An Investigation and Classification of ERP Project Managers’ Required Skills

Mohsen Sadegh Amalnik, School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran
Ahad Zare Ravasan, Department of Information Technology Management, Mehralborz Institute of Higher Education, Tehran, Iran

ABSTRACT

Implementation of Enterprise Resource Planning systems (ERPs) is a complex and costly process that is usually accompanied with serious risks. Numerous research projects have been conducted to illuminate ERP Critical Success Factors (CSFs) so as to identify the main factors in enhancing success rate. Although project managers’ skills of ERP system implementation projects are viewed as one of the most effective factors in the success of such projects, scant attention has been paid to them and their unique aspects have not been sufficiently discussed in the extant literature. Hence, this article aims at identifying the most relevant skills of ERP project managers and proposing a classification scheme. Based on the results of the robust Exploratory Factor Analysis (EFA), 16 identified skills were grouped into four distinct categories: “managerial,” “project management,” “human resource,” and “technical.” The results of this article can help scholars and managers to grasp an in-depth understanding of the skills required for project managers and the challenges they have to mitigate while implementing ERP projects.

KEYWORDS
Critical Success Factors (CSFs), Enterprise Resource Planning (ERP), ERP Project Managers’ Skills, Robust Exploratory Factor Analysis (EFA)

INTRODUCTION

Enterprise Resource Planning (ERP) systems are defined as software system allowing the complete integration of information flow from all functional areas in companies by means of single database; such a system is accessible through a unified interface for communication (Davenport, 1998). These systems have been increasingly adopted by organizations across various industries. Despite the numerous capabilities and advantages offered by ERPs, their implementation has not always proved to be effective and a high rate of failure has been reported as a major concern (Zare Ravasan & Mansouri, 2014). Therefore, over recent years, some researchers have provided valuable insights into the process of ERP implementation (e.g., Abdel-Kader & Nguyen, 2011; Soja, 2008; Soltani, Elkhani, & Bardsiri, 2014; Subramanianh & Hoffers, 2005; Wang, Shih, Jiang, & Klein, 2008) and others reported a set of Critical Success Factors (CSFs) or Critical Failure Factors (CFFs) in ERP projects (e.g., Amid, Moalagh, & Zare Ravasan, 2012; Payam Hanafizadeh, Gholami, Dadbin, & Standage, 2010; Khattak et al., 2013; Kini & Basavia; 2013; Nour & Mouakket, 2011; Zhang et al., 2005). Within these lists of ERP projects’ CSFs, the availability of competent ERP project team and required competencies of...
project team members have been enumerated among the important CSFs (Doom, Milis, Poelmans, & Bloemen, 2010; Soja, 2006; Upadhyay & Jahanyan, 2011; Zare Ravasan & Mansouri, 2016). Similarly, some researchers have considered the inadequate skills of project team members as one of the main failure factors in ERPs (Aloini, Dulmin, & Mininno, 2007; Beheshti, 2006; Hawari & Heeks, 2010). As a result, previous research highlights the significance of competencies and selection of qualified and competent team members that possess the appropriate knowledge and skills. It is clear that the success of an ERP project relies on its team members competences. In particular, given the enterprise wide scope of an ERP project, the availability of interdisciplinary and specialized skill groups in the form of teams is of crucial importance (Hanafizadeh & Ravasan, 2011).

That is why it is imperative to make sure that team members possess the essential skills of carrying out an ERP project. In addition, since ERPs are more complicated than the traditional information systems, it is crucial to identify and evaluate the skills of individuals that are heavily involved in these sort of information systems (Mahdavian & Mostajeran, 2013). Then, the overall purpose of this research is to identify and classify the critical skills required of project managers in implementing ERPs. It is noteworthy that regarding our in-depth literature review, no research on the identification and classification of critical skills required of ERP project managers has been undertaken or if any, the results have not been published widely. Identification and classification of these skills help organizations focus effectively on enhancing the chance of their success in implementing the system.

LITERATURE REVIEW

Schmidt (2001) implied that the lack of required knowledge/skills in the project team is amongst the top five factors influencing the success of information technology (IT) projects. In the same vein, Wateridge (1997) argued that the skills of project managers fulfill a critical role in the success of IT projects, so organizations should focus on developing these skills if they wish to perform IT projects efficaciously. While Verner and Evanco (2005) were attempting to identify the successful methods of conducting software development projects, they came up with some evidence that confirmed Wateridge’s argument. These findings indicated that communication skills of project managers, staff’s competence, and the ability to control the project have positive and significant impact on ERP system success (Verner & Evanco, 2005). Since specific skills required of IT project managers appear to be linked to the results of a project, it is of vital importance to identify these skills. If there is a list of ranked skills required of IT project managers, it will be conducive in many respects (Keil & Lee, 2013). The rest of this section provides an overview of the most recent related studies in the field.

One of the most important research studies was undertaken by Sumner (2000). She reviewed seven IT system implementing projects at the organizational level and identified 20 risk factors through interviews with firms’ project managers and then categorized them into six groups. In another research, Somers and Nelson (2001) explored the most important critical factors in implementing ERPs. They enumerated 22 essential factors in implementing ERPs and then recognized the most significant of these factors in implementation phase. In their study, competency of project team members, preceded by senior managers’ support, was ranked as the second essential factor in successfully implementing ERPs.

Kumar et al., (2003) identified the major barriers to ERP implementation projects. One of the significant factors identified were the lack of access to proficient and skillful team members. In reviewing the research on the ERP CSFs, Pairat and Junghirapanich (2005) found out that in the majority of studies, team-working in ERP implementation projects has been viewed as one of the major CSFs. Soja (2006) identified ERP CSFs and elaborated that the team composition (making teams with diverse set of knowledge and skills) is the third important factor influencing the successful implementation of ERP projects. Other scholars have referred to the significance of project managers’ competencies, qualifications, and skills in implementing ERPs (Al-Mashari, Ghani, & Al-Rashid, 2006; King, 2006; Remus, 2006). In another study done by Aloini et al., (2007) based on the literature
review and analyzing critical factors in the ERP implementation, risk factors were identified and poor skills of a project team was determined as one of those ten risky factors.

In a study by Wu et al., (2004) presented an activity competency model (ACM) that was developed to investigate the perceived importance of managerial activities and skills/knowledge required for three levels of information systems (IS) managers from three types of industries. The results of that study revealed the importance of IS managerial activities varies significantly for different levels of management but does not vary significantly for different industries. Napier et al., (2009) asking 19 IT project managers to describe the skills that successful IT project managers exhibit, identified 46 skills under nine main categories including client management, communication, general management, leadership, personal integrity, planning and control, problem solving, systems development and team development.

Along the same lines, Hanafizadeh and Zare Ravasan (2011) carried out a research study to investigate organizational readiness for implementing ERP system. They examined the various skills needed by IT managers, end users and IT staff in the implementation of ERP systems as one of the main factors in ERP readiness. In another study, Mahdavian and Mostajeran (2013) investigated the skills required in information systems and ERP systems, determined skills required of power users, and then evaluated factors in successful implementation of ERP systems.

A review of the literature illustrated that researchers have mainly attempted to identify the reasons for success and failure in ERP projects. However, what is important in this research is to recognize and prioritize ERP project management skills. As it can be understood by reviewing previous research, only one single study by Mahdavian and Mostajeran (2013) has been conducted to classify power users’ skills required to implement ERP systems. Then, the novelty of this research is its focus on the skills required by project managers as one of the main pillars in ERP implementation projects.

**ERP PROJECTS MANAGERS’ REQUIRED SKILLS**

In this section, through review of literature, the required skills of ERP project managers are identified and introduced as below:

1. **Technical and Support Skills**: Technical skills are typically associated with developing IT systems. This group of skills entails technical knowledge as well as knowledge of development methodologies, processes and techniques used in IT systems (Keil & Lee, 2013). This group also includes providing support for hardware and software, the use of equipment, and/or installation and operation of systems in a timely manner, ensuring that the system is properly installed and appropriately maintained in their right place, being aware of the technical knowledge to make communication possible, creating communication networks to establish effective relationship with technical and managerial staff. (Wei, 2007). It is essential that project managers be equipped with this skill in order to have an adequate understanding of the technologies utilized for effective decision making throughout the project phases. It is noteworthy that these technologies must be aligned with business objectives (Keil & Lee, 2013). Support skills also embrace activities that lead to sustainability of applications. Additionally, this skill includes training, updating, constant communication, discussing the status quo and problems, and defining policies and procedures (Mahdavian & Mostajeran, 2013);

2. **Business Planning Skills**: Refer to a deep understanding of the business units and effective employment of IT/IS to figure out solutions to business problems. This skill may incorporate participation in business strategies, applying IT tools in practice, and creating new values through IT for the business (Wei, 2007). Other subskills include knowledge of business processes, knowledge of business functions, the ability to promptly capture customer needs, the ability to understand and analyze the business environment, the ability to interpret business problems, the
ability to develop appropriate solutions to business problems, business processes re-engineering skills, the rapid respond to business problems, etc. (Mahdaviani & Mostajeran, 2013);

3. **ERP Skills**: Pertain to selection, acceptance and /or negotiation about internal and external resources to meet the requirements of the project at the designated time. This skill involves search for and access to external resources, consultation and/or other services / product resources that are needed to accomplish the goal (Wei, 2007), awareness of ERP concepts, programming languages related to ERP (e.g., ABAP, JAVA), general configurations of ERP systems, ERP technical knowledge, skillfully utilizing human resources, appropriate selection of ERP package, etc. (Keil & Lee, 2013; Mahdaviani & Mostajeran, 2013; Nah & Delgado, 2006; Napier et al., 2009; Peslak & Boyle, 2010; Skulmoski & Hartman, 2010; Stevenson & Bekkering, 2007);

4. **IT Management Skills**: Denote the ability to learn new technology skills, and the ability to understand the IT trends (Mahdaviani & Mostajeran, 2013). The IT service management tasks including IT service strategy, design, transition, implementation and continuous improvement according to ITIL version 3 framework (Galup, Dattoro, & Quan, 2016). Also, this skill means taking time to examine the organization’s environment in order to develop IT and related technologies employed to comprehend business concepts. Similarly, it refers to the comprehensive exploration of internal strengths in order to utilize opportunities for the use of IT innovation and the alignment of IT management strategies with IT organizational strategies (Mohammadi, Zare Ravasan, & Hamidi, 2015; Wu, Yi-Cheng, & Jack, 2007);

5. **Behavioral Skills**: Signify special personal qualities that required of a competent IT project management in order to implement projects. Even though in this category there are personal characteristics that may be innate, but they can still be promoted and developed (Keil & Lee, 2013). Capabilities such as self-confidence, determination, patience, creativity, etc. are incorporated in this group (Keil & Lee, 2013; Napier et al., 2009; Peslak & Boyle, 2010; Skulmoski & Hartman, 2010);

6. **Project Management Skills**: Refers to the awareness of and experience in techniques, principles and tools of a project (Mahdaviani & Mostajeran, 2013). Project management skill entails subskills that are related to various aspects of IT projects containing scope, time, quality and budget (Golpira, 2015). IT project management competence is associated with the ability to effectively plan, monitor, and control projects (Keil & Lee, 2013). Skills/knowledge of project management in an organization embraces processes related to project initiation, planning, implementation, monitoring, reporting, and closure of a project, risk management, and control of project time, cost, and quality (Wu et al., 2007);

7. **Communication and coordination skills**: Refer to the ability to communicate effectively (e.g., verbal, and written communication), constructive communication, and management communications (Mahdaviani & Mostajeran, 2013; Wu et al., 2007). This skill implicates the subskills needed to communicate with those involved in a project and includes listening skills that are essential to understand the expectations and recognize the problems that might arise in a project. Similarly, coordination means synchronizing IT activities in support of operational managers, suppliers and customers (Wu et al., 2007);

8. **Team management Skills**: Skills / knowledge that help project managers to achieve goals of the team in terms of specific measures or criteria and to ensure collaboration of information system members in order to move toward the users’ goals (J.-H Wu et al., 2007). In other words, team management skill incorporates those subskills that are required for IT project management;

9. **People and Social Relations Skills**: Refer to social skills in relationship management and networking (Wu et al., 2004). This skill is required of project managers so that they can get along well with anyone who is involved in a project. These skills are also related to understanding the perspectives of the various stakeholders involved in the project as well as managing conflicts and activities influencing people (Keil & Lee, 2013);
10. **User training Skills:** Intends to provide knowledge of teaching methodology, assessment methods to measure education, and measurement of the user’s learning. This skill leads to the development of end-users’ capabilities and applies those capabilities to information systems by providing training courses which allow end-users to think clearly of solving the problems and catering for the expectations of their customers. This skill involves skills / knowledge required to carry out needs analysis, determine areas that require education, offer proper training programs, perform and evaluate education programs, seek for relevant training programs and specific skills that are concerned with job duties and are conducive to their growth and development (Jen-Her Wu et al., 2004);

11. **Change Management Skills:** Change management means planning, launching, understanding, and eventually stabilizing change processes at corporate and personal level (Recklies, 2001). This skill embraces knowledge of the conceptual underpinnings of change management strategies and an awareness of strategies that are employed to deal with resistance to change (Mahdavian & Mostajeran, 2013);

12. **Stress Management Skills:** Entail subskills in identifying stressful factors and implementing strategies to overcome stress (Mahdavian & Mostajeran, 2013). Project managers should be able to moderate stress for proper performance since projects do not always proceed as scheduled nor accomplished within forecasted budget (Keil & Lee, 2013);

13. **Negotiation and Conflict Management Skills:** Means conflict resolution between subordinates and staff peers (Jen-Her Wu et al., 2004). This skill also comprises the ability to negotiate with stakeholders, project team members and suppliers to come to mutually agreed terms with regard to programs, costs, and risks (Keil & Lee, 2013);

14. **Decision Making and Problem-Solving Skills:** Means realizing the problem, recognizing and evaluating solutions, selecting the best solution and evaluating their results (Mahdavian & Mostajeran, 2013). This skill includes a set of skills required to identify, analyze, and solve problems that arise during the course of the project (Keil & Lee, 2013);

15. **Diagnostic and analytical skills:** Refer to the ability to analyze difficulties and problems at various stages of a project (Keil & Lee, 2013). It also entails the analysis and review of work, including gathering relevant information needed to evaluate the project with considering business conditions, current technologies, and policies to which organizations are committed or have been laid down for a certain period of time (Wu et al., 2007);

16. **Planning Skills:** Consist of the ability to break down a high-order goal into measurable and rational sub-goals and tasks, the ability to plan schemes and activities and set out appropriate and significant milestones (Keil & Lee, 2013);

17. **Organizing Skills:** Refers to the ability to coordinate and organize the elements (project activities and resources) in a system (Keil & Lee, 2013). This skill involves setting a goal/ a set of goals, setting steps, the allocation of resources, organizing and forming activities into one single coherent unit or performing a general operation to accomplish programs (Wu et al., 2004);

18. **Leadership Skills:** Means the ability to lead the project team, empowering and motivating team members. A powerful and influential leader can make a team powerful (Keil & Lee, 2013). It also includes identifying the way to communicate with subordinates, setting out the environment in which they work, examining the individuals’ activities to ensure their awareness and alertness to a sufficient level (Wu et al., 2004).

**Research Method**

The research steps including identifying ERP project managers’ skills, instrument development, data collection, data analysis using robust EFA is shown in Figure 1.

An 18 items questionnaire has been designed based on the identified ERP project managers’ skills. The survey instrument asked the respondents to rate the importance of each 18 skills using a nine-point scale with items ranged from 1 (strongly low) to 9 (strongly high). The target of this
study was ERP project team members in Iranian firms who had ERP implementation experience. In order to gather data from the respondents, at first, the companies and related ERP team members were identified, then they were asked to fill the questionnaire and finally, they filled and replied the questionnaires. Totally, 300 questionnaires were sent out to the respondents, 117 questionnaires were gathered and 105 usable questionnaires were used for the data analysis (response rate: 0.35). Sample size of 105 seems to be adequate for conducting robust EFA (recommended ratio of 5:1) (MacCallum, Widaman, Preacher, & Hong, 2001).

RESULTS

EFA is a frequently used method to discover patterns of multidimensional constructs that are subsequently used for the development of measurement scales. Its major objective is to reduce the number of observed variables to fewer factors in order to enhance interpretability and detect hidden structures in the data. Here, robust EFA (Treiblmaier & Filzmoser, 2010) was employed to perform the analysis. Prior to factor analysis, a test was conducted to verify the adequacy of the data for FA. The Kaiser-Meyer-Olkin (KMO) was calculated to ensure sampling adequacy. The KMO for the sample, is 0.87 which is above the “Mediocre” threshold of 0.5 (Kaiser, 1974). Furthermore, we also performed a Bartlett sphericity test, which was statistically significant (p < 0.05), indicating the eligibility of the data. Then, we used a Shapiro–Wilks test to determine whether our sample had a normal distribution. We found that none of our variables was normally distributed. Thus, principal component analysis (PCA) was our choice for the factor extraction method as proposed in robust EFA. The rotation method should also be selected for the robust EFA purpose. Oblimin rotation, which is proposed in robust EFA was used in this research (Treiblmaier & Filzmoser, 2010). Finally, the number of factors to be extracted from the data were determined based on Eigen values greater than one, and an absolute factor loading values greater than 0.6 (Chin, Gopal, & Salisbury, 1997). As a result, two out of 18 factors were dropped from the initial pool and remained 16 factors were grouped into four components. The results can be seen from Table 1.

Extraction method used is Principle Component Analysis and the rotation method used is Oblimin. To indicate the meaning of the components, they have been given short labels indicating their content. Since the results of this stage were open to several interpretations, we decided to use experts’ opinions here. So, three ERP project managers were invited and based on the discussions on the factors meanings in each component, four “Managerial”, “Project Management”, “Human”, and finally “Technical” labels were assigned to the extracted components. The final results are shown in Table 2.
Table 1. The results of robust EFA

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<tbody>
<tr>
<td>Negotiation and conflict</td>
<td>0.78</td>
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<td>management skills</td>
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<td>Decision making</td>
<td>0.80</td>
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<td>and problem-solving</td>
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<td>skills</td>
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<td>Diagnostic and analytical</td>
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<td>skills</td>
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<td>Organizing skills</td>
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<td>Leadership skills</td>
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<td>Project management skills</td>
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<td>Team management skills</td>
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<td>Planning skills</td>
<td>0.77</td>
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<td>Communication and</td>
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<td>coordination skills</td>
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<tr>
<td>People and social skills</td>
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<td>User training skills</td>
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<td>Change management skills</td>
<td>0.82</td>
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<td>Stress management skills</td>
<td>0.85</td>
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<tr>
<td>Technical and support</td>
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<td>skills</td>
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<td>ERP skills</td>
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<td>IT management skills</td>
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<td>0.87</td>
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<tr>
<td>% of variance</td>
<td>24.71</td>
<td>20.36</td>
<td>16.54</td>
<td>13.23</td>
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<td>Cumulative %</td>
<td>45.07</td>
<td>61.61</td>
<td>74.84</td>
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Table 2. Extracted components and their related factors

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Factor Name</th>
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<tr>
<td>Managerial</td>
<td>Negotiation and conflict management skills</td>
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<td>Decision making and problem-solving skills</td>
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<td>Diagnostic and analytical skills</td>
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<td>Organizing skills</td>
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<td>Leadership skills</td>
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<td>Project Management</td>
<td>Project management skills</td>
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<td>Team management skills</td>
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<td>Planning skills</td>
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<td>Human Resources</td>
<td>Communication and coordination skills</td>
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<td>People and social skills</td>
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<td>User training skills</td>
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<td>Stress management skills</td>
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<td>Technical</td>
<td>Technical and support skills</td>
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<td>ERP skills</td>
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<td>IT management skills</td>
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DISCUSSION

The classification made in this study partially resembles those in previous studies that intended to identify skills required for the ERP implementation projects. Hanafizadeh and Zare Ravasan (2011) and Mahdavian and Mostajeran (2013) based on the (1974) taxonomy, classified skills into three main groups: technical, human and conceptual. In this research, the technical and human skills are left intact, and managerial skills are defined similar to the conceptual skills cited in the two mentioned studies. Moreover, a new group of project management skills being proposed, here. Each distinct category is discussed in the following.

MANAGERIAL SKILLS

According to the research results (see Table 1), managerial skills are considered as the most significant skills required of project managers in ERP implementation projects. The negotiation and conflict management skill, problem solving and decision-making skill, diagnostic and analytical skill, the organizing skill, and leadership skill are included in this skill group. As it can be observed in the Table 2, the organizing skill is of more importance compared with other skills. This skill can be broken down into these subskills: applying knowledge of the organization (Wateridge, 1997), configuration management (Wateridge, 1997) and organizing skills (Keil & Lee, 2013; Napier et al., 2009).

Diagnostic and analytical skill is comprised of these subskills: understanding failure criteria (Wateridge, 1997), understanding systems and methods (Wateridge, 1997), analysis and judgment (Skulmoski & Hartman, 2010; Wei, 2007), understanding the strategies of the project (Wateridge, 1997), quickly understanding the capabilities of the customer (Peslak & Boyle, 2010), and analyzing users’ feedback (Nah & Delgado, 2006). The problem solving and decision-making skill includes the ability to make a persuasive argument (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010). Leadership skill can also include the ability to lead a team (Wateridge, 1997), the ability to accomplish the assigned missions (Peslak & Boyle, 2010), the ability to define project milestones (Nah & Delgado, 2006), the ability to facilitate project meetings (Napier et al., 2009), the ability to identify the stakeholders (Skulmoski & Hartman, 2010), the ability to admire and appreciate success (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), awareness/agility/political tact (Skulmoski & Hartman, 2010), the ability to create an efficacious environment (Skulmoski & Hartman, 2010; Wateridge, 1997), the ability to terminate the project (Keil & Lee, 2013; Skulmoski & Hartman, 2010), the ability to make a project appealing (Skulmoski & Hartman, 2010), the ability to upgrade to a newer system or platform (Stevenson & Bekkering, 2007), the ability to deal proactively with problems (Napier et al., 2009), the ability to discern whether the project succeeds or fails (Wateridge, 1997), the ability to manage goals (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), the ability to empower leaders (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), taking responsibility for errors and flaws (Napier et al., 2009), the ability to learn and self-assess (Skulmoski & Hartman, 2010), and being sensitive to organizational culture (Peslak & Boyle, 2010).

PROJECT MANAGEMENT SKILLS

According to the results of the study, preceded by management factor, project management component appears as the second most important skill required of project managers to implement the ERP systems. Effective project management fulfills a critical role in successful implementation of ERPs. In project management, not only should responsibilities be clearly assigned, but it is also essential to clearly define the ERP project objectives and monitor their achievement. Given the huge number of people involved in the implementation of ERPs, it is of prime importance to coordinate activities of all parties involved in the project (Nah & Delgado, 2006). Internal integration tools are necessary
for coordinating the activities involved in the project; while, external integration tools are needed to facilitate collaboration with external stakeholders and to ensure that users’ requirements are integrated with the system processes. The success of a project can be assessed based on the completion date, cost, quality and performance of the system (Nah & Delgado, 2006).

Project management factor refers to the following subskills: project design (Skulmoski & Hartman, 2010), application of the principles of project management (Napier et al., 2009), the allocation of responsibilities (Nah & Delgado, 2006), utilization of project management tools (Keil & Lee, 2013; Skulmoski & Hartman, 2010), the use of knowledge management technologies (Mahdavian & Mostajeran, 2013), management of multiple projects / tasks (Keil & Lee, 2013), justification of investment in ERPs (Nah & Delgado, 2006), expenditure management (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), time management (Keil & Lee, 2013; Mahdavian & Mostajeran, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), scheduling techniques (Wateridge, 1997), risk assessment and management (Keil & Lee, 2013; Mahdavian & Mostajeran, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), the ability to focus on quality (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010) and monitoring and controlling (Wateridge, 1997).

Another skill associated with this factor is team management, which involves the subskills as the ability to build up a team (Mahdavian & Mostajeran, 2013), the ability to make connections between different teams (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), the ability to remove obstacles the team may encounter (Napier et al., 2009), the ability to create a virtual team (Keil & Lee, 2013; Skulmoski & Hartman, 2010), interpersonal skills (Tadinen, 2005), the ability to motivate team members (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), the ability to support team members (Skulmoski & Hartman, 2010) as well as the ability to manage large teams (Stevenson & Bekkering, 2007). The last skill introduced in the project management factor is planning skill which comprises such subskills as the application of planning techniques (Wateridge, 1997), strategic thinking (Keil & Lee, 2013; Napier et al., 2009) and strategic planning (Keil & Lee, 2013; Mahdavian & Mostajeran, 2013; Napier et al., 2009; Tadinen, 2005; Wateridge, 1997).

**HUMAN SKILLS**

The human factor is recognized as the third group of skills required of project managers. Previous research demonstrates that the main reason for the failure of IT projects is related to the organizational and social issues rather than technical problems (Amid, Moalagh, & Zare Ravasan, 2012). In the implementation of ERP systems, the major resistance to change and problems (90%) are demonstrated by the organization’s human resources and staff; and technical issues account for only 10 percent of the problems (Wognum, Krabbendam, Buhl, Ma, & Kenett, 2004). Hence, the essential human skills are indispensable to human resource management and project team members. It is worth mentioning here that human skills can be denoted as “people skills” (Mahdavian & Mostajeran, 2013). Katz (1974) introduces human skills as the ability to work effectively as a member of a group and the ability to coordinate the team. Human skills are mostly needed at all levels of management in organizations. Successfully implemented ERP projects rely heavily on human factors that embrace essentially diverse stakeholders in project implementation. When any of the personnel of a company is mainly involved in a new ERP system on a daily basis, technological and organizational issues also arise in parallel with human and political issues (Akkermans & Van Helden, 2002; Mendel, 1999).

The human factor refers to communication and coordination skills, including a variety of written and oral communication skills (Keil & Lee, 2013; Mahdavian & Mostajeran, 2013; Napier et al., 2009; Stevenson & Bekkering, 2007), listening skills (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010), public relations (Skulmoski & Hartman, 2010), industrial relations (Wateridge, 1997) and communication at all levels (Nah & Delgado, 2006). Another skill of the human factor is social relation skills that is composed of subskills such as the ability to deliver impressive messages (Peslak & Boyle, 2010; Skulmoski & Hartman, 2010), understanding people from a psychological.
perspective (Keil & Lee, 2013; Napier et al., 2009), raising good questions (Skulmoski & Hartman, 2010) and responding to others’ questions (Napier et al., 2009). As illustrated in the Table 2, the human factor incorporates education skills, change management, and stress management, as well.

TECHNICAL SKILLS

The final skill required of project managers is related to technical knowledge. Technical knowledge is concerned with the ability to use methods, techniques and equipment. In other words, a manager should acquire the essential knowledge about the tasks, methods and styles through education, and training courses. The technical skill addresses the ability of managers to recruit specific methods and techniques while performing managerial tasks. However, these technical skills are not contingent on technologies such as engineering skills. Technical skills for managers refer to the use of methods such as dissecting tasks in minute detail, planning analysis or the ability to conduct structured interviews (Papulová & Mokroš, 2007). According to Katz (1974), this skill group involves skills of “how to do business” and the relevant methods, processes, procedures and techniques. The technical factor also includes technical and support skills such as support for end-user computing (Peslak & Boyle, 2010), support for existing practical applications (Peslak & Boyle, 2010), support for hardware (Peslak & Boyle, 2010), the use of telecommunications and networking (Peslak & Boyle, 2010; J.-H Wu et al., 2007), as well as professional skills in using the operating system (Peslak & Boyle, 2010; J.-H Wu et al., 2007), the use of programming languages (J.-H Wu et al., 2007), data management (Krimpmann & Stühmeier, 2017; Wahi, Medury, & Misra, 2015), the use of relational databases and database management systems (Peslak & Boyle, 2010; J.-H Wu et al., 2007), the use of decision-making support systems (Peslak & Boyle, 2010), skills development methodology (Keil & Lee, 2013; Napier et al., 2009), design/integration, and analysis of information systems (Peslak & Boyle, 2010; J.-H Wu et al., 2007), teaching and educational skills (Mahdavian & Mostajeran, 2013; Stevenson & Bekkering, 2007), multilingualism (Jen-Her Wu et al., 2004), the ability to effectively write reports / notes/documents (Peslak & Boyle, 2010), and research skills (Keil & Lee, 2013; Napier et al., 2009).

ERP skill is considered as another skill in the set of technical skills. It embraces such subskills as the ability to understand and use programming languages related to ERP (Peslak & Boyle, 2010), awareness of the ERP concepts (Peslak & Boyle, 2010), the overall architectural settings of ERP (Nah & Delgado, 2006) and its technical knowledge (Keil & Lee, 2013; Mahdavian & Mostajeran, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010; Stevenson & Bekkering, 2007; Wateridge, 1997), the exploitation of resources (Keil & Lee, 2013; Napier et al., 2009; Skulmoski & Hartman, 2010) and selection of the appropriate ERP packages (Nah & Delgado, 2006). The IT management skill (Tadinen, 2005; Wu et al., 2007) is viewed as another technical skill. In this skill, it is highly recommended that more attention be paid to the ability to learn new technologies (Peslak & Boyle, 2010), and the ability to apprehend the technological trends (Wateridge, 1997; Wu et al., 2007).

CONCLUSION AND LIMITATIONS

Over the years, business organizations have undergone a great deal of pressure to adapt to variable business environments. Organizations should be able to quickly adapt to the changing business conditions, if they are supposed to survive, especially in today’s highly volatile market. To overcome this problem, large organizations around the globe are seeking for agility and flexibility and are striving to address internal and external changes in their business by implementing enterprise systems such as ERP systems. Despite all the advantages that ERPs bring to organizations, the high failure rate is a major concern. Therefore, many researchers have been motivated to identify factors effective in success or failure of ERP implementation. In the same vein, the current study was carried out to find out the answer to this question “What skills are required of project managers to implement ERP systems?” In order to answer this question, by reviewing the most relevant literature, skills required
of project managers to implement information systems in general and ERP systems in particular were identified. In the next step, using robust exploratory factor analysis, factors including each skill were extracted. The results of the analysis revealed that four components: “managerial”, “human”, “project management”, and “technical” can be considered as the main groups of skills required of project managers to implement ERP systems. From these four components, the managerial skill and its related skills fulfill a much more significant role than other factors in implementing these systems.

The results of this study provide a fairly comprehensive classification of skills required of project managers to implement ERP systems and can assist organizations in recruiting project managers. Based on the results of the current study, it is suggested that organizations elevate the level of skills required of project managers, which were introduced in this research, if they are willing to raise the probability of success of their ERP projects. Although the findings of this study play a significant role in the successfully implement ERP systems in organizations, this study encountered some limitations. The first and most significant limitation of this study was that the skills introduced in this study were identified merely by reviewing the extant literature in this field that have mostly been conducted in well-developed countries. Therefore, with respect to the differed context of Iran as a developing country, there might be other skills required of project managers, which have not been addressed in this study. In case there are any other skills, they can be elicited through qualitative research methods such as case studies which can be offered as a research opportunity for future studies. For future research, the authors suggest that a study can be conducted to investigate the effect of any of the aforementioned skills on the project implementation phases. Moreover, future research can move beyond listing required skills and could explore the interrelationships between them. For example, investigating whether mismatches between skills of the main categories are the cause of problems or not.

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Mohsen Sadegh Amalnick received his B.Sc. degree in Electrical Engineering in 1980 from the State University of New York, America and his M.Sc. degree in Industrial Engineering and Manufacturing Engineering in 1996 from Moscow State Technical University, Russia. He also got his Ph.D. degree in Industrial Engineering and Manufacturing Engineering in 1999 from Russian Academy of Sciences, Russia. He is a full professor in Department of Industrial Engineering, College of Engineering, University of Tehran, Iran. His research interests include information technology, knowledge management, automation systems, CAD/CAM and flexible production systems, and new product development.

Ahad Zare Ravasan is currently Assistant Professor of Information Technology Management in Mehralborz Institute of Higher Education, Tehran, Iran. He has published papers in acclaimed journals, such as the Expert Systems with Applications, Information Systems, International Journal of Production Research, Production Planning & Control, Scientia Iranica, International Journal of Data Warehousing and Mining, Telecommunication Systems, Journal of Enterprise Information Management and International Journal of Enterprise Information Systems. His research interests include ERPs, business process outsourcing and business intelligence.