Developing a comprehensive methodology for BPR projects by employing IT tools

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Abstract

Purpose – The purpose of this paper is to present a comprehensive IT tools based methodology (CITM) for BPR projects in order to facilitate implementing BPR project by considering relevant IT tools in each phase of the methodology, both approaches (clean slate and analysis of existing processes on details), and failure analysis for diminishing the risk of the BPR project.

Design/methodology/approach – In today's world, corporations need to adjust with the environment changes in order to stay stable in facing market changes. This paper presents a comprehensive methodology in which by considering different aspects for implementing BPR project including IT tools, both BPR approaches, and failure analysis can facilitate BPR project. The proposed methodology's validation was tested by getting the 50 experts' ideas in each phase of the methodology and in a case study at organization and planning department in an IT company.

Findings – The structured methodology developed in this paper contain the two debatable approaches of BPR (clean slate approach as well as analysis of existing processes on details approach). This methodology enables the organization to derive a proper way to implement BPR project in order to its situation. In every phase of this methodology, based on their applications in each specific phase, required softwares and IT tools are proposed. The applicability of methodology was analyzed and confirmed thoroughly by the 50 BPR experts and in a case study at an IT company.

Originality/value – This study provides a comprehensive methodology to consider the gap of the BPR methodologies in their comprehensiveness, use IT tools and softwares and lower the risk of the BPR implementation. In developing the CITM the challenging approaches are considered, the related softwares and IT tools are proposed and failure analysis is done and considered in each phase of the CITM in order to decrease the risk of its implementation.

Keywords Business process re-engineering, Information technology, Methodology, Research methods

Paper type Research paper

1. Introduction

Business process reengineering is the innovation in management knowledge that attempts to raise the improvement of the organization by focusing on radical designing of strategies, processes, guidelines and organizational structure. Since the application of BPR concepts can have different forms, its methodologies are different. Because concerning to some factors varies from one project to another project.

Today, in order to implement a successful implementation of BPR, special techniques and guidelines are needed to enable business process re-designers to reorganize business activities and processes in an organization. These special techniques and

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guidelines which have been developed by several researchers are considered as BPR methodologies. Methodologies exist due to the need of solution to frequently occurring problems (Valiris and Glykas, 1999).

BPR methodologies can be categorized in different ways. Hammer and Champy (1993) believe in using clean-slate approach. On the other hand, some researchers like Davenport and Stoddard (1994) argue that current experiences are required. Because of these different ideas, BPR methodologies are different and applying them might be encountered with some problems. In this paper, a structured methodology is developed which contains the two debatable approaches of BPR (clean-slate approach as well as analysis of existing processes on details approach). This methodology enables an analyst of the organization to derive a proper way to implement BPR project according to organization's situations.

Another feature of this methodology is using IT tools in every phase of it that comes from the notion IT and BPR have close relationship with each other and are not separable. Therefore, in every phase of CITM required softwares and IT tools are used based on their applications.

Since over 70 percent of all BPR projects have failed to reach their expected outcomes (Hammer and Champy, 1993; Chiplunkar *et al.*, 2003; Dennis *et al.*, 2003), the risk of BPR implementation is high and companies have become reluctant to implement BPR projects for radical improvement. To develop CITM the most important key failure factors of BPR projects are identified, categorized, questioned from 50 BPR experts, the most important failure factors were extracted and prioritized through the questionnaire outcome. Then concerned in the phases of the methodology. Analyzing BPR failure factors can help decreasing the risk of BPR implementation and failure rate of BPR projects.

All in all, CITM is a consolidated approach which contains the two debatable approaches at the same time that researchers can use or compound depending on organization conditions. It also can use related IT tools and softwares for each phase and can decrease BPR projects risk by identifying the most important key failure factors of BPR projects.

In the following sections, the general classification of BPR methodologies, the important role of IT in BPR, the process of deriving of key failure factors is explained. Then CITM and its validation process are discussed.

2. General classification of BPR methodologies

Researchers propose different classification criteria for BPR methodologies. Valiris and Glykas (1999) have explored BPR methodologies in three classifications:

(1) management accounting methodologies, in which more focus is on redesigning the processes and the role of IT is considered as an enabler (Morris and Brandon, 1993; Petrozzo and Stepper, 1994 approach);

(2) information systems (IS) influenced methodologies which use modeling techniques that support both the process and data perspectives (Avison and Fitzgerald, 1988 approach); and

(3) organizational theory-based methodologies; the stress here is on modeling with an aim to understand the organizational environment (Dardenne *et al.*, 1994 approach).

Willcocks and Smith (1995) have considered another classification including consulting methodologies for developing in different countries (Davenport and Short, 1990), methodologies that have developed the role of IT in BPR (Davenport, 1993), methodologies with industrial engineering viewpoint to organize the business processes (Davenport and Short, 1990), methodologies with developing softwares (Jackson, 1997), methodologies with system analysis viewpoint (Morris and Brandon, 1993), and methodologies with quality approach (Harrington, 1991).

There are different research approaches for implementing BPR projects. Some related to this research are as follows.

Some research approached to existing processes, simulation and best practices. Hesson and Al-Ameed (2007) have the incremental approach for their methodology which is similar work of Gunasekaran and Kobu (2002). Doomun and Jungumimply (2008) develop their methodology for business process modelling, simulation and reengineering (BPMSR), and consider BPR project by decomposing to different sub-phases which seems more focus on the existing processes.

Adesola and Baines (2005) developed a methodology for business process improvement which they imply is could be used for both process improvement and reengineering initiatives. Hanafizadeh and Osouli (2011) present a model for selecting the appropriate process for BPR in terms of the degree of change.

The methodology proposed by Rao *et al.* (2012) stress on overcoming the obstacles which in the authors' view are caused by an emphasis on the business processes itself and lack of the tools for identifying the cause of inefficiencies and inconsistencies in BPR through the use of organizational ontology and knowledge and sources maps. They more focus on the automatic approach of IT in BPR.

Bevilacqua *et al.* (2012) implement BPR methodology through an industrial process modeled by IDEF0, and tried to minimize or downtime, and deficiencies in emergency management.

Cheng *et al.* (2012) suggest a BPR model through combining knowledge management (KM) and BPR. The model focuses on business processes and use KM learning to analyze business processes.

This paper proposes a consolidated classification approach, which aggregates debatable issues of BPR projects together. In this classification, BPR methodologies are divided into two main groups:

(1) analysis of existing processes on details approach methodologies; and

(2) clean-slate approach methodologies.

According to the literature, the main dissension of researchers is applying one of these two approaches for BPR projects. Actually, one of the most important reasons for dispersing of BPR methodologies is using one of these two approaches.

In CITM, both approaches have been considered. The design of CITM is in such way that researchers can use either of these two approaches or a combination of them based on organizational status. The general classification of BPR methodologies and the position of CITM in the classification are shown in Figure 1.

3. Important role of IT in BPR

The term reengineering first appeared in information technology (IT) field and has evolved into a broader change process. IT has been used to overcome communication

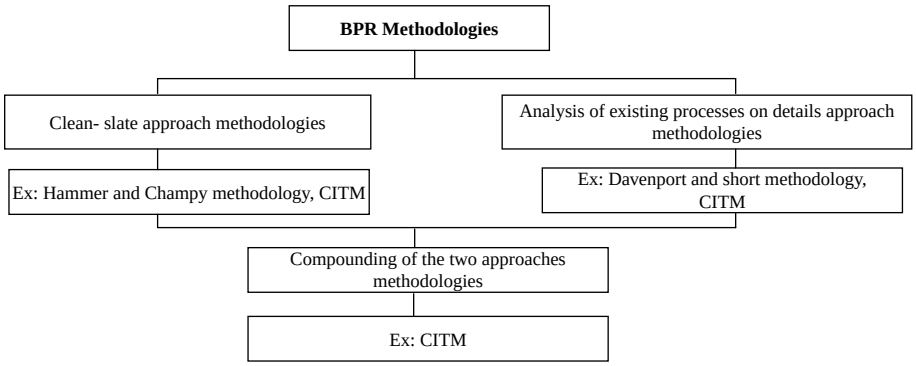

Figure 1.
General BPR methodologies classification

barriers among different corporate functions, to empower line workers and to fuel process reengineering (Attaran, 2004).

If used together, IT and BPR can create more flexible, team oriented, coordinative, and communication-based work capability (Whitman, 1996).

Hammer and Champy (1993) introduce IT as a key enabler of BPR. According to Davenport and Short (1990) BPR needs to take a broader view of both IT and business activity. IT capabilities should support business processes and business processes should be in terms of IT capabilities.

Attaran (2004) considers the role of IT in BPR before the design of the process, while the process is being designed, and after the completion of design.

In this research the role of IT in BPR has been explored in three aspects:

(1) the role of IT in BPR projects as an enabler;

(2) the role of IT in BPR projects as a supportive; and

(3) the role of IT in BPR projects as a facilitator and catalyst.

The role of IT could be considered as "disruptive technologies" such as shared databases and integrated systems (Presley, 2006), knowledge-based systems that facilitate decision making for the organization's objectives (Hendriks, 1999), telecommunication and wireless communication networks that enables the organization's structure be decentralized and the tasks to be distributed (Wei *et al.*, 2006).

Eardley *et al.* (2008) show the role of IT in BPR within six categories including: as a constraint, as a catalyst, as a neutral, as a driver, as an enabler, as a proactive and discussed the possible negative and positive role of everyone of these characteristics.

This paper considers the role of IT by focusing on Attaran (2004) approach.

3.1 The role of IT in BPR projects as an enabler

There is a general agreement among researchers that IT can be a key enabler in BPR. In fact IT is one of the several enablers, besides human resources and organizational change, that all must be considered together to bring about change in business processes (Attaran, 2004).

Some of the important roles of IT in BPR projects as an enabler are as follows:

- provides company with a really superior way to link and integrate activities between customers, employees, and external partners and suppliers (Wu *et al.*, 2006);

- supports process works with technologies such as expert systems (Lyons, 1997);
- enables a more effective creation, documentation and sharing of information/ knowledge (Attaran, 2004; Tippins and Sohi, 2003);
- automates and speed up processes (Harmon, 2003);
- breaks assumption of physical world and enables coordination (Attaran, 2004); and
- provides firms with a superior position for managing the invisible assets that create market leadership (Tippins and Sohi, 2003).

3.2 The role of IT in BPR projects as a supportive

It should be considered that in BPR, identifying and redesigning different aspects of the organization are employed (Lyons, 1997), and all BPR projects not necessarily lead to automate the processes. So another approach to the role of IT in BPR in which how technology could be applied in order to facilitate BPR projects implementation. To do so, the role of IT could be considered as a supportive tool in BPR implementation. A successful approach for BPR needs to apply IT tools and redesign the process at the same time. IT can improve the use of computers and softwares to convert, store, protect, process, transmit, and retrieve information. The approach of IT as a supportive in BPR can be considered in the use of related softwares in BPR methodologies phases. In this research supportive role of IT in BPR projects is shown by identifying the role and application of related softwares in each phase of the methodology. In CITM the related softwares for each phase have been derived.

3.3 The role of IT in BPR projects as a facilitator and catalyst

As mentioned before, BPR is an approach to help the organizations change and work through modern processes. For doing so, some special tools are needed. These tools are considered as facilitators for changing the processes (Hammer and Champy, 1993).

Some of the important roles of IT in BPR projects as a facilitator are as follows:

- It can facilitate the reengineering design process through the use of project management tools. It helps to identify, structure, estimate BPR activities and control contingencies that arise during the process (Attaran, 2004).
- IT applications make it possible for organizations to build a database in order to track customer satisfaction, analyze complaints, and obtain employee's feedback to improve customer satisfaction. This process enhances collaboration between marketing and sales and makes it possible to present the summaries of analysis to senior management (Malone and Rockart, 1991).
- Telecommunication technologies such as LANs and groupware can improve collaboration among personnel of different functional units in their efforts to accomplish a common business process (Magnet, 1992).
- IT tools can facilitate gathering and analyzing information of the process performance and structure, mapping or flow-charting the existing process and measuring the results with respect to cost, quality, and time. To do so, IT tools as facilitators can facilitate this step by providing modeling and flow simulation, documenting business processes, analyzing survey data, and performing structured evaluation (Attaran, 2004).

4. The critical failure factors of BPR projects

Organizations are continuously seeking for innovative ways to operate in order to survive in today's competitive business environment. Management approaches such as business process reengineering are adopted by many organizations to achieve a dramatic increase in performance and cost reduction. Since the failure rate associated with BPR projects is very high, it is important to investigate the reasons for failures in a systematic and multidisciplinary approach.

Different research has been conducted for extracting success and failure factors of BPR projects. According to resent studies, Motwani *et al.* (2005) and Terziovski *et al.* (2003) investigated on finding the success factors of BPTR projects, and they consider IT as a critical success factor for BPR. Abdolvand *et al.* (2008) approached the readiness for implementing BPR by comparing two companies in terms of BPR failure and success factors. They considered "resistance to change" as a negative/failure factor for BPR.

Despite the significant growth of the BPR concept, not all organizations embark on BPR projects to achieve their intended results. Hammer and Champy (1993) estimate that as many as 70 percent of BPR projects have not achieved the dramatic results they seek. Although, BPR has great potential for increasing productivity through reducing process time and cost, improving quality, and customer satisfaction, it often requires a fundamental organizational change. As a result, the implementation process is complex, and needs to be checked against several success/failure factors to ensure successful implementation, as well as to avoid implementation pitfalls.

In this study, key failure factors of BPR projects have been identified in order to develop a comprehensive methodology with lower risk for implementation. The failure factors of BPR projects were elicited from the literature. And then categorized into a number of subgroups representing various dimensions of change related to BPR implementation. In order to identify the most important failure factors, a questioner was designed and 50 BPR experts ranked the failure factors. The experts were all educated in master and PhD with the experience in BPR project theoretically and practically. So, all were fully familiar with the BPR project problems. The questionnaire was designed on the basis of Likert scale (Oppenheim, 2000). The questionnaire was web-based designed in the way that it was sent to the experts' e-mail address. They scored the failure factors in terms of their importance in BPR projects failure (9 – extremely important, 7 – important, 5 – slightly important, 3 – neither important nor unimportant, 1 – unimportant). The questionnaire was designed in the way that experts in the first level scored the main groups, then go to the second level and scored the groups, in the third level scored the subgroups and in the last level the failure factors were scored. After collecting the experts' ideas the analysis was conducted. In the way that the average of the experts' ideas in each level was calculated and the score of the levels was extracted. Then the factors were prioritized in terms of the extracted scores. As the main purpose was eliciting the important failure factors, the failure factors with 7 and 9 scores were extracted (Figure 2). Having these critical failure factors at hand and considering them in every phase of CITM, we can decrease the failure probability of the project implemented by this methodology.

5. Developing CITM

CITM has three main stages: before starting BPR project, BPR implementation, and after BPR implementation. And four steps locating in the stages. Each step has different phases explained in the following. The phases are designed to be simple and to be

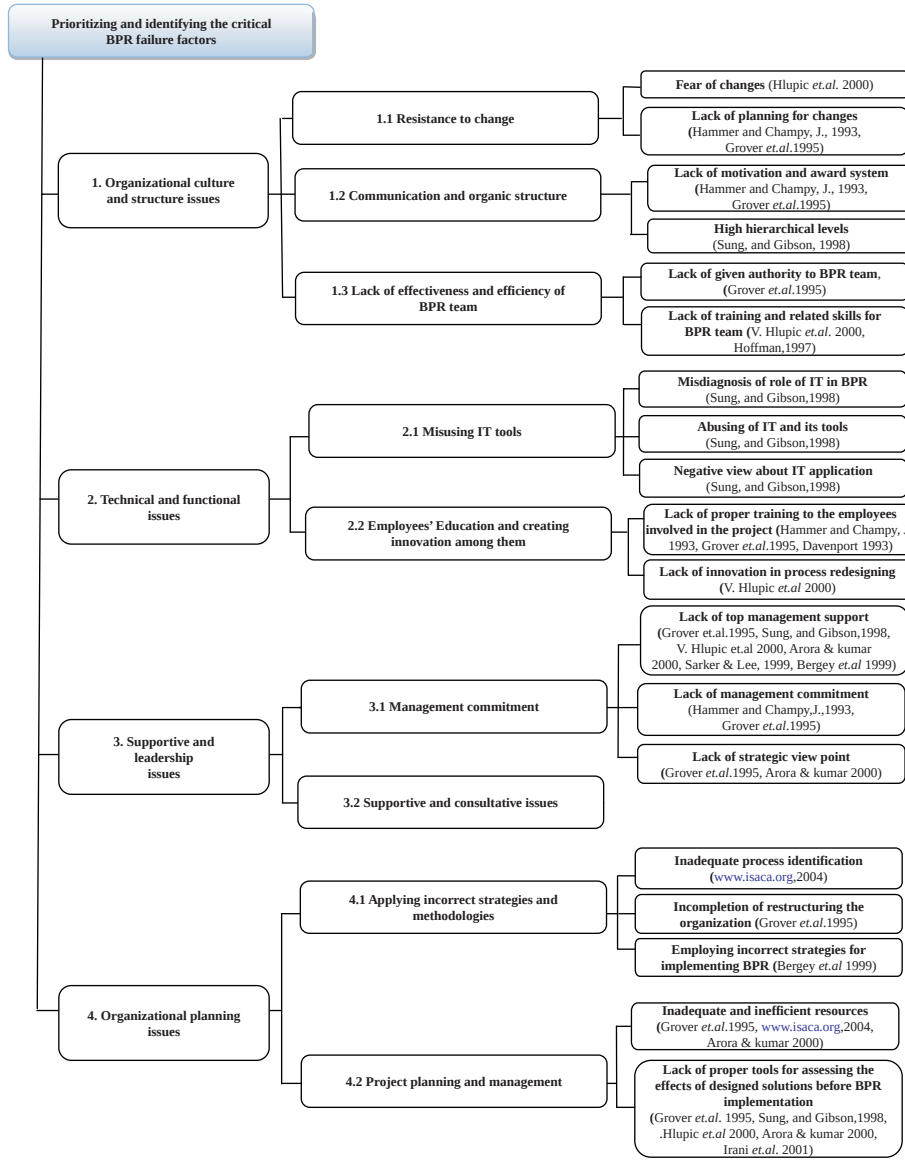

Figure 2.
Critical failure factors of BPR project

implemented using IT tools and softwares. For each phase, various IT-related tools and softwares are proposed.

The first layer of the methodology is shown in Figure 3.

"Before starting BPR project", the organizational performance is generally evaluated.

In the stage of "BPR implementation" which is the main body of the project, new processes are designed and located based on the two existing approaches mentioned earlier (clean slate/analysis of existing processes on details).

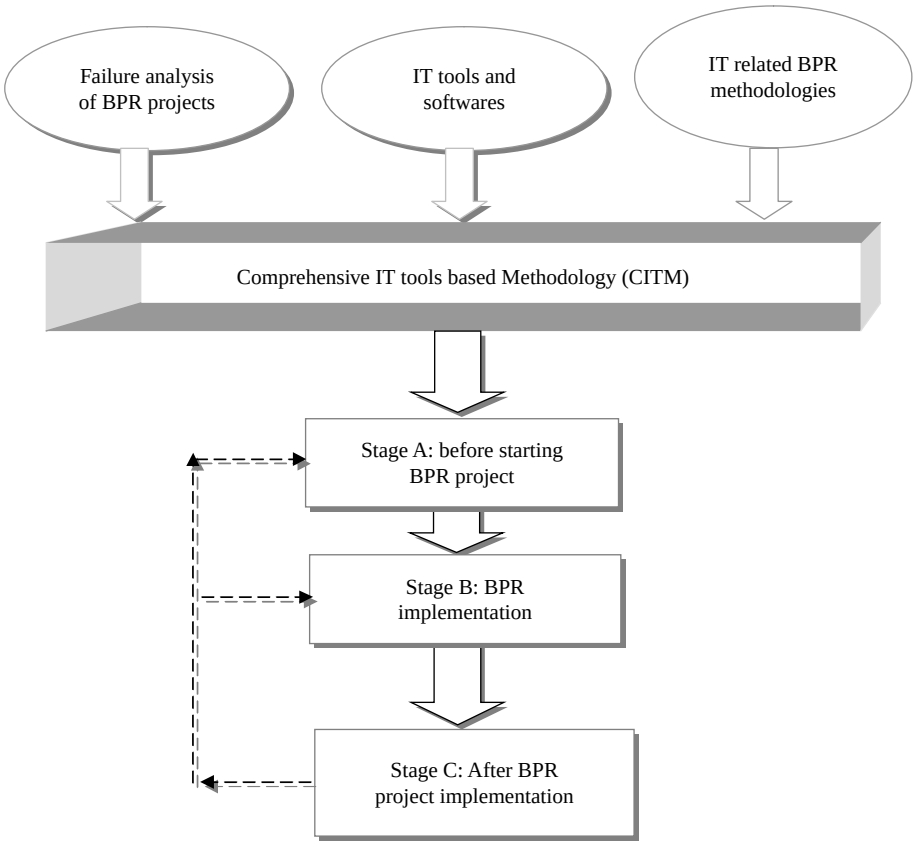

Figure 3.
CITM (layer 1)

"After BPR project implementation", includes the plans and improvements of after locating new processes.

Stage A: before starting BPR project

This stage is the critical stage of the methodology and has a large impact on the final result of the BPR project. It needs consuming an abundant considerable amount of time and patience. Essentially, in this stage the whole performance of the organization is evaluated and the support and commitment of the senior management is solicited for implementing the project.

In this stage, the strategies and visions of the organization, the whole structure of the organization, customers' demands, performance of market and competitors, and strengths and weaknesses of the organization are identified, the performance of the organization processes is evaluated and the support and motivation for the senior management is created.

Accomplishing all of the above activities requires a team including managers and experts from the company and consultants from outside the company. This team is called "guidance team". Members of the guidance team should have sufficient level of skills, authority, and popularity in the company. The chief of the guidance team is the senior manager of the company. This person motivates other managers and experts

supplies the vital resources for the project such as technology, human and financial resources. The guidance team will select the members of BPR project team, control its work processes, and evaluate the organizational performance.

Step 1: evaluating the organization performance. In this step, the performance of the organization processes is evaluated and the senior manager comes to understanding of the necessity of the BPR implementation.

This step is conducted through the following phases:

Determining and developing organization visions (Hammer and Champy, 1993; Vakola and Rezgui, 2000; Damij, 2003):

- interviewing with the top and middle managers for identifying the organization plans and strategic goals and for recognizing the whole structure and system of the organization as well as detail situation of each department;
- analyzing and exploring the organizational processes and their relationships, evaluating each process individually and with respect to other processes;
- exploring and analyzing the data from internal documents;
- eliciting the top and middle managers ideas about performance of different organizational processes; and
- analyzing the performance of the whole organization and each department separately.

All information gathered in this phase including internal documents, charts, related models of the organizational processes, and top and middle managers' ideas will be stored in a database which is the expected output of this phase:

Identifying market, customer demands, and competitors' activities (Valiris and Glykas, 1999; Hammer and Champy, 1993; Vakola and Rezgui, 2000; Damij, 2003):

- exploring and analyzing competitors' activities and market status by employing tools such as benchmarking; and
- evaluating the customer demands and the ways of complying customers demands, and measuring customer satisfaction.

This phase can be implemented after or in parallel with the previous phase. In this phase the relationship with outside of the organization are analyze. And the charts and models of internal organizational processes are collected and presented. In this phase, the necessity of radical changes will be deduced:

Exploring and recognizing the structure of IT in the organization. In this phase, usage of IT tools and perception of managers and experts about the role of IT in the organization are investigated. If there are negative viewpoints about IT or there is a lack of knowledge about its role in success of the project or the IT tools are being used incorrectly, then managers and experts should be trained to work with IT tools and acknowledge their role in the project. So the infrastructures for BPR implementation will be constructed in this phase.

Evaluating current organizational performance. Using all the data collected in the previous phases, the current status of the organization is evaluated comprehensively and the gap between current performance and the environment (competitors' activities and customer demands) is measured (Vakola and Rezgui, 2000; Castano *et al.*, 1999).

Inputs and output of this phase is shown in Figure 4.

The results of implementing the stage "before starting BPR project" are:

- Complete identification of the organizational structure.
- Analysis and evaluating the organization processes performance.
- Acknowledgment of the necessity for changes by the managers.
- Management commitment to support the changes.
- Identification of organizational strengths and weaknesses.
- Analysis of the conditions of organization (stable or unstable). Stable conditions are the conditions in which the organization is in consistent position and employees' performance is satisfied. In an unstable condition, organization encounters problems to reach its goals.
- Evaluation of the organizational performance in comparison with the environment (competitors, market, customers).
- Selection of the approach to BPR project implementation (clean-slate approach, or analysis of existing processes on details approach).

In stage A, IT is considered as an enabler (Attaran, 2004). The role of IT tools is shown as follows:

- Employing IT tools can remove organizational barriers and can make a bridge for constructive relationship among organization, customers, market, and competitors.
- By using IT capabilities, the market opportunities and structure can be identified.
- IT helps to overcome organizational geographic barriers (e.g. e-mail systems for sharing the information with each other, and integrated IS for holding the group meetings).
- Employing benchmarking tools for identifying various industrial activities and using their experience and effective improvements.
- Using internet/intranet tools to recognize the market opportunities and exchanging information among team works in or out of the company.

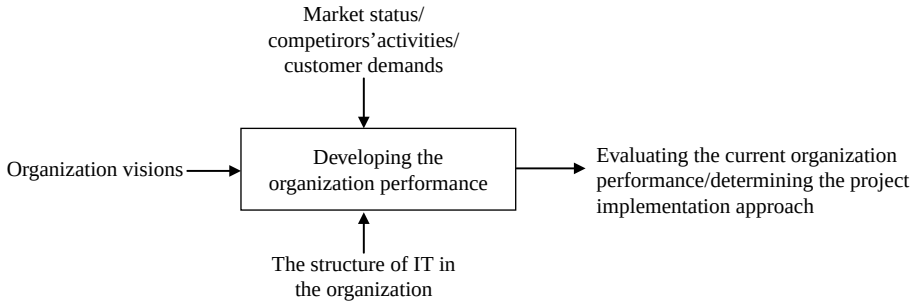

Figure 4.
Step 1 – evaluating the organization performance

- Employing IT tools for analyzing the current processes of the company and their relationship.
- Using IT tools for designing an integrated IS to collect ideas from managers and experts.

The related softwares that can be applied for each phase are shown in Table I.

Stage B: BPR implementation

One of the results of conducting the previous stage was selecting a proper approach for implementing the BPR project. Each of these two approaches (clean slate/analysis of existing processes on details) have two main steps explained in the following.

(a) Implementing BPR project by "clean-slate" approach.

Step 2: identification. The main goal of this step is to organize a BPR project team in order to schedule the project implementation and identify organizational key processes. This step may be conducted the following phases:

Organizing the project team and project planning. The BPR team is comprised of different experts with different specialties from inside and outside the organization.

Stage A phases	Software	Application of the software for implementing the phase
Determining and developing organization visions	Team work[a]	Managing and making the relationship among the works in the project
	RFP[b]	Collecting data, identifying demands and gathering them electronically
	Pathmaker[c]	Identifying the processes, collecting the data and analyzing them
	Data works[d]	Providing a general picture of organization information flow, enabling the user to analyze database, their characteristic, and relationship, and designing a common, consistent, and flexible database
	Process work[e]	Providing a general picture of the organization, illustrating the current processes and identifying business demands
Identifying market, customer demands, and competitors' activities	RFP	Providing clear relationship between demands and qualified suppliers, analyzing suppliers' suggestions, evaluating them and selecting the best. Clarifying suitable suggestions and selecting the best system
Evaluating current organizational performance	Process works	Providing a general picture of the organization, illustrating the current processes and identifying the business demands
	Data works	Mapping the information, identifying its location and origin, helping to identify the way of using the information to its users
	Smart Draw[f]	Mapping the processes and drawing the flowcharts simply

Table I.
Related sofwares for each phases of stage A (before starting BPR project)

Source: [a]www.twproject.com/overview.page; [b]www.infotivity.com/rfp_outsourcing.html; [c]www.skymark.com/pathmaker/uses/reengine.asp; [d]www.wizdom.com/dataworks.htm; [e]www.wizdom.com/processworks.html; [f]www.smartdraw.com/

It is very important that BPR team members are selected from different parts of the organization and all of them have expertise in their field. The BPR team begins its work by investigating the ideas elicited from the top and middle managers. In order to identify the organizational key processes and implement the project, regular meeting are held so that members can brainstorm and present their innovative ideas. Key success factors are also analyzed by the BPR team in this phase. These activities will set the stage for the planning to implement the project.

Exploring IT capabilities (IT tools and softwares) to be used in every phase. After forming the BPR team and starting basic planning for implementing the project, appropriate IT capabilities for different phases of the project are identified, the procedure for using them is designed and their impact on project success is analyzed.

Identifying key processes to be re-designed and starting from clean slate. Considering the results of the previous stage and recognizing organizational strategies and performance, the BPR team uses all available tools and documents about the organizational processes to identify the key processes (e.g. IT tools and softwares, map and organizational processes flowcharts). Among the identified organizational key processes, vital processes are extracted and ranked to be re-designed (Hammer and Champy, 1993; Kettinger *et al.*, 1997).

Inputs and output of the step 2 (clean-slate approach) are shown in Figure 5.

Step 3: implementing the change plans. The main goal of this step is selecting the best method to re-design, test and finally establish the key processes.

This step is comprised of the following phases:

Reengineering the processes that need to be changed. After specifying the key processes for reengineering, BPR goals and strategies of the organization are identified and modified. For doing so, the current tenets and rules are disregarded and the organization structure is completely redesigned. This phase needs innovation. Brainstorming, IT tools and softwares, project management tools, and information databases can be helpful for this phase.

Testing and evaluating new processes. New processes can be tested through simulation and prototyping. Basic samples of the new processes are also provided to

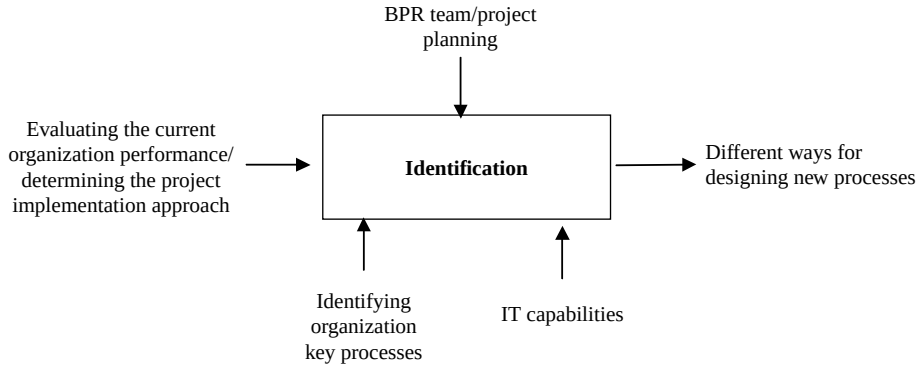

Figure 5.
Step 2 – (clean-slate approach) – identification

the users to collect their ideas about new processes. The users are expected to adapt themselves to the new situation (Davenport and Short, 1990; Simon, 1999).

Establishing the new processes. After prototyping and simulating the new processes, the users are trained to gain the skills to implement the new processes. During the training they come to understand the necessity of such fundamental improvements in the organizational processes and then the new processes are established and implemented.

Inputs and output of step 3 is shown in Figure 6.

Suitable softwares that can be used in each phase are shown in Table II.

(b) Implementing BPR project by "analysis of existing processes on details" approach.

Step 2: analysis. The main purpose of this step is to form and organize the BPR team and to plan for BPR implementation. In this step current organizational processes and their performance are also identified in details. This step is comprised of the following phases:

Organizing the project team and planning to implement the project. This phase is the same as the phase explained in step 2 of clean-slate approach.

Exploring IT capabilities (IT tools and softwares) to be used in every phase. This phase is the same as the phase explained in step 2 of clean-slate approach.

Analyzing current processes and determining their problems on details. The main difference between these two approaches ("clean-slate" approach and "analysis of existing processes on details" approach) is in this phase. In this phase all processes of the organization are analyzed and identified completely. The identification of the processes is done by exploring the existing documents of the processes and activity models. Then the processes are analyzed by simulating and modeling and the processes that need to be redesigned are extracted. Since all the processes cannot be redesigned simultaneously, they are ranked based on their importance. Then the vital processes can be extracted (Davenport and Short, 1990; Damij, 2003; Muthu *et al.*, 1999).

Inputs and output of this step are shown in Figure 7.

Step 3: modification and redesign. In this step, organization processes are identified, incorrect processes are extracted and modified, and finally new processes are designed. This step includes the following phases:

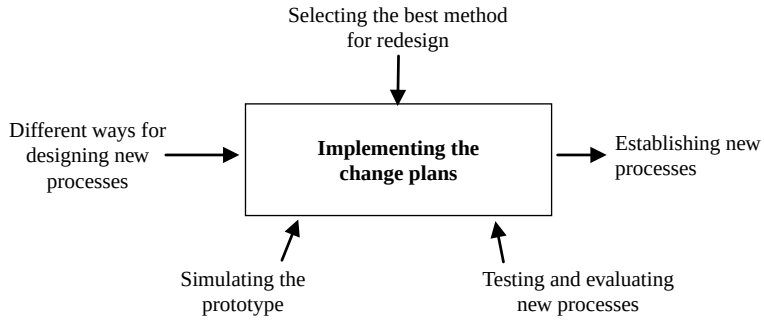

Figure 6.
Step 3 – (clean-slate approach) – change plans implementation

Stage B phases (clean-slate approach)	Software	Application of the software for implementing the phase
Organizing the project team and project planning	Team work	Enabling different groups to have an effective communication with each other simultaneously
	Mindjet MindManager Pro 6[a]	Business planning, managing the results of brainstorming meetings and strategic thoughts
	Blue-eXplorance[b]	Questioning and analyzing its results
Identifying key processes to be redesigned and started from clean slate	Pathmaker	Testing the processes, identifying the processes goals clearly, collecting data and analyzing them
	QPR[c]	Making comprehensive business processes models for precise exhibition of the current status
	Task manager 2007[d]	Developing a complete list of all tasks and projects
	Process Developer 2.1[e]	Assessing processes before their implementation, mapping business processes from beginning to the end
	AllCLEAR[f]	Drawing charts, analyzing the processes, and controlling the process charts
Reengineering the processes that need change	SIMUL8[g]	Making an integrated environment for working with simulating models and enabling the user to make consistent, flexible, and accurate simulation
	Wizdom works[h]	Analyzing and editing the process flows and data models
	Rational Rose[i]	Modeling and analyzing the processes
Testing and evaluating new processes	Proforma[j]	Clarifying the models and analyzing the results of the changes
	Trakstar-Promantek[k]	Automating the process analysis and process performance, developing plans to evaluate the quality of performance
	Blue-eXplorance	Evaluating the performance of processes
Establishing the new processes	Visual Mind[l]	Mapping the users' thoughts, organizing and managing them
	Trakstar-Promantek	Leading the organizations to improve management capabilities, helping the staff to communicate with each other effectively

Source: [a]www.mindjet.com/eu/; [b]www.explorance.com/blue.htm; [c]www.qpr.com/Company/index.html; [d]www.orbisoft.com/index.htm#benefits; [e]www.Process_Developer_2_1_Enterprise_Edition_Software_-end-detail.html; [f]www.allclearonline.com/default.asp; [g]www.bpr-simulation.com/index.htm; [h]www.wizdom.com/wizdomworks.html; [i]www-306.ibm.com/software/rational/; [j]www.metastorm.com/; [k]www.hr-guide.com/data/209.htm; [l]www.visual-mind.com/

Table II.
Related sofwares for each phase in stage B (implementing BPR project by clean-slate approach)

Modifying and redesigning the processes. After complete identification of the processes in step 2, different benchmarking models to define the ideal status are analyzed and the best way for ideal status is identified. The design of ideal status is done based on the current status of the processes and their performance. Benchmarking, modeling, flowcharts, related softwares, and electronic IS are effective tools to evaluate the ideal status (Muthu *et al.*, 1999).

Testing and evaluating the performance of the new processes. New processes can be tested through simulation and prototyping. Basic samples from the new processes are also given to the users and their ideas for employing them are asked. And users are expected to adapt themselves to the new situation (Davenport and Short, 1990; Damij, 2003; Simon, 1999).

Establishing modified processes. After prototyping and simulating the new processes, the users are trained to gain the skills. During the training, they come to understand the necessity of such fundamental improvements in the organizational processes and then the new processes are established and implemented.

Inputs and output of this step are shown in Figure 8.

Suitable softwares that can be used in each phase are shown in Table III.

Despite several major differences between the two approaches, there are a few common points in some phases. One of the advantages of CITM is its flexibility. Based on the situation and structure of each organization, either of these two approaches or even a combination of them can be selected to implement the project.

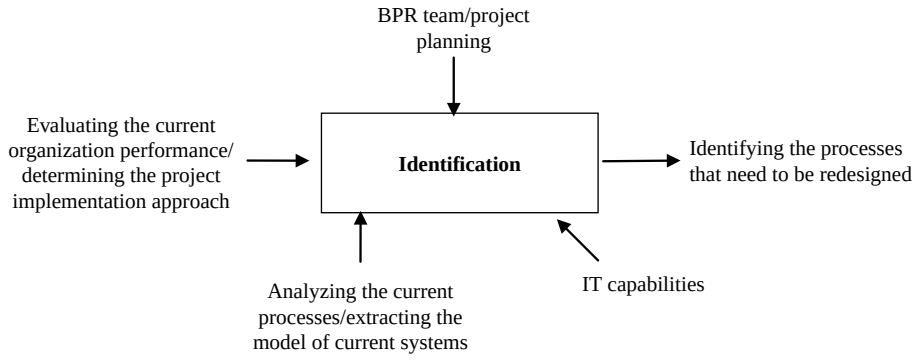

Figure 7.
Step 2 – (implementing BPR project by analysis of existing processes on details approach) – analysis

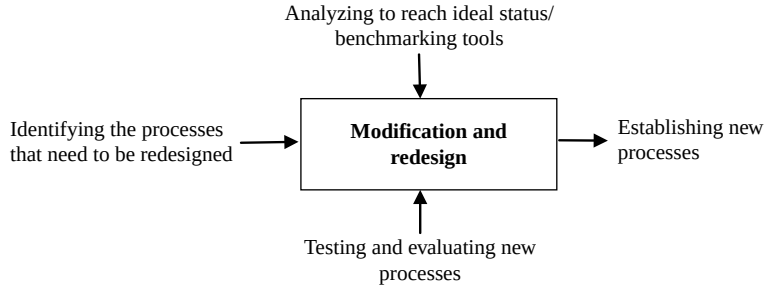

Figure 8.
Step 3 – (implementing BPR project by analysis of existing processes on details approach) – modification and redesign

Stage B phases (analysis of existing processes on details approach)	Software	Application of the software for implementing the phase
Organizing the project team and project planning	Team work	Enabling different groups to have an effective communication with each other simultaneously
	Mindjet MindManager Pro 6	Business planning, managing the results of brainstorming meetings and strategic thoughts
	Blue-eXplorance	Questioning and analyzing its results
Analyzing current processes and determining their problems on details	Rational Rose	Mapping, identifying, creating, and documenting the processes
	Pathmaker	Testing the processes, selecting suitable processes. Explaining the processes goals, drawing a new process, testing and collecting data, analyzing them
	Data works	Modeling data, drawing and mapping information, analyzing data base
	AllCLEAR	Drawing charts, analyzing processes and organization chart, simulating the processes
Modifying and redesigning the processes	QPR	Organizing and improving business processes, exploring the information and sources flow, analyzing and simulating processes
	Wizdom Works	Improving business processes, creating, analyzing, editing the process flow components and data models
Testing and evaluating the performance of the new processes	Proforma	Clarifying the models and analyzing the results of the changes
	Trakstar-Promantek	Automating the process analysis and process performance, developing plans to evaluate the quality of performance
	Blue-eXplorance	Evaluating the processes performance
Establishing modified processes	Visual Mind	Mapping the users' thoughts, organizing and managing them. This software is applicable for users and people wanting to know the users ideas
	Trakstar-Promantek	Leading the organizations to improve management capabilities. And helping the staff to relate with each other better

Table III.
Related softwares for each phase in stage B (implementing BPR project by analysis of existing processes on details approach)

The role of IT is considered as a facilitator in stage B (Attaran, 2004) as follows:

- modeling tools, flowcharts, and simulating for modeling the identified processes, as well as changing and designing new processes;
- project management tools for identifying organizational structure, as well as exploring and controlling activities during the process design;
- telecommunication tools for improving collaboration among personnel of different functional units; and
- IT capabilities for depicting different models for new processes and selecting the most effective ones.

Stage C: after BPR project implementation

After implementing the project and establishing the new processes, the new system needs to be supported.

Step 4: supportive plans after BPR project implementation. The main purpose of this step is to improve and control the new processes continuously and to evaluate the improvements. In other words, new system is evaluated and up-dated regularly. This step is comprised of the following phases:

Measuring the improvement and comparing it with the ideal status. In this phase, progress in the implementation step and its outcome are measured and compared with the ideal status. The system capabilities, effectiveness, the ease of the system for personnel, and the impact of using IT in the new system are also evaluated.

Evaluating the gaps among organization, market and competitors. The organizational status is frequently compared with the competitors' activities and market status in order to identify the gaps and plan for improvement.

Evaluating customers satisfaction. Since customers interests are changing continuously, the extent to which their demands are met is also evaluated frequently. Based on this evaluation, future plans are defined.

Developing organizational vision. The organizational performance is evaluated regularly and the way of implementing the activities are controlled. Innovative ideas are considered and effective guidelines are suggested for future strategies.

Inputs and output of step 4 are shown in Figure 9.

The role of IT is considered as an implementer in stage C (Attaran, 2004):

- Electronic communication facilitate the communication among users.
- Project management and process analysis tools help in implementation of the new processes.
- The problems occurring during the implementation of the new processes can be controlled simply.
- Evaluating potential investments and return investment is vital. Evaluation and process analysis tools help to assess potential investment.

Suitable softwares for each phase are shown in Table IV.

The second layer of CITM is shown on details in Figure 10.

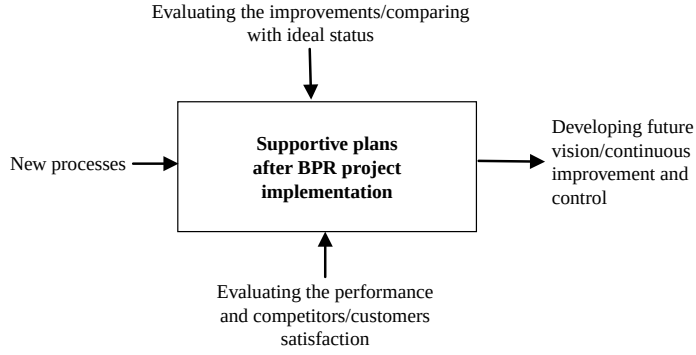

Figure 9.
Step 4 – supportive plans after BPR project implementation

Stage C phases	Software	Application of the software for implementing the phase
Evaluating the improvement and comparing it with the ideal status	Proforma	Clarifying the models, observing and evaluating results. Managing data and preparing conditions for implementing business improvements
	Project management software	Presenting the solution for decreasing expenses, improving the effect of the performance, and increasing the strategic interest
	Task manager 2007	Managing and pursuing all tasks, projects and teams
	Trakstar-Promantek	Automating process evaluation, improving performance evaluation plans
Evaluating the interval among organization, market and competitors	Project management software	Evaluating the performance continuously by controlling the projects
Evaluating customers satisfaction	RFP	Preparing clear relationship between demands and qualified suppliers, analyzing suppliers suggestions, evaluating the results and selecting the best
Developing future vision	Blue-eXplorance	Evaluating organizational performance

Table IV.
Related softwares for each phase in stage C (after BPR project implementation)

6. CITM validation

The evaluation of the CITM was based on the two approaches: first, through getting 50 experts' ideas for each phase of the methodology and improving the methodology by the experts' feedback. Second, the revised methodology by experts was carried out in organization and planning department of an IT company.

6.1 Evaluation through experts' ideas

As the evaluation of the methodology needed meetings in various sessions and also participating the best people of this field involved in BPR project was mandatory, we chose 50 best experts (the ones that also participated in extracting key failure analysis). The analysis of the methodology was conducted in two sessions with every one of the experts individually and then in one sessions with all of the experts in a meeting for brainstorming discussion. As a whole, the methodology analysis lasted 35 days to be done. The range of experts' age was between 32 and 38 years old. They were all graduated in master and PhD in industrial engineering, and MBA major and specialist in BPR field. They were all involved at least in one BPR project that also in some cases was failed.

The interview was based on the open questionnaire in the way that first they were contacted individually by e-mail and got an appointment for a meeting. In the meeting the methodology was explained and they were asked to give their feedback in every phase of the methodology. The second session was held after the experts' feedbacks were ready. In this session after getting the written feedbacks, the strengths and weaknesses also were discussed. The feedbacks were based on the CITM strengths and weaknesses in successful implementation.

So, interviews were two session for each expert individually. And one session was held by gathering all 50 experts. In this session other experts' written feedback was

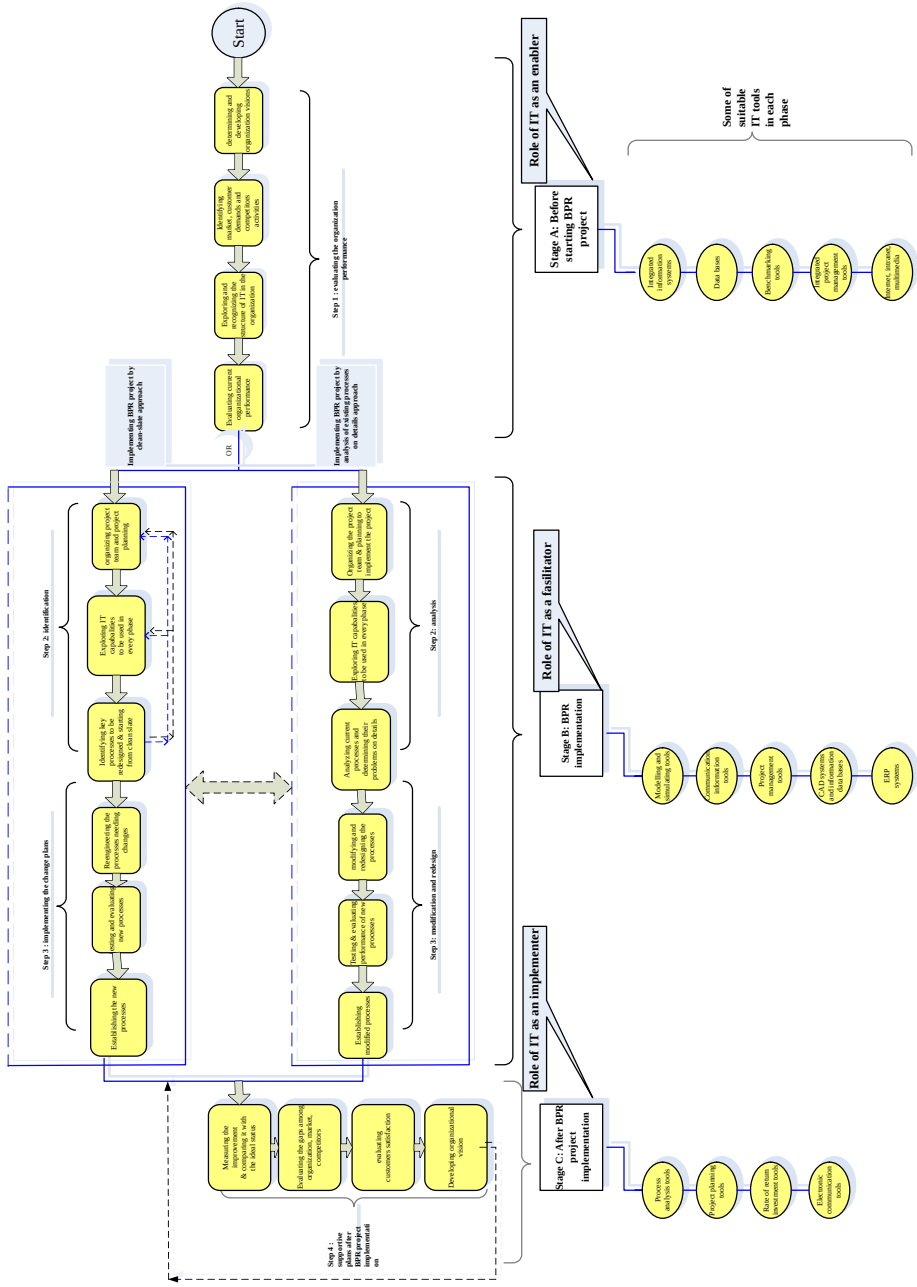

Figure 10.
CITM (layer 2)

given to every expert. After 30 minutes the complementary ideas were taken from each of the expert. This session was more a discussion session for completing the feedbacks for strengths and weaknesses of the methodology in terms of implementation. The session was concluded by collecting the final ideas for improving the methodology.

The final experts' feedback for improving the CITM is shown below.

The experts' feedback for improving the methodology

The experts feedback for CITM improvement:

- The process model in level 2 should be drawn clearly.
- The application of each software should be identified for implementation.
- Choosing one of the approaches or combination of both of them should be clarifies after step 1.
- In each phase of the methodology the role of IT should be elaborated, so it could be better that some phases for using IT are added.
- Making the guidance team before implementing the project should be added.

The experts' ideas about each phase of the methodology were considered. After that, the improved methodology was shown to them in the separate meeting with every one of them for any other recommendation. In these sessions all the experts confirmed the effectiveness and efficiency of the methodology for implementation.

6.2 Case study

The company which due to the some limitations and confidential reasons was not allowed to express the name, was established in 1990 as a response to the importance of investment in IT sector. In 1991, the company officially commended its activity with an annual production of 28,000 computer units. The technical knowledge of the company's specialist is kept up-to-date through research and development departments and through the CRM system which facilities clients' relationship with the company. Now the company has more than 100 employees with the department including: training, organization and planning, R&D, production and quality control, network, sales and after sales services.

Because of the company's constraints, we could implement the methodology in organization and planning department which its main tasks is to organizing the procedures of the different departments, analyzing the organizational structure, and responsible for getting the certificates such as ISO9000 for the company.

Stage A: before starting BPR project. We started the project by expressing the methodology and BPR generally to the manager and supervisors of the department through different sessions. After justifying the methodology to the managers, we held two other sessions with the department's employees which were ten. We took quite sufficient time with the employees to explain the benefits of the project and the vital results could be got from implementing the methodology.

By cooperation with the employees all of the processes of the department and tasks were extracted and analyzed by detail. There were four main processes in this department including planning, performance measurement, management review, continuous improvement. By brainstorming meetings, we decided to use RFP software for the first step, although we could access the trial version, it helped us to collect and analyzing data fast.

Analyzing data showed that they are on somehow on stable conditions in which the performance is slightly satisfied. So, the analysis of existing processes on details approach was selected.

Stage B: BPR implementation. The current processes which were composed of four processes analyzed by detail and the problems were extracted. The Rational Rose software was the base for analyzing the processes.

The main problems of the processes were: they did not have connection to each other, and each process was implemented separately without coordinating with other processes, however, they has a lot of similarities together. It caused different overlapping with one another. Besides, the processes could be merged together because they were almost the same process with little differences. So, we decided to merge two processes together. To do so, we established some new tasks for the processes in which they were connected to each other and easier for tracking them. The two new processes are: design and planning, continuous review.

Before establishing the new procedures, we held two meetings with all of the department employees. And discussed the strengths and benefits of the new designed processes. As we designed the new processes with the close coordination with the employees and managers, they all agreed with the vitality of changing the processes.

Stage C: after BPR project implementation. Through project management software, the performance of the processes was controlled in two months. The results were quite satisfactory. In order to continuous improvement, the management team decided to develop the future vision for improving the performance of the department. They were going to have meeting to establish short- and long-term plans for the department improvement.

After establishing the new processes we had some interview with employees and managers asking about the changes.

"The changes were very beneficial for me to track the processes and now I can design the processes faster. On top of that I have the close coordination with other employees inside our department. It helps enhance the performance of the department". One of employees said.

"The results of the project were good. I think justifying the employees before starting the project is one of the most important reasons for the project' success. But it seems necessary to conduct the project in other departments, as we have relationship with them. Now we know that they should make some changes in their processes. In our long term plan for process improvement, we have decided to analyze all of the company's processes with this methodology's instruction." Said one of the supervisors.

Therefore, the CITM was quite successful in implementing in an important department in α company. The main results of the implementing CITM gained through interview with the managers and employees was the coordination of the processes, fast conducting the processes by using IT tools, and easily tracking them and also because of the close cooperation between the team project and the management commitment and belief on the project CITM was successfully could improve the process in the organization and planning department.

7. Discussion

BPR projects are referred as a risky effort (Hammer and Champy, 1993; Crowe *et al.*, 2002; Chiplunkar *et al.*, 2003; Dennis *et al.*, 2003). Different methodologies have been

developed in order to facilitate the process of implementing BPR projects. In this research a different approach has been considered. A gap in the literature of the methodologies was extracted in which there is a need for a comprehensive methodology for implementing BPR projects. First, a methodology that ensures the failure rate could be lower. Second, as the role of IT is so important in BPR projects (Hammer and Champy, 1993; Attaran, 2004; Eardley *et al.*, 2008; Ramirez *et al.*, 2010), involving IT tools in every phase of the project could facilitate the project implementation. Third, researchers argue for conducting two approaches for BPR projects (clean-slate approach, analysis of existing processes on details approach), a methodology was needed to consider these two approaches together that the firms can select one or combining of both in some processes in execution. In this research by extracting the gap in the literature as mentioned above. A comprehensive methodology was developed. For decreasing the risk for implementing the project failure analysis was conducted and the critical failure factors for BPR projects were extracted on the basis of experts' ideas. The role of IT in BPR was considered as an enabler, as a supportive, and as catalyst and the related IT tools and softwares were suggested for each phase of the project. The two debatable approaches are involved in the methodology in the way that one can go through one or combining both of them with respect to the need for changing radically or improving the processes. The effectiveness and efficiency of the CITM was validated by interviewing with 50 professional experts and improving the methodology by getting their feedbacks. And the methodology was tested in a case study in an IT company. The results of redesigning the processes in the department that CITM was implemented were quite satisfactory. The validation results showed that CITM could be used as a comprehensive methodology for improving the BPR projects implementation.

8. Conclusion

In this paper, we presented the comprehensive IT tools based methodology (CITM) that covers the two debatable approaches for implementing BPR projects, failure analysis, and the related IT tools and softwares in each phase. There are different methodologies in the literature that approach BPR projects in special aspects. Implementing BPR project through one of the two possible approaches, clean-slate approach and analysis of existing processes on details approach, is one of the challenges among researches. CITM addresses the two approaches in the way that regarding the processes status of the organization, either on or combining of two approaches could be selected during executing the BPR project. Besides, as the companies are worried about implementing BPR projects because of the high rate of the failure in the projects, for developing this methodology the failure analysis was conducted. The BPR failure factors were gathered from the literature, categorized, and then the key failure factors extracted by getting the experts ideas. And then we tried to consider these factors in developing each phase of the methodology these factors to lower the risk of implementing the CITM. Furthermore, IT has as important role in BPR projects and researches have studies the role of IT in BPR in different approaches. CITM considers the role of IT as an enabler, as a supportive and as a catalyst tool for BPR project and then the related IT tools and softwares are proposed for each phase of the methodology. The proposed IT tools and softwares can facilitate executing the BPR project because the users can easily select the related tools for the related step and phase of the project. Hence, it speeds up the project implementation. CITM's validity was assessed by getting the experts' ideas in each

phase of the methodology. The experts' ideas were collected in different sessions. The usability of each phase in practice was discussed and analyzed in detail by experts. Thereafter, the methodology tested as a case study in a department at the IT company. The results of the project showed the comprehensiveness of the methodology as well as the important role of IT tools in advancing the BPR project.

There were some limitations for CITM implementation that could be useful for the future research. As we had the problems, the CITM was tested in one department in a company which can be conducted in the company and is considered as a big project for the big company to redesign all of the processes of the company. Besides, the methodology could be implemented in two different companies (product and service) and the results can be compared in terms of that the methodology is more effectiveness in which field.

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