong decisions about improvement of business processes, that mainly caused by incomplete and incorrect understanding of business processes and its problems [15][17].
Business process models extensions, helps analysts and managers to understand business processes and identify their defects. Business process modeling has increased the ability to understand business processes and to make rational decisions for organizing activities in a traceable and understandable way [13][18]. Regard to that elements and rules of BPMN is not able to singly provide necessary support to make decisions about business processes improvement, Therefore, following using the theory of pattern matching and linking between a theoretical and an operational perspectives, we provide a framework for business processes continuous improvement based on BPMN.
According to Ref[11], the successful BPM implementation, needs effective and structured participation of different levels of managers in the project to make correct decisions about business processes. On the other hand, according to Ref[13] and Ref[19], providing efficient extensions on BPMN cause to increase understanding of business processes and therefore a wise decision to organize the activities of business processes will be followed. The essential issue in providing a graphical models is filtering of available information according to the needs and status of audience and stakeholders of the project.
The proposed framework entitled "Business process improvement framework based on managerial levels (BPIML)", determines a certain type of business process diagrams (BPD) based on BPMN with respect to the objectives and tasks of the various managerial levels of organizations and their roles in business process management (BPM) projects. This framework also improves understanding of business processes and their problems by reducing the cognitive load of displayed information for their audience at different managerial levels and provide details and complete information. This framework able to provide the necessary support to making decisions about improving business processes. Following we introduce the proposed framework.

4.1 Senior managers

Senior managers have played a leading role in BPM projects and make the final decision on the choice of methods and procedures to business processes improvement. Due to the multiple duties of senior managers and multiple business processes within an organization, study of the exact details of the business processes are not required for them. So at this managerial level, BPMN conventional diagrams are not applied, it is necessary to generate diagrams for this level that includes only informations such as: the efficiency of business processes and level of business processes readiness to improvement, by filtering of informations. For example, in the case of product manufacturing process that there are five activities that executed to manufacture a product within it (Fig. 1) we assume three diagrams for this manager level (Fig. 2-4). We define three classes in cost dimension to arrange activities of processes and their involved elements in the Fig. 2. It should be noted that time efficiency of the process comes from comparison of operational time and idle time of the process. Similarly, efficiency of the process comes from comparison of time efficiency and cost of the process. Also the level of business processes readiness to improvement can be displayed by colors in diagrams. In most processes, usually there are activities that according to the organization's policies, national laws, religious ordinances, etc. changes in them are impossible or are low. This also shown in Fig. 4.

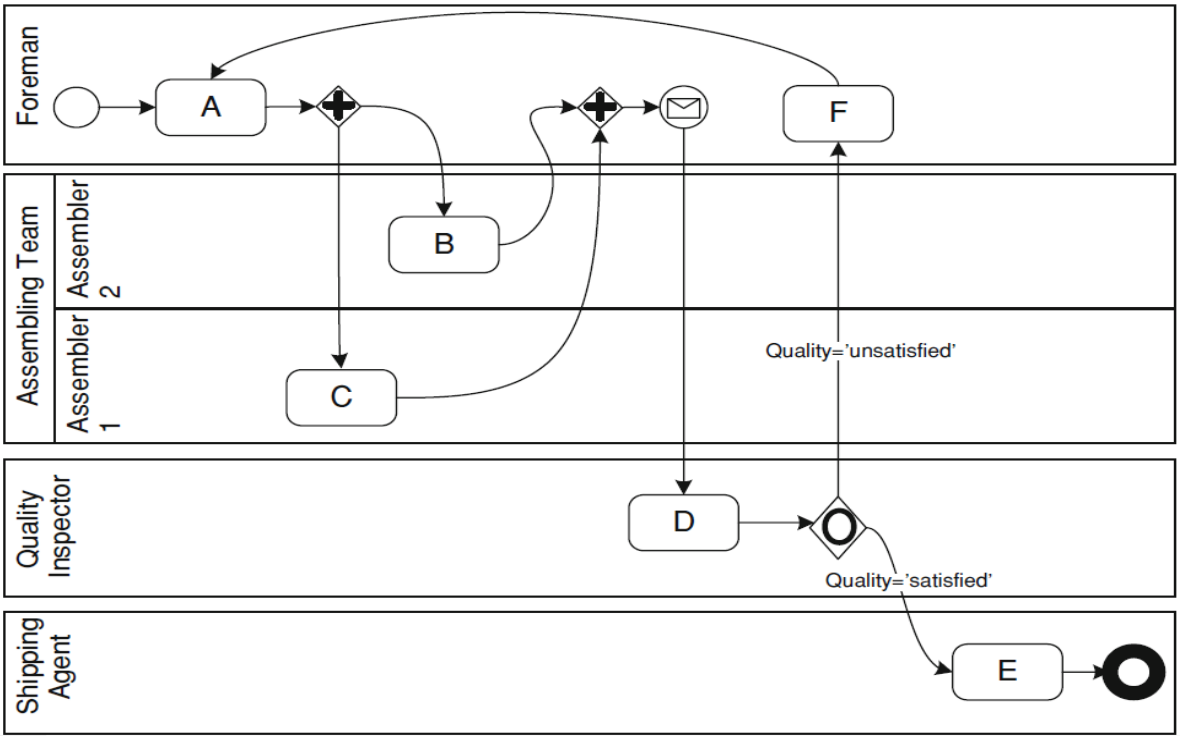

Figure 1. Product manufacturing process diagram using BPMN[13]

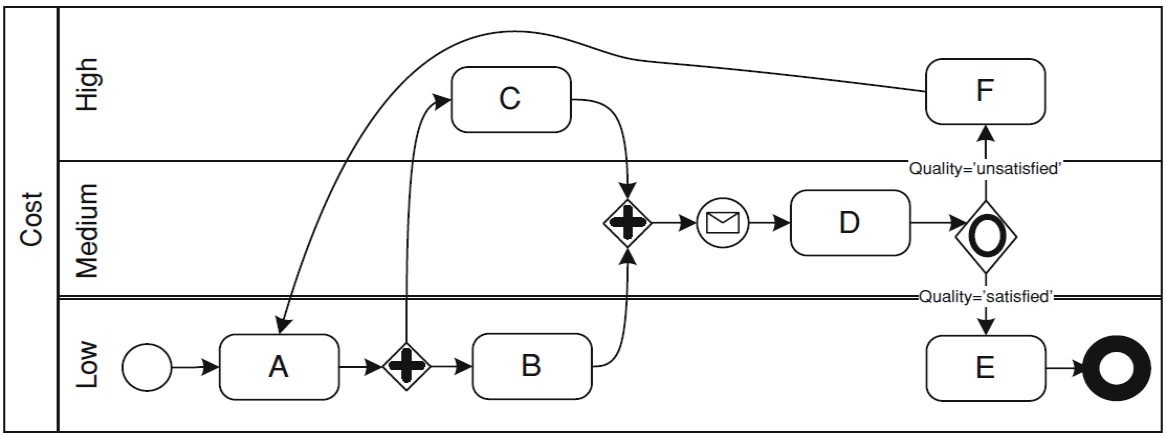

Figure 2. Product manufacturing process diagram based on cost[13]

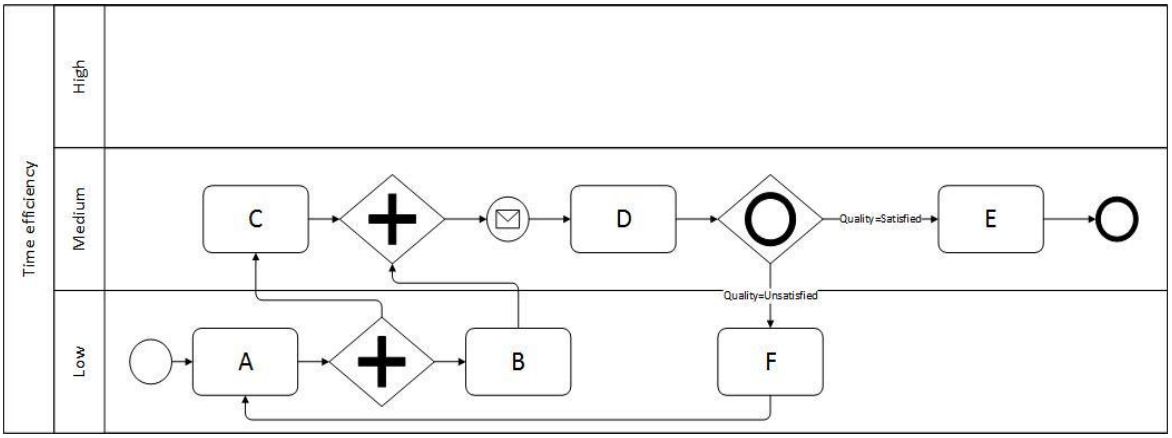

Figure 3. Product manufacturing process diagram based on Time efficiency

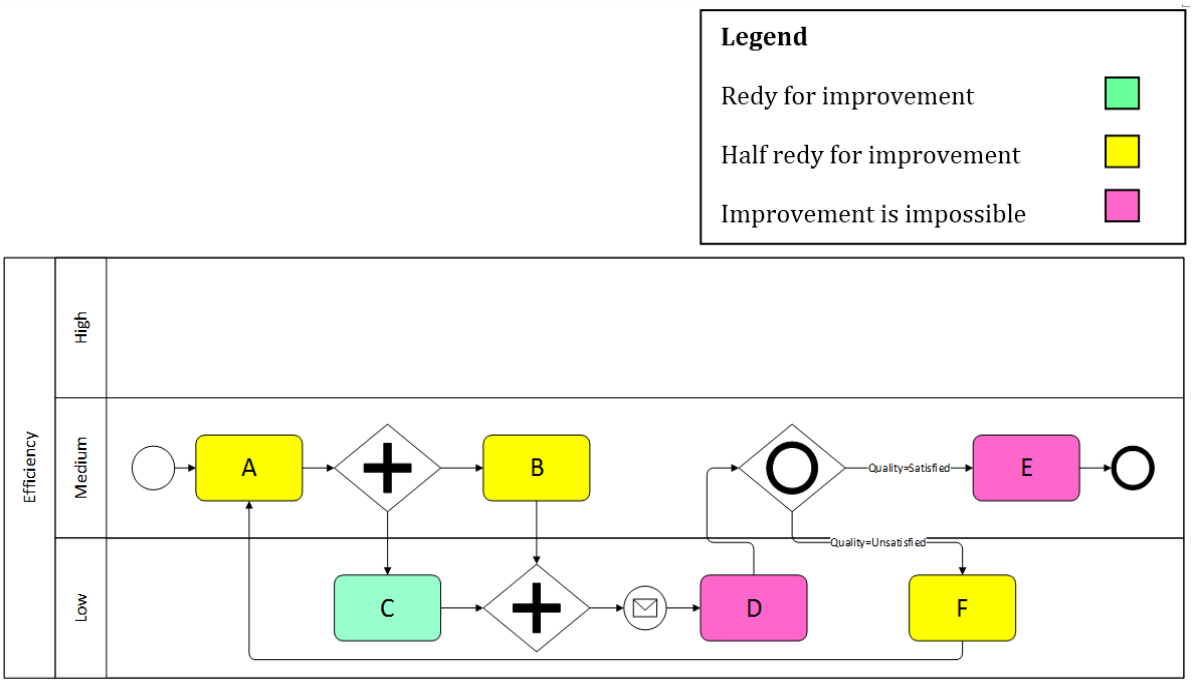

Figure 4. Product manufacturing process diagram based on Efficiency

4.2 Process managers

As previously mentioned, these managers are responsible for designing and monitoring of business processes and organizational structure based on strategic vision of the organization and existing resources and constraints. So, they are project manager in BPM projects and naturally knowing the details of business processes are necessary for them. Therefore, BPMN conventional diagrams (e.g. Fig. 1) are useful at this level.

4.3 Operational managers

Operational managers play two key role in BPM project. First, identify, analysis and drawing of each business process activities, Second, efforts to successful build to make the changes in the structure of business processes that senior managers concerning about them and follow the strategic shared value. So at this managerial level, BPMN conventional diagrams are not applied, it is necessary to generate diagrams for this level that more focus on the details of the implementation of the business processes activities. For example, in the process of Fig. 1, during the implementation of the Activity D, assembled parts inspection done. These activities may include steps such as: Initial evaluation, Practical test, Comparison test results with quality requirements and finally approval or disapproval parts. So, we consider a diagram such as Fig.5 that only model the implementation of Activity D.

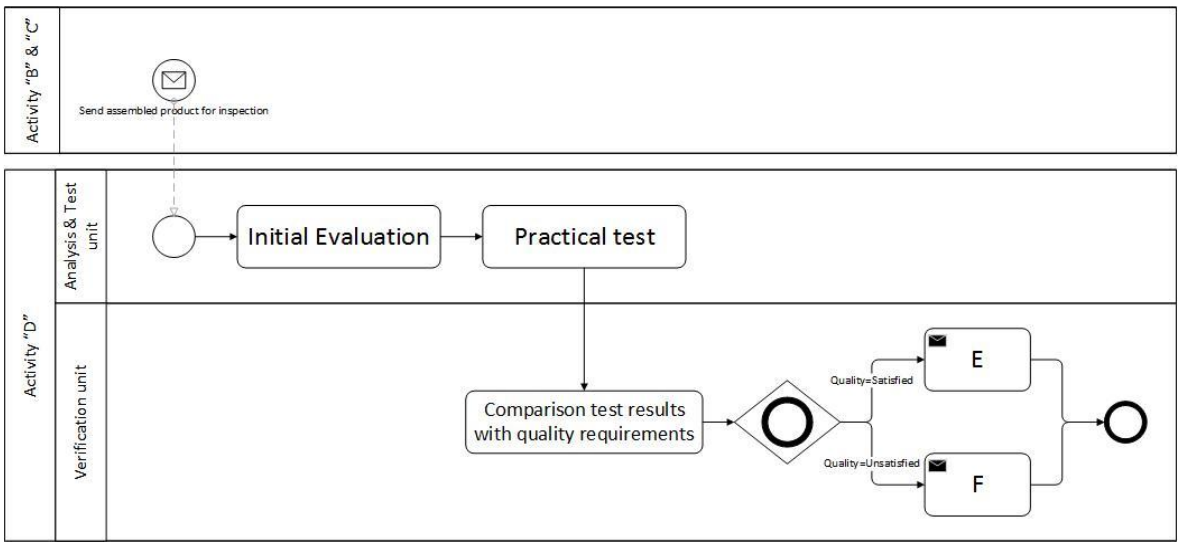

Figure 5. Diagram of activity D

In Table 1, we compare conventional method and the proposed framework (BPIML). In the next section, we evaluate and validate the proposed framework and the contents of the following table.

Table 1. Compare conventional method and the proposed framework (BPIML)

No.	Parameter	Conventional method			Proposed framework (BPIML)		
		Low	Medium	High	Low	Medium	High
1	Cost and time			*		*	
2	Ability to understand		*				*
3	Complexity		*			*	
4	Support for the correct and timely decisions	*					*
5	Ability to be used in different areas			*			*
6	Functionality for all managerial levels	*					*

5. Evaluation and Validation of the proposed framework

In order to evaluate and validate the proposed framework we used it in Bank Refah Kargaran with the respect to some BPMN exceptions measurement methods such as: González et al (2011) method, Indulska et al(2011) method, Recker et al (2009) method and Rolón et al (2006) method [20][21][22][23]. Bank Refah Kargaran is one of Iran's major banks that its headquarters in Tehran, Iran. Considering that according to the ideas of the Bank's managers and experts, the main process of the Bank is the credit process (Bank loans), thus, this process was selected as a priority for analysis and improvement. For this purpose, we modeled the current state of the credit process by conventional method (like Fig. 1), then we modeled the current state of the credit process according to BPIML framework and presented those diagrams to managers of the bank.

After that we designed a questionnaire consists of 10 questions using Likert scale and was given to the participants (managers of Bank Refah Kargaran three managerial levels). The purpose of this questionnaire was assessing strengths, weaknesses and the success rate of the BPIML framework. The questions were designed as propositions that the interviewees had to declare explicit feedback. These people could respond to questions with five options, 1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree and 5-strongly agree. In Table2, we describe the results, calculate the average and the number of positive responses (agree and strongly agree responses).

Given the results of this questionnaire, it can be concluded that position of the BPIML framework in the life cycle of enterprise solutions has been clearly determined, and has a certain quota in advancing of business process management projects. Also as expected, the framework is very simple and understandable for the operation and the audience by reduce the complexity of the models based on BPMN and make them more applied. The proposed framework is not customization for specific applications or business and is a public model. Also according to breadth of business processes in organizations, the proposed framework has high usability in large scale organizations.

As previously been mentioned according to Ref[11], the successful BPM implementation need effective and structured participation of different levels managers in this project and makes correct decision about business processes. By examining the results of the questionnaire, it can be said that the proposed framework provide support for correct and timely decisions by increasing the clarity and transparency of the business processes which led to success in BPM projects.

According to opinions of the participants in this poll, the proposed framework with a special focus on each business process activities is semi useful to make the changes in the structure of business processes that senior managers concerning about them.

Table 2. The proposed framework (BPIML) evaluation and validation questionnaire

No.	Questions	1- Strongly disagree	2- Disagree	3- Neither Agree nor Disagree	4- Agree	5- Strongly Agree	Number of Positive responses	Present of Positive responses	Average
1	The position of the framework in life cycle of enterprise solutions is clearly identified.	0	0	1	5	4	9	90%	4/30
2	The proposed framework is simple and understandable.	0	0	1	4	5	9	90%	4/40
3	This framework, with consider to the different levels of management reduce complexity of models based on the BPMN and make them more practical.	0	1	1	2	6	8	90%	4/30
4	The proposed framework can be used in different areas. (Different Business)	0	0	0	4	6	10	100%	4/60
5	Given the wide range of business processes, the proposed framework can be used in organizations with large scale.	0	0	0	2	8	10	100%	4/80
6	The proposed framework with increases the success of BPM, provide platform for ERP implementation in organization.	0	0	1	3	6	9	90%	4/50
7	The proposed framework, reduce time and cost of the BPM projects.	1	1	2	3	3	6	60%	3/60
8	The proposed framework with increased clarity and transparency of modeled processes, support correct and timely decisions.	0	1	0	4	5	9	90%	4/30
9	The proposed framework, with a specific focus on each of the activities of business processes, facilitate to make changes.	2	3	0	3	2	5	50%	3/00
10	This framework, helps organizations to achieving the goals and strategic vision, and enhance its position among competitors.	1	4	1	2	2	4	40%	3/00

6. Conclusions and future work

In this paper we proposed an extension of BPMN. Emergence extended business process models based on BPMN, helps analysts and managers to understand business processes and identify their defects. These models provide the context for rational decision to organize business processes activities in an understandable manner. In this research, we reviewed the literature and study the theoretical and operational perspectives in this regard. We also proposed a framework entitled "Business process improvement framework based on managerial levels (BPIML)". This framework, considers three levels of management (Organizational level managers, Process/Departmental level managers and Activity level managers) for manager of an organization. Then, defines certain types of models based on BPMN, for each management level, by taking into the account the objectives and tasks of various

managerial levels in [organizations and their role in Business Process Management (BPM) projects. For Organizational level managers, the model generates information such as: business processes efficiency, cost and etc. For Process/Departmental level managers, according to their role in BPM projects as a project manager, knowing the details of the business process is essential for them. So, conventional models of BPMN are considered for this level. For Activity level managers, models which focuses on details of implementation of business process activities are generated. This framework improved understanding of business processes and their problems by reducing the cognitive load of displayed information for their audience at different managerial levels and provided details and complete information. This framework able to provide the necessary support to making decisions about improving business processes. In the end, we evaluated and validated the proposed framework. By examining the results of the questionnaire, it can be said that the proposed framework improved the effective and structured mangers participation and provide support for correct and timely decisions by increasing the clarity and transparency of the business processes which led to success in BPM projects.
Business process management and business processes reengineering have a special importance because of extensiveness of the workspace, so with respect to the limitations of this study the future works as follows:

A. The case study we carried out involves a single organization, albeit a large and complex one. We therefore believe that further case studies need to be undertaken to improve external validity of our results, and demonstrate BPIML superiority over the conventional method.
B. The proposed framework introduce an extension of BPMN that have a significant impact on the success of business process management projects in organizations, so, we recommend further studies carried out to meet the business and technical perspectives in these projects.

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