**Relevance of ERP Implementation and Critical Success Factors in SMEs of Developing Countries**

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**Abstract:** Small and medium enterprises (SMEs) with their crucial role in generating employment and supporting trade are encountering numerous challenges. Meanwhile, towards to stay alive in a competitive edge in today's dynamic business environment, SMEs are improving their usage of information systems (IS) and increasingly implementing of enterprise resource planning (ERP) systems. However, successful implementation and utilization of ERP systems requires adequate attention to a proper and comprehensive implementation framework and considering of significant critical success factors (CSFs) in implementation phases. Expert panel with ten experts and interview instrument was conducted in this research. This study aims to contribute three major goals: to find the required characteristics of SMEs' framework and then propose a conceptual framework and seek the relevance of critical success factors (CSFs) along the four phases of proposed framework for implementation of ERP systems in SMEs of developing countries. These findings aim to saturate the proposed frameworks that can help SMEs of developing countries towards improving the ERP implementation success rate. The case study in Iranian SMEs was used to validation of the final proposed framework.

## 1. Introduction

The Information and Communication Technology (ICT) and particularly Information Systems (IS) and Enterprise Resource Planning (ERP) issues are recently bringing to be the forefront agenda for improving the poorness of information usage in developing countries (Zaied, 2008). Furthermore, small and medium-sized enterprises (SMEs) constitute the majority of businesses and are as a proportion of all business and large percentage of both employment and turnover (Beaver and Prince, 2004, Eurostat, 2004, Meckel *et al.*, 2004, Walsh *et al.*, 2010). As SMEs includes more than 90% of businesses in many countries, more attention and rigorous related studies are required seriously (Bannock, 2005, Bannock and Daly, 1994, Stokes and Wilson, 2010). Due to the inherent differences between SMEs and large firms, the findings of the researches based on large businesses cannot be suited for SMEs (Blau *et al.*, 1966, Blili and Raymond, 1993, Cohn and Lindberg, 1972, Dandridge, 1979). Some specific characteristics of SMEs can be counted as: having simple and highly centralized structures that generally chief executive officers (CEOs) are the owners and also makes the most of the critical decisions (Gable, 1996, Lefebvre *et al.*, 1997). SMEs also prefer the employment of generalists rather than specialists (Gable, 1996, Thong, 2001, Thong *et al.*, 1996, Wong and Aspinwall, 2004, Yusof, 2000). Furthermore, SMEs

tend to plan for short-term rather than long-term strategic. The communication in different levels of organization in SMEs is less complex. They have fewer bureaucratic procedures and less inertia for organizational changes (Harvey *et al.*, 1992, Lefebvre and Lefebvre, 1992). SMEs are usually encountered by lack of technical and expert staffs, and financial and human resources (Lefebvre *et al.*, 1997). In SMEs often decisions are made without full awareness of information (Lynch and Wilson, 2009). In brief, the SMEs differ from larger enterprises in various aspects, including their workflow, decision-making process, levels of hierarchy, resources, and corporate culture (Walsh *et al.*, 2010). Due to the distinctive differences of SMEs and large enterprises, there is a need to study these enterprises separately (Blau *et al.*, 1966, d'Amboise and Muldowney, 1988, Dandridge, 1979, Welsh and White, 1981). ERP systems of SMEs in developing countries, totally, cannot just imitate the model, frameworks and methodologies and also approaches adopted by large counterparts and in developed countries. They need developed, revised or modified frameworks and models to adapt with SMEs' of developing countries' needs and characteristics. In spite of this need, there is not adequate study on proposing the favorite framework for these enterprises.

The first section of this paper discusses the review on ERP implementation frameworks. This is

followed by identification of the required specifications for SMEs' framework and a discussion of the authors' proposed framework. Then the relevance of critical success factors (CSFs) along the implementation phased is evaluated. This will be followed by case study results. Finally, conclusion and suggested future research directions are presented.

## 2. Current Models and Frameworks of ERP Implementation

There are many proposed models and frameworks for implementing of ERP systems. In this section we are evaluating some of the issues that are more related to ERP implementation in brief, as follows:

Regarding of enterprise-wide of the ERP implementation, most of the proposed model and framework state the required stages to manipulate the planning (Chan, 2008, Kalakota and Robinson, 2001, Parr and Shanks, 2000a). In the proposed frameworks by these authors, a planning process is involving project planning, financial and other resource planning, and leadership roles planning are designed. Chan (Chan, 2008) and Umble et al.'s (Umble *et al.*, 2003) proposed frameworks begin the implementation process with doing of pre-implementation process. Umble et al. (Umble *et al.*, 2003) proposed the considering of all factors critical in pre-implementation phase to insure having a successful implementation. Despite of training and including of the all staffs and stakeholders in all stages of ERP project in SMEs are a significant factor for successful implementation (Aarabi *et al.*, 2011), they proposed the training procedure after installing the hardware and software of the systems. They've also not cleared the CSFs and their relevance with implementation process clearly. The framework proposed by Somers et al. (2000) includes some elements such size of the firm, organizational structure, and industry type. The stages of the life cycle to implement of ERP systems are included in their framework. Furthermore, their proposed framework has specified the internal and external elements. They stated the implementation processes and the related elements, but they've not considered the critical factors that affect on successful implementation in each process.

Markus and Tanis (Markus and Tanis, 2000) proposed a framework to implement of ERP systems in four phases: (1) Project chartering: to make the decisions on business cases and solution constraints, (2) Project configure and rollout: the system gets up and runs by end users, (3) Shakedown: the implemented system is stabilized and its bugs will be resolved and gets to normal operation, (4) Onward and upward: maintaining, supporting and updating of the system are included in this phase. They specified

the lifecycle of system implementation. Nevertheless, many of the critical factors and the relation of CSFs in any stages of implementation are not cleared.

Parr and Shank (Parr and Shanks, 2000a) proposed a framework includes three phases: planning, project, and enhancement. The focus of their framework is on project implementation phase that is divided to five sub-phases: set-up, re-engineering, design, configuration and testing and installation. They tried to find the relation of the CSFs to the phases of implementation. They focused on literature of large companies to find the CSFs and used two case studies in order to do comparision to find their similarities and differences.

Ehie and Madsen (2005) presented a five-stage ERP implementation model includes: "project preparation", "business blueprint", "realization", "preparation" and the last phase, that is "go live and support". The framework includes the strategic enterprise architecture approach and life cycle processes of implementation. Nevertheless, the CSFs of SMEs and their relevance with implementation stages are not considered in this framework. Furthermore the implementation methodology is not simplified adequately.

Chan (2008), proposed a theoretical framework concerning critical success factors, organizational environment, and internal and external stakeholders. His framework divided in three major phases: pre-implementation, implementation and post-implementation processes. During the implementation process, the framework suggests three major activities to be carried out: the business process reengineering process, the management of organizational changes, and the management of ERP project. The mentioned classified CSFs are not for SMEs and the related CSFs in each major three phases of implementation are not specified clearly. Nevertheless, the framework is not simplified enough for SMEs to follow it as implementation and documentation of ERP in these enterpises.

The current moldels and frameworks are generally focused on large firms in developed countries and don't consider the particular conditions and characteristics of SMEs in developing countries. Meanwhile the present framework doesn't include all elements, phases and approaches that are needed to implement of ERP systems and none of them relates CSFs of SMEs to the phases of implementation. The purpose of this study is proposing of the framework for implementting of ERP in SMEs. The authors believe that this framework fits the SMEs' characteristics and it can be used as guideline to help SMEs of developing countries to have better implementing of ERP systems and improve their success rate.

**3. The Research Method**

This study tries to response to the following three research questions:

1- What are the required characteristics for SMEs' framework?

2- What is the suitable conceptual framework for ERP implementation in SMEs of developing countries?

3- How is the relevance of CSFs along the proposed phases of implementation methodology?

In order to develop a suitable framework for SMEs, certain characteristics should be considered. Expert panel method using interview instrument was used to explore the required specifications of SMEs framework and it was continued to propose a comprehensive conceptual framework for ERP implementation in SMEs of developing countries.

Table 1. Expert specifications

| Current Position | Company type | Industry sector | Experience (Year) |
| --- | --- | --- | --- |
| Planning manager | Medium | Manufacturing | 9 |
| Head master of system development and support | Small | Service | 7 |
| Executive director | Medium | Manufacturing | 8 |
| Planning manager | Medium | Manufacturing | 8 |
| Chief manager | Small | Service | 12 |
| Business development manager | Medium | Manufacturing | 14 |
| System & planning manager | Medium | Manufacturing | 10 |
| Financial system designer | Medium | Manufacturing | 9 |
| System Analyst | Medium | Manufacturing | 13 |
| System developer assistant | Small | Service | 8 |

As the next purpose of this study, the relevance of the CSFs and the phases of implementation methodology are surveyed. Table 1 shows the tabular summaries of the interviewed expert specifications and background.

Regarding lack of experts in SMEs of developing countries for ERP field, it seems that ten experts are enough for a survey in this kind of research as were done in similar researches (Parr and Shanks, 2000a, Parr and Shanks, 2000b).

**4. Specifications of SMEs' Framework**

Before proposing any framework, the required characteristics of the framework should be identified. Furthermore, it should be guaranteed the final proposed framework follows the needed specifications. For this purpose a survey in priori literature and personal contacts and interview with the experts were used to find the SMEs' framework specifications. The interviews were conducted from 9th February to 15th March 2012. The findings of these interviews resulted the specifications of the framework for ERP implementation in SMEs that can be briefed in eleven key items that are (Aarabi *et al.*, 2012):

- Generic and not perspective
- Implementable
- Simple structure and practical for implementation
- Simplify for understanding
- Facilitate the communication
- Links clearly between elements of framework
- Present key ERP system implementation processes
- Include stakeholders interface
- Not tool-based
- Include CSFs of ERP systems implementation
- Aid to documentation

These criteria should be considered when developing a framework for SMEs. The next section discusses a proposed conceptual implementation framework considering these characteristics

**5. Current Conceptual Framework for ERP Implementation**

Broadly defined, a framework is a theoretical or conceptual structure intended to serve as a support or guideline for the building of something useful. Bernard (Bernard, 2005) defined framework as a structure for organizing information that defines the areas of the architecture and relation of the components among the scope. The framework applies to enterprises to classify and simplify the logical structure to organize the descriptive representation of enterprises (Zachman, 1996).

The graphical framework is the most simplistic form depicts the data, process, relation and the intersections between the roles in the design process (Zachman, 1996).

Regarding, the implementation of ERP systems is risky and enterprise-wide project and lacking of framework for implementing of ERP systems in developing countries and especially in the SMEs of these countries, there is a need for a comprehensive

framework as a guideline to implement ERP systems in SMEs of developing countries. This framework can

be considered as a first step for developing software modules for the various ERP applications.
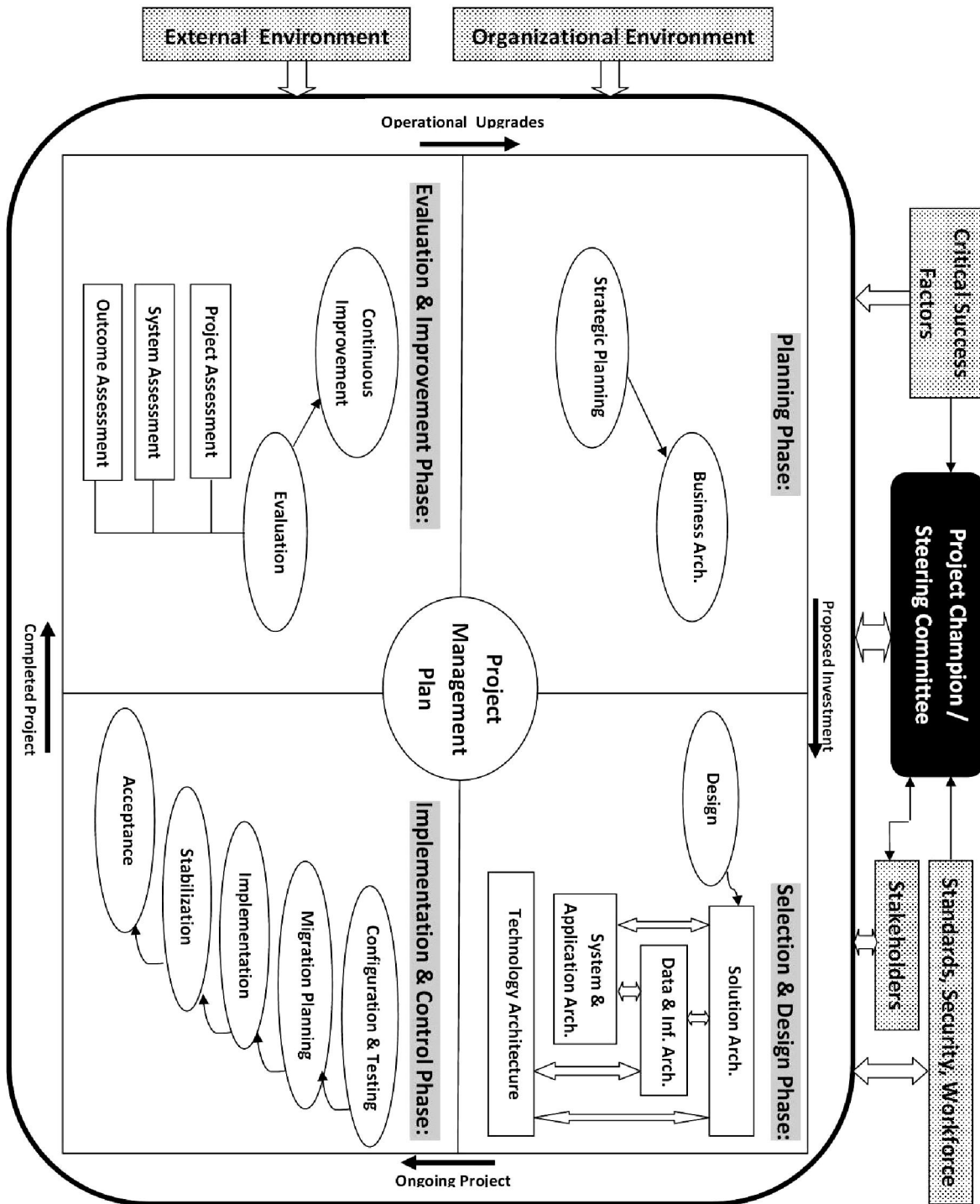


Figure 1. The Proposed Framework for ERP Implementation (Aarabi *et al.*, 2012)

It's aimed that the proposed framework in this study attends to the required specifications of SMEs' framework, with simple implementation methodology and lifecycle, and also includes the CSFs and all required elements and approaches of ERP implementation. In the case of ERP implementation, it should be started by trying to include the range of approaches such as developing a project plan management with detailed stages suitable as implementing methodology, enterprise architecture and including the stakeholders, standards, internal and external environment, etc. (see Figure 1). The description of four stages methodology of proposed framework will be outlined as follows:

The first phase, planning for implementation: involving the strategic planning to enterprise, identification, conceptual definition, setup the system and requirements and analysis of current status of the enterprise. It follows by business architecture to define the lines of business and business functions performed enterprises, as well as the grouping of common business processes (Saha, 2007). This identifies the business products and services of the enterprises and the contribution of technology to support this processes. (Bernard, 2005). The second phase of ERP implementation includes the design of the systems involving of preliminary and detailed designs. The following architectures should be established in this phase:

*Solution architecture:* A portfolio of integrated application systems required to satisfy business information needs and solutions, which facilitate rapid development and delivery in a systematic and well-disciplined manner (Saha, 2007).

*Data & Information architecture*: A set of data models that examine the key information assets.

with the aim of providing a shared, distributed, and consistent data resource. It also identifies individual responsibilities for managing information (Saha, 2007).

*System & Application architecture*: The application architecture describes the software applications that are needed to deploy organization's business processes governed by business rules (Bernard, 2005, Saha, 2007).

*Technical architecture*: This element details the organization's technology strategies, its extended technology linkages, and their impact on business initiatives (Saha, 2007). This is the backbone of the architecture that is intended to the networks and infrastructure that the enterprise uses to host systems, applications, databases, websites, local area networks (LANs), wide area networks (WANs), system application networks (SANs), Intranets, Extranets, and wireless networks.

Third phase is implementation & control: including the configuration, migration, implementation, and stabilization stages of the system. The development of a comprehensive configuration and test of components (modules) with real data will be constituted as the first step and Migration Planning is the next step of this phase. The planning of the system migration and analyze the costs, benefits and risks of migration and fitting of system and training of end user and preparing of user manual are included in this step. The implementation defines all those tasks that must be carried out, such as: hiring and training personnel, and developing or changing the organization; testing and validation of system integration and releasing into operation. The next step of the implementation and control phase is stabilization. The enterprise attempts to clean up its processes and data and adjusting to the new environment. The next step of this phase is acceptance and regular operation of the system. Organizational members accept and employ the ERP application in organizational tasks. Forth phase of ERP implementation is evaluation and improvement of the implemented system. Evaluation divided by three categories: (1) project assessment with evaluating of time and budget, (2) system assessment that evaluates system quality, service quality, user satisfaction, user satisfaction and organizational satisfaction, and (3) outcome assessment: the implemented system will be assessed comparing with the expectations of the users, owners and all internal and external stakeholders of the system. The last step of this phase is maintenance and continuous improvement with upgrading of the system.

In addition of the aforementioned implementation methodology phases, the proposed framework is considering the following approaches:

*Organizational Environment*: includes upper management, size of the firm (Somers *et al.*, 2000), capabilities & skills of staffs (Sledgianowski *et al.*, 2008), change culture, business culture, IT infrastructure (Somers *et al.*, 2000), resources (Vos, 2005), organizational structure, policy of communication & collaboration and decision making style (Otieno, 2010).

*External Environment:* includes kind of industry, competitive moves (Vos, 2005), national culture, market area, economy status (local and global), legislation/government (Otieno, 2010), customer orientation (Vos, 2005) and supplier orientation (Vos, 2005).

*Critical Success Factors*: successful implementation of ERP in SMEs of developing countries is crucially related to attention to the critical success factors that classified in seven major factors:

culture and resource management, project management and evaluation, process reengineering and change management, project team and training, upper management support and commitment, and consultant and vendor services. The relation of these factors to each stages of implementation of system is discussed in next part of this study.

*Project Champion / Steering Committee*: champion is an experienced member of the project whose provides the authority to engage the proper members in project team. This element is one of the key elements for project success.

*Project Management Plan:* due to the ERP implementation projects are an enterprise-wide and complex project, a proper project plan and management of its activities, resources and evaluating of cost and time are very significant to achieve the successful implementation.

*Workforce planning:* as the people are the most valuable resource of an enterprise, their roles, responsibilities and skills should be noticed. This element is for the planning workforce and their detailed training for ERP component operations support at all levels of the enterprise (Bernard, 2005).

*Standards:* the needed system's standards are included in this category. The required standards for data acquisition, transaction of data, security and etc. should be considered. These standards are key of framework and process management and can be came from International (ISO/CEN/IEEE), national, local, governmental, industry and enterprise sources (Bernard, 2005).

*Security Planning:* The security should be one the most significant part of the strategic goals in any information systems. It includes physical and informational securities that guarantees the accuracy, safety and authentication of the systems, information into business processes and controls the information flows in all levels of the enterprise (Scheer, 2000).

## 6. Relevance of CSFs and Implementation Phases

Regarding the characteristic of qualitative research that can be descriptive (Bogdan and Biklen, 2003), the interview as a general qualitative instrument was used to specify the interrelationship between the classified CSFs (Aarabi *et al.*, 2012) and the stages of proposed methodology in framework for implementation of the ERP systems in SMEs. The questionnaire was designed for structured interview. The first version of the questionnaire asked CSF of each stage separately and the respondents should be listed their desired CSFs in a list at the under of each stage. The content validity of the questionnaire was checked using the recommendation of four academic and practitioner experts. They recommended that it will be better that the relevance can be specified as a

relevance matrix. The files contained the specification of the proposed framework, methodology process stages and classified CSFs with the detailed items of each factors and explanation of the interview questions, were sent to the respondents. They have been wanted to study the files containing the detailed exploration of the framework and CSFs first. Then, they were asked this question: *Which CSF(s) is/are important (or very important) and should be considered well in each implementation stage to be confident for achieving the success in implementation?*

The interviewees studied and concentrated on implementation framework and methodology and specified which CSFs are important or very important at each stages of implementation. In particular status, they explained more to clarify their responses.

Having interview results and open coding for validation and getting more reliability in results, the experts' suggestions for the relevance of the CSFs with the stages of implementing ERP in SMEs proposed in developed framework are summed in Table 2. Regarding the literature, it seems that ten respondents are adequate to find the relevance of the important CSFs with the stages of ERP implementation (Parr and Shanks, 2000a, Parr and Shanks, 2000b). The summed occurrence number means the count of the expert's opinion that believed the CSF is important (or very important) in the particular stage of ERP implementation and should be considered well to achieving the successful implementation in that stage and whole of the project confidently.

In a scale of the results, the numbers greater than 3 that shows the loading scale more than 0.33 (Ho, 2006) were considered as very significant that they are high relevance. It's not mean that the other CSFs with a summation less than 3 are not important. But also, these CSFs are less relevant with the stages of the implementation.

Therefore, all of the CSFs should be carefully considered. The high relevant factors in each stage are gray highlighted in Table 2 to show more visible. It can be seen that the most quoted factors that are significant in the most of the stages of implementation are related to them are: "Upper-Management Support, Commitment and Communication" and "Culture & Resource Management" factors with total 86 iterations of quoting as important (or very important) factors by experts panel. The second rank is being allocated to "Project Management and Evaluation" and "ERP Project Team & Training" factors with 83 iterations. The third grade is for "Consultant and Vendor Services" factor with 62 occurrences. "Process Reengineering & Change Management" is ranked in fourth grade with 44 iterations and "Technology

Management & Suitability" is the next one with 38          occurrences**.**

Table 2. The matrix of CSFs versus implementation stages interrelationship

| Critical Success Factors / Stages of Implementation | Consultant and Vendor Services | Upper-Management Support, Commitment and Communication | Technology Management & Suitability | Process Reengineering & Change Mgt | ERP Project Team & Training | Project Management and Evaluation | Culture & Resource Management |
|---|---|---|---|---|---|---|---|
| Enterprise Identification | 1 | 7 | 0 | 0 | 0 | 5 | 3 |
| Conceptual Definition | 4 | 6 | 0 | 0 | 1 | 5 | 3 |
| Setup | 2 | 5 | 1 | 1 | 7 | 6 | 3 |
| Requirements | 5 | 8 | 5 | 2 | 7 | 7 | 6 |
| Current status analysis (AS-IS) | 5 | 6 | 2 | 3 | 7 | 5 | 3 |
| Business architecture | 6 | 6 | 2 | 6 | 7 | 3 | 8 |
| Design | 6 | 4 | 1 | 7 | 8 | 8 | 8 |
| Configuration and Testing | 6 | 5 | 5 | 5 | 8 | 8 | 8 |
| Migration Planning | 6 | 6 | 1 | 3 | 8 | 8 | 8 |
| Implementation | 8 | 8 | 3 | 4 | 8 | 3 | 8 |
| Stabilization | 2 | 6 | 6 | 5 | 8 | 3 | 8 |
| Acceptance and Regular Operation | 2 | 8 | 1 | 6 | 8 | 3 | 8 |
| Evaluation | 5 | 5 | 6 | 1 | 3 | 8 | 3 |
| Continuous Improvement | 4 | 6 | 5 | 1 | 3 | 6 | 3 |
| **Total** | **62** | **86** | **38** | **44** | **83** | **83** | **86** |

## 7. Case Study

To check applicability and validation of the framework, it was applied in a case study. Company A was established in 1985 and started to producing in 1992 in industrial region of Yazd, Iran and one of the pioneer companies in producing of refractory materials in Iran. It has about 230 employees and can be classified as medium sized enterprise with annual selling in 2011 was about 2.58 million US$. The company used computerized information systems in 1992 and installed the ERP system, designed and implemented by one of the local vendors, in 2005. The system was improved to new version modules in early of 2012 among an improvement and implementation project during three months. The proposed framework was implied as a guideline for implementation of new version of ERP system in this company. After following the framework, the summarized results of the evaluation are as followings:

The respondent in this company was the system analyst and manager of IT department. He has more than eleven years experience in this field. He believed that the proposed framework with including of the appendix and detailed description is complete and their company followed it regarding the requirements of the implementation and improvement of ERP system in the company. Totally about 70% of the stages of the framework could be implied in their firm and about 35% of the CSFs were considered among the implementation of the system. Nevertheless, some of the articles and approached could not be followed

because of the required infrastructure was not been ready. The respondent in this case company believed that there is not any wrong link, wrong or extra element in the proposed framework and it was useful for their company and can be useful for similar ones. He mentioned the phase 3 (implementation and control) and phase 4 (evaluation and improvement) have most usefulness stages and noted as the strength points of this framework. The framework is simplified adequately and included the all required stakeholders in implementation of the system. The suggestion to improve the usability of this framework is preparing and enhancing of organizational culture in SMEs of developing countries. The results of the survey in this case showed that the proposed framework covers all required specifications of SMEs' framework**.**

## 8. Conclusion

Now a days, enterprises can be alive only and only if they can fulfill their customer orders in proper time, with the best cost and quality and also can obtain the reasonable customer service for them (Irfan *et al.*, 2008). Information technology and particularly ERP systems can facilitate these aims. While there is wide adoption of ERP systems in Western economies, developing countries lag far behind them (Al-Mabrouk and Soar, 2009). However, due to recent economic growth and increased global competitive pressure, developing countries and especially the SMEs in these countries are increasingly becoming major targets of ERP vendors. As ERP systems are still in their early stages in these countries, there is an urgent need for understanding ERP implementation issues in SMEs of developing countries.

The authors attempt to specify the required characteristics of SMEs' framework and then propose a comprehensive conceptual framework with considering of the desired specifications of SMEs framework. This framework includes the approaches, elements and implementation methodology processes.

The proposed conceptual framework included four phases of implementation as lifecycle: planning, selection and design, implementation and control, and evaluation and improvement. There are also the required elements in the framework that can improve the suitability and usability of the framework: project champion / steering committee, project management plan, critical success factors (CSFs), organizational environment, external environment, stakeholders, standard, security and workforce.

The including of simplified methodology in the framework and attending of required characteristics of SMEs' framework can facilitate the implementation of the ERP in SMEs without need to technical tools, high experienced and technical staffs. Furthermore, identification of interrelation of CSFs and implementation stages can guarantee catching the ERP project aims.

The proposed framework was validated in an Iranian SME and the results showed that it is a comprehensive methodology that can help SMEs of developing countries to implement their own ERP systems. It needs further studies and implementing in different industries cases to improve the validation and possible revision to enhance it**.**

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