Identifying and Prioritizing Critical Success Factors and Indices of Implementing Enterprise Resource Planning (ERP) in Government Agencies

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Abstract: In this study, identification and prioritization of ERP implementation success factors were presented. Based on the study conducted, organizational culture, job security, education and top managers support can be named, respectively as the most important critical success factors in ERP implementation in government agencies.

Key words: Enterprise resource planning, government agencies, organizational culture, job security, education

INTRODUCTION

In today's world, the growth and development of Information Technology have changed to the most significant measure of competition and in this relation, planning systems and comprehensive databases are considered as one of the basic requirements of every organization especially government agencies and the bigger the organization, the more widely this need will be felt. Perhaps, one of the most comprehensive information systems available which has been used widely in recent years is enterprise resource planning system.

A comprehensive and integrated system like Enterprise Resource Planning system has the ability to collect information from all parts of the environment into the organization. In addition, by reducing the time of activities performance cycle, it causes better management of properties and costs reduction.

Since in new era of information and communication technology, time has a decisive role in information value especially on the battlefield and in government operations, success belongs to the unit that obtains the information in the least time (timely and accurate) which needs to have an information integrated system to take the battlefield pulse by an organized and proportionate reaction.

Therefore, one of the most important research topics regarding information systems is implementing theses systems successfully. Successful implementation of ERP can speed up logistic and operation cycles and increase future predictions precision. Although, ERP systems can bring many benefits for the organization, high failure rate in implementing such systems has created a basic concern. Thus in order to reduce the worry about applying such systems in government agencies, this study attempts to identify critical success factors and indices of implementing these systems and at the end, factors are prioritized using network analysis process to find out the importance of each factor.

Research literature

Research problem statement: A comprehensive and integrated system like enterprise resource planning system has the ability to collect information from all parts of the environment into the organization. In addition, by reducing the time of activities performance cycle, better management of properties and costs reduction, it helps government agencies in the following cases:

- Compensation of available technologies disability in organizations which work seamlessly at the same independenc
- Reducing costs arising from weak coordination between organization parts and creating a communication bridge between organization information gaps
- The possibility of controlling and precise planning of managers decision making process in crisis
- Facilitating decision making procedure due to available comprehensive and timely information available and its appropriate presentation

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Establishing enterprise resource planning systems has different steps such as evaluating organization readiness for acceptance and appropriate use of these systems, selecting the suitable system, implementing system and supporting these systems. One of the steps to establish enterprise resource planning systems is to identify and prioritize critical success factors and indices of implementing these systems. Many researchers try to clarify success factors in organizations as different titles. In this study, we try to identify and prioritize critical success factors in implementing this system in government agencies.

Research problem importance: Since, in new era of Information and Communication Technology (ICT), time has a decisive role in information value especially on the battlefield and in government operations, success belongs to the unit that obtains the information in less time (timely and accurate) which needs to have an information integrated system to take the battlefield pulse by an organized and proportionate reaction. In addition, the following cases show the importance of issue in determining battle destiny:

- Accuracy of information-operation data in all managerial levels of the organization
- Coordination and coherent compatibility of decision makers according to full and up-to-dated understanding of operation environment in order to adopt common strategic decisions
- Significant increase in resources productivity so that with the least force and facilities we obtain the most success
- Clarifying managers performance to avoid individual mistakes which would lead to saving forces life

This matter is so important that the existence of this information system can convert an organization from a static and declining mode into a dynamic unit. Therefore, we should accept a manager is in the worse information condition when he sees himself in an non-integrated, contradictory and old information archipelago and should decide on his organization fate through strategic decisions.

Research purposes: Since, in this study we want to identify and prioritize critical success factors and indices of implementing ERP systems in government agencies through a qualitative and quantitative approach, therefore Research macro and micro purposes can be categorized in the following classifications.

Main purpose: To identify and prioritize the critical success factors and indices in implementing Enterprise Resource planning system in government agencies.

Secondary purpose:
- To present an adequate strategy and method to achieve implementation success in government agencies
- To present adequate preparation plans for achieving macro goals

Research questions: According to the slow trend of establishing and doing projects and integrated systems in government agencies, we decide to identify success factors and indices of implementing Enterprise Resource Planning systems, thus, research questions are as follows:

- What are critical success factors of implementing ERP in government agencies?
- Which critical factors of implementing Enterprise Resource Planning systems are having higher priority?
- Can managers and top managers have an adequate planning for future strategies by presenting the proposed indices?

Research hypotheses: In the shadow of determining implementation success indices in government agencies, we are hopeful to understand which areas have deficiency to try to correct them, thus research hypotheses are as follows:

- The indices extracted cause increase in ERP Implementation Success Rate in the organization
- The administrative activities related to fixing the challenges of ERP implementation can be planned and managed with the help of identified indices.

Literature review: The formation of Enterprise resource planning systems was an evolutionary process. These systems are actually the evolved form of operational systems which developed in 1960s and 1970s. Material Requirement Planning System is one of the systems created before enterprise Resource planning systems and paved the way for the rise of enterprise resource planning systems. The source of materials requirement planning systems is inventory management processes mechanization. These systems ability in effective inventory management caused that system scope of action covered all the organization resources so that today various activities such as planning, manufacturing,

buying and controlling inventory, cost management, capacity planning and logistics management takes place in material requirement planning systems. Applying material requirement planning systems caused that material flow in manufacturing organization has facilitated and production cycle time and material support cost have reduced. In addition, communications between organizational units have improved and planning integration has also been created . After being recognized as an independent country in August 1965, Singapore's Ministry of Defence, as a strong and advanced unit was in charge of security. In addition to country's security, in critical situations such as flood and earthquake, Singapore military helps victims and in some cases it sends assistance forces to other countries. Therefore, establishing a comprehensive information system like enterprise resource planning system was specified as an essential action and it was implemented. Also in the USA which has one of the powerful militaries in the world, this system has been implemented and it should be pointed out that unlike Singapore which reached an agreement with SAP, US military reached to an agreement with Oracle company to implement this system. Many researchers with different titles, try to clarify these success factors for the organization. Some researchers publish some studys specifically issuing ERP critical success factors in various organizations. In these studies which will be referred to later here, researchers usually try to identify critical success factors by studying the literature and evaluate these factors with experts comments. Some of these researches are as follows: success factors of ERP implementation in organizations (Kabaran, 2012), a survey of the implementation aspects of enterprise resource planning systems in Iranian companies (Hanafizade *et al.*, 2012), determining critical factors for ERP success in Iranian government agencies (Mahmoudi and Fereidun, 2011), the effective vital factors in ERP successful implementation (Naderi, 2012), introducing practical criteria for identifying and selecting ERP in accordance with the organization, critical success factors in ERP software implementation projects, important and critical criteria for ERP success in large and medium sized companies presented by Bernoyder and Koj which includes (Depending on the operating system, process improvement, seller's market place, customer and supplier needs, software Cosmopolitanism, flexibility created in the organization, customer satisfaction, helping tips from controlling organization, software flexibility and adaptability, added creativity capacity, short implementation time, good support) and the effect of each of these factors in organization with different sizes (small, medium, large) is being pointed (Naderi, 2012).

Jiang evaluated six success factors of implementing ERP in Finland organizations and companies and indicated six factors (top management support, effective project management, business process re-engineering, hardware and software coordination, education, users motivation) as critical success factors. The researcher has pointed out in the current study that these six factors can ascertain the accomplishment of ERP implementation projects at the predicted time and cost. According to studies conducted by Ful-Hoon and Delgado there are seven sets of critical success factors identified in ERP implementation in the organization including vision and business plan, change management, communication management, combination, skill and payment of implementer team, top management support, project management and selection and analysis of system and tactic implementation. According to Markus and Tanis's four-phase model, as a result of this accordance, the importance of these seven factors was explained in different ERP performing and improving phases (Kabaran, 2012).

By considering 22 success factors in ERP implementation in organizations, Plant and Willcocks evaluated the effect of these factors on the project life cycle (Kabaran, 2012). The result was that some of these factors such as (top management support, exact definition of project objectives, strong inter-organizational communications have more effect on project life cycle. Some other researchers have discussed ERP implementation reports in different organizations and have pointed to some critical factors. On the other hand, the initial review of a comprehensive research or report which systematically evaluates implementation critical success factors shows that these factors are influenced by local and environmental conditions and success factors of ERP implementation can be defined in different forms for different countries with different environmental conditions. Meanwhile, researchers have named one or some critical success factors of implementation in Iranian organizations. For example, Mahmoudi and Fereidun (2011) whose research regards customizing ERP selection process in Ministry of commerce mentioned human factor as an influential factor in ERP implementation success. They pointed to the importance of organization culture in ERP implementation in their published study and considered organizational culture adjustment with ERP as a CSF for ERP implementation.

MATERIALS AND METHODS

Generally research methods in human sciences can be classified based on two criteria including research

purpose and data collection methods. Researches are categorized in terms of purpose into three groups: fundamental research, practical research and developmental research and the present study is practical. The purpose of practical researches is to develop practical knowledge in a specific field. In other words, practical researched are guided toward the practical application of knowledge based on the way the required data is obtained. Scientific researches are divided into two groups: descriptive research and experimental research and the present study is experimental. Descriptive studies are used to identify the existing status and the results of these studies are led to future planning and decisions or they provide a background for further, more precise studies and better direction. Since the present study is based on different ways of collecting and analysing the extracted information, the methodology of the research is survey.

Data collection tools: To collect data related to theoretical foundations and the information regarding enterprise resource planning system, library studies and evaluating documents, books, studys, reports and Internet search were used in this research.

Data collection by questionnaire: A questionnaire is a set of written questions and is mostly based on specific options which the respondent checks the answers on. Questionnaire is considered an efficient tool to collect information. In this research according to systems and available theoretical studies, the basic indices were extracted and a questionnaire was designed and was given to officials, experts in state universities and educational centres. Five-point Likert scale (strongly agree to strongly disagree) was determined and respondents determine the status of each index. After final identification of effective factors in successful ERP implementation (which was driven from analysing data obtained from the first questionnaire) the second questionnaire was used to prioritize the identified factors. Statistical population and sample

That part of the required information regarding system development indices analysis in government agencies which was obtained through experts comments, was collected by questionnaire. Therefore, statistical population consists of experts, the relevant authorities and government agencies.

Five raw proposed questionnaires (including three basics in the form of 15 indices) were collected and distributed among experts to determine the validity, and after reforms, deletions and additions the final and validated questionnaire was prepared. 140 questionnaires were distributed among the selected and targeted statistical samples including:
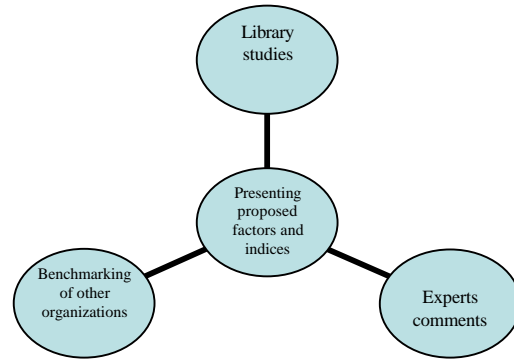

Fig. 1: Basics and indices determination

Table 1: Cronbach's alpha

Cronbch's alpha	No. of items
0.856	57

- Ministry oF Science
- Ministry of Agriculture
- Monistry of Roads
- Transportation Organization
- Sampling method

In this research, experts were used to select the sample: indices determination method and presenting proposed model.

Determining and presenting proposed basics and indices of implementation success were done through library studies, expert comments and studying cases conducted in other organizations which are presented in Fig. 1.

Based on the conducted studies, the initial framework of following factors and indices was presented in the table below to identify and prioritize critical success factors of ERP systems implementation (Fig. 2).

Data analysis method:
- Factor analysis method was used to identify success factors and to prioritize the given factors, network analysis process method wad applied

Questionnaire reliability for questionnaire data:

- Reliability is calculated through Cronbach's alpha . An alpha >0.8 indicates high reliability (Table 1)

Strategic factor analysis (top managers support index): The strategic basics includes six main indices, top.
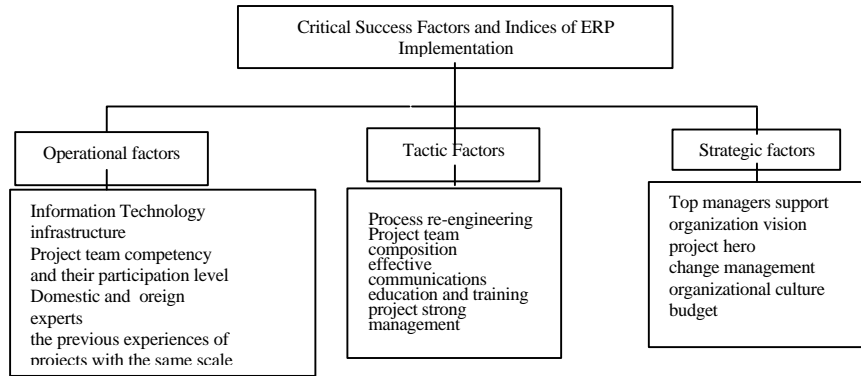
Fig. 2: Critical success factors and indices of ERP implementation
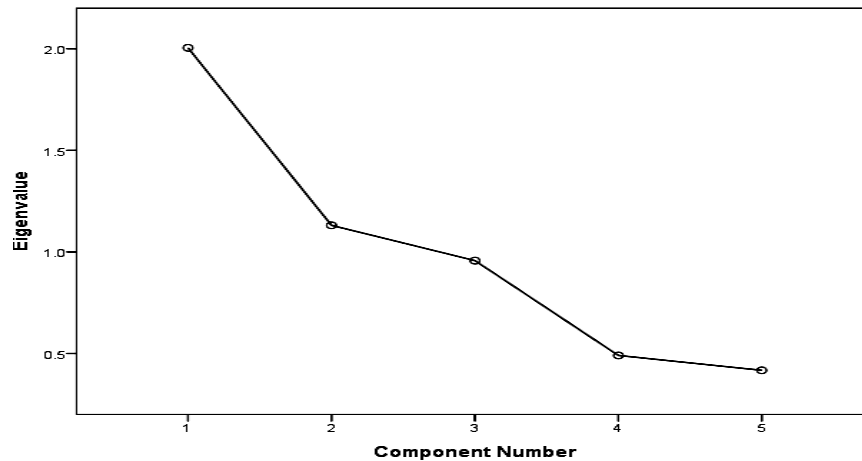

Fig. 3: Scree plot graph for top managers support

Table 2: The proposed and initial table of top managers support

Code	Secondary index	Main index
HF1	To what extent is managers and top managers commitment to run large projects (like ERP)?	Top managers support
HF2	To what extent do management and top management support running large projects?	
HF3	To what extent do managers and top managers control and pursue administrative efforts during large projects?	
HF4	To what extent do managers and top managers hold regular meetings with managers and other managers during running large projects and discuss the reasons for changes?	
HF5	To what extent can managers and top managers lack of support be a drawback for implementing large projects like ERP?	

managers support; organization vision; project hero change management; organizational culture; budget top managers support index is presented in the following proposed table with describing characteristics and mentioning the related codes (Table 2).

Scree plot graph: The following figure provides scree plot graph of proposed five-factor indices related to top managers support and extracts main and final components of this index. As the figure shows, the number of extracted components (>1) is two (Fig. 3).

Table 3: Rotary component matrix for top managers support factor

	Component	
Factors	1	2
HF1	0.804	0.160
HF2	0.821	0.207
HF3	0.375	0.761
HF4	-	0.851
HF5	0.437	-0.333

Rotary component matrix: It is observed in Table 3 that each proposed basics and index has adequate absolute loading after three rotations. So, variables with absolute factor loading >0.6 are organized in two main index

Table 4: The main and final table of top managers support index

Code	Index	Factors	Values
Coponent 1	To what extent is managers and top managers commitment to run large projects (like ERP)? To what extent do management and top management support running large projects?	Top managers support	1
Coponent 2	To what extent do managers and top managers hold regular meetings with managers and other manager during running large projects and discuss the reasons for changes? To what extent do managers and top managers supervise and pursue administrative efforts during large projects?	Regular supervisory meetings	2

Table 5: The finale table of main indices

The secondary ratified index	The main proposed index	Basics	Rows
4	6	Strategic	1
3	5	Tactic	2
4	4	Operational	3
11	15	Total	

Table 6: Final table of secondary indices

The secondary ratified index	The main proposed index	Basics	Rows
7	22	Strategic	1
7	21	Tactic	2
8	14	Operational	3

Table 7: Iindices prioritization table

Index	Certain weights	Normalized weights	Priority
Managers and top managers support	0.549	0.321	4
Software	0.468	0.256	7
Job security	0.584	0.396	2
RE-engineering	0.246	0.102	11
In-service training	0.495	0.239	8
New communication services	0.303	0.144	10
Strengthening education	0.571	0.375	3
Group decision-making process-oriented	0.682	0.413	1
Technical expertise of forces	0.428	0.211	9
Regular supervisory meetings	0.491	0.274	6
Domestic and foreign experts	0.524	0.309	5

categories as follows (HF5 is deleted). Therefore, five secondary indices were analysed in two main indices and are presented in the table below. So, the result obtained from rotary components matrix in the format of final and main index is presented in the following. Final strategic factor Table 4 (top managers support index).

As can be seen, the index of regular supervisory meetings was added to the evaluating indices. In the same way, we evaluate the other related indices. the results below were obtained. The final table of the number of main indices. Table 5-7 includes the main indices of the research.

Therefore, after doing different tests on other components and verification (final validation) of extracted indices by experts from different government agencies, the following framework is presented and finalized. The final graph of factors and indices.

According to analysis performed, the final graph of evaluating basics are presented in the following Fig. 4. The graph related to strategic factor and related indices. The graph related to tactic factor and related indices.

Fig. 4: Main indices of strategic factor

The graph related to operational factor and related indices. Now that final indices obtained from analysing factors were determined and presented, we prioritize the mentioned indices using ANP.
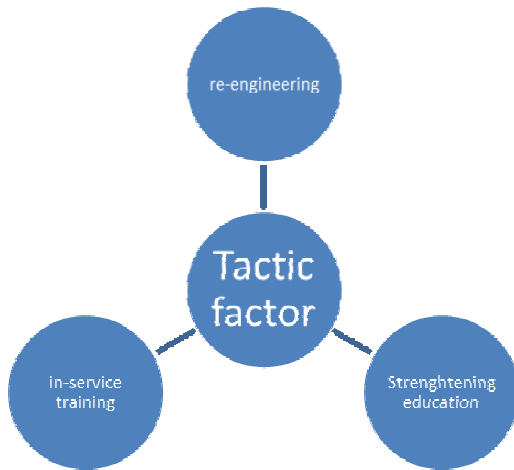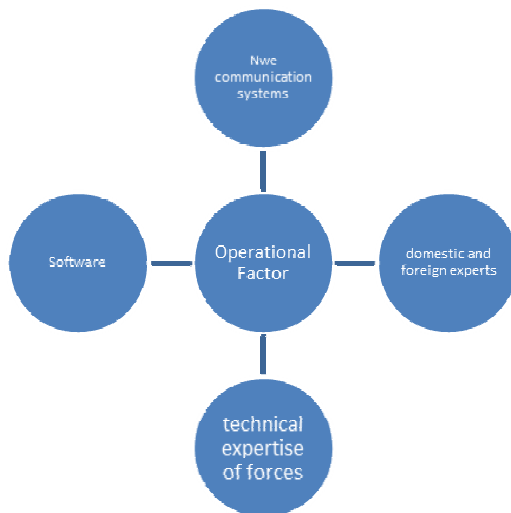
Fig. 5: Main indices of tactic factor

Fig. 6: Main indices of operational factor

Indices prioritization: Network analysis process method was used to prioritize the most important determined effective factors.

CONCLUSION

In the shadow of determining critical success indices (with high effect) of implementing ERP systems in government agencies and by using low effect indices determination, challenges of establishing this system can be identified and challenges of implementing these systems in government agencies can be restored. Thus, practical use of basics and indices of implementation success can be applied to overcome problems of running

theses systems in organization, help managers for strategic planning the future status of organization, obtain the necessary criteria to have precise control on collecting exact and timely information, organization readiness in terms of structural, managerial, human, technical, infrastructural and cultural aspects. Therefore, we can take a big step toward efficient and successful establishment of Enterprise Resource Planning system in government agencies by presenting and running the mentioned proposed model. Based on the study conducted, organizational culture, job security, education and top managers support can be named, respectively as the most important critical success factors in ERP implementation in government agencies.

SUGGESTIONS

In this study, identification and prioritization of ERP implementation success factors were presented, however, research perspective was general and no specific analysis for government agencies such as Basij, Sepah, Police, military (other organs) based on their cultural differences was not proposed in cases or proposing the integration between them. Therefore, to complete the work, the followings are suggested:

- The solutions of implementing enterprise resource planning system technology in government agencies
- Presenting the customized model of implementing enterprise resource planning system technology in government agencies
- Presenting comprehensive enterprise resource planning system for the country by all forces

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