Evaluation of the ERP Implementation at Esfahan Steel Company Based on Five Critical Success Factors: A Case Study

Mohammad Reza Moohebat, MIT

Dept. of MIT, University of Payam-e- Nour, Tehran, Iran

E-mail: moohebat@gmail.com

Mohammad Davarpanah Jazi, PhD

Foolad Institute of Technology, Fooladshahr, Isfahan, Iran

E-mail: mdjazi@cc.ui.ac.ir

Asefeh Asemi (Corresponding author), PhD

Dept. of Library and Information Sciences, University of Isfahan, Isfahan, Iran

E-mail: af_asemi@yahoo.com

Abstract

ERP implementation had always been a complicated process, but it seems it is difficult for business and companies to overlook of assets of these information systems. Iran is a developing country and tries to improve its economy and compete with other economies. Studying ERP implementation in such country which has not had noticeable experiences in this area can be interesting for developers, vendors and other similar cases in developing countries.

In this research we will investigate ERP implementation in first Iranian pioneer company that implemented and used this system. Our evaluation will be base on CSFs (Critical Success Factor) which cited as index for success of ERP implementation in others researches.

Keywords**:** Critical success factors, ERP, Information systems, Esfahan steel company, Iran

1. Introduction

On the competition edge many companies try to elevate qualities of their products and services and get the focus of their customers' attentions. Information systems play a very important role in this area. One of the most important information systems which are used in this competitive situation is Enterprise Resource Planning (ERP). ERP systems are being use in thousands of large and medium companies worldwide (Turban, McLean, & Wetherbe, 2004). Although, use of ERP has a lot of advantages, but ERP implementation can be very risky and if companies do not pay sufficient attention to their requirements and limitations, it might worsen the organization situation. ERP software can be extremely complex to implement; as companies often need to change their existing business processes to fit the ERP's framework, on the other hand, some companies require only parts of the ERP's software modules, but they have to purchase the entire package. For these reasons, ERP software may not be attractive to all companies (Turban et al., 2004). A large number of ERP based researches have been carried out around the world, but most of them related to developed countries. For this reason, it seems essential to investigate ERP implementation in the developing countries. Iran is a developing country where different organizations try to change their traditional information systems to new information systems like MIS, SCM and ERP. In recent years the number of ERP implementations has increased, however, little researches and surveys have been carried out regarding such systems in Iran. Hence, we decided to investigate success of the first ERP implementation which has been accomplished in one of the biggest and oldest companies in Iran, "Esfahan Steel Company".

The main objective of this research is to evaluate success of ERP implementation in this organization based on Critical Success Factors (CSF) consisting of the following major questions:

- How much Top management supported this project.

- How important was the role of Team project, consultants and project manager in during ERP implementation.

- Did Business Process Reengineering (BPR) accomplished completely in the organization?

- How successful was Project Management in this project?

- What was the level of user involvement in ERP implementation?

2. Literature Review

2.1 Enterprise Resource Planning

ERP life began in the 1960s in the form of Material Requirements Planning (MRP) as an outgrowth of early efforts in bill of material processing (Wallace & Kremzar, 2001). MRP inventors were looking for a better method of ordering material and components. It used the master schedule (What is going to be made?), the bill of material (What it takes to make it), and inventory records (What we have) to determine future requirements (What we have to get). MRP evolved quickly, however, into something more than merely a better way to order. Early users found that Material Requirements Planning comprised capabilities far greater than merely giving better signals for reordering (Wallace & Kremzar, 2001). MRP was able to detect when the due date of an order (when it's scheduled to arrive) was out of phase with the date it was. For the first time ever in the manufacturing, there was a formal mechanism for keeping priorities valid in a constantly changing environment, but it wasn't enough as the issue of priority was only one side of the coin. The other side was capacity, representing an equally challenging problem (Wallace & Kremzar, 2001). After a while MRP evolved to closed-loop MRP with additional features like sales & operations planning, financial interface and simulation was developed to Manufacturing Resource Planning or MRP II. Eventually, these evolutions cycle leaded to Enterprise Resource Planning (Wallace & Kremzar, 2001).

Gartner institute(2004) describe ERP as "Business strategies and enabling software that integrate manufacturing, financial and distribution functions to dynamically balance and optimize enterprise resources". The enterprise system collects data from various key business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources. The system stores data in a single comprehensive data repository where they can be used by other parts of the business (Laudon & Laudon, 2005).

Assessing the success of ERP in adopting organizations is difficult because of their complex nature. Moreover, such systems are capable of generating a wide range of benefits (tangible and intangible) to different organizational users (Ifinedo, 2006).Markus and Tanis (1999) state that success has different meanings depending on who defines it (Esteves-Sousa & Pastor-Collado, 2000). Traditional investment analysis techniques and criteria, such as return on investment, net present value, or payback period could be used; but because of the unique nature of the Information System investment, they seldom suffice in practice (Saarinen, 1996).

Critical Success Factors (CSFs) approach was first used by Rockhart (1979) in Inform IS area. It has been applied to many aspects of IS including project management, manufacturing systems implementation, reengineering, and, more recently, ERP systems implementation (Rasmy, Tharwat, & Ashraf, 2005).

2.2 Critical Success Factor in ERP implementation

Gibson defined CSF as "factors needed to ensure a successful ERP project" (Rasmy et al., 2005). One of the first researches about CSF in ERP implementation is accomplished by Holland in 1999 titled "A Critical Success Factors Model for ERP Implementation". He divided CSF in two dimensions including of strategic and technical, then he classified legacy system, business vision, ERP strategy, top management support and project schedule and plans under strategic dimension and client consultation, personal, BPC and software configuration, client acceptance, monitoring and feedback, communication and trouble shouting under technical dimension (Holland & Light, 1999). Esteves & Pastor (2000) after scrutinizing previous researches proposed a model for CSF. They sorted these CSFs in to strategic and tactical factors and after that separate these factors in to technological and organizational. In another survey, Nah & Lau (2001) in order to find and collect CSFs in ERP implementation investigated preceding works. They gathered CSFs based on four phases model of Markus and Tanis ERP implementation and cited some factors for each step. These factors were ERP team work & composition, tope management support, business vision and plan, effective communication, project management,

project champion, appropriate business & IT legacy systems, change management, BPR, testing & troubleshooting and monitoring and evaluation of performance (F. F. Nah & Lau, 2001). Somers and Nelson (2001) selected randomly 500 fortune firms and a random sample of 200 organizations from the Directory of Top Computer Executives who indicated the existence of an ERP system. Data were collected by a mail questionnaire. They investigated 22 factors and eventually figured out among them Top management support, Project team competence, Interdepartmental cooperation, Clear goals and objectives, Project management, Interdepartmental communication, Management of expectations, Project champion, Vendor support were more important (Somers & Nelson, 2001). Jafari et al in 2006 investigated critical success factors in ERP implementation in Malaysia finally they concluded 10 factors include top management support, clear goals and objectives, communication, effective project management, business process reengineering, data accuracy and integrity, suitability of software and hardware, vendor support, education and training, and user involvement are critical in Malaysia (Jafari, Osman, Tang, & Tang, 2006). In 2006 Alizadeh and Hanifizadeh in their article titled "Investigating CSF in ERP Implementation and Ranking them" in order to propose adaptive CSF model for Iranian companies after scrutinizing previous researches related to CSF, classified collected factors to eight main groups and 38 sub groups. They compared these factors in different researches and after summarizing and removing their faults, they sent it to 60 Iranian IT experts. Eventually, they concluded top management support, change management, vision and business planning are more important among other factors (Alizadeh & Hanifizadeh, 2006).

2.3 Background of the case study company

Esfahan Steel Company (ESCo) is the first and largest manufacturer of constructional steel products in Iran. This complex started production in 1971 with annual capacity of 600,000 MT. Taking advantage of state of the art technology, this company has been reconstructed and expanded recently (ESCo, 2010). In 2002 ESCo understood to improve their products and services to be able to compete with foreign similar companies. For this competition, it was essential to promote ESCo information systems. After investigating various solutions and researches they decided to implement ERP system in this company. Two consultants elected for this project. The first one was BASA from Iran and the second one was GTS from EUA. The selected ERP package was Oracle E-Business suite. Project started at 2003 and finished in 13 months. Five ERP modules were implemented at ESCo consisting of: Financial Modules, Supply chain Management, Oracle Human Resource, Manufacturing and Enterprise Asset Management.

3. Research Methodology

After studying previous researches in the area of critical success factors in ERP, five of more frequently used factors, were selected. These factors based on their repetitions and popularities in different researches are change management, business process reengineering (BPR), project team, project management and top management (Asemi & Moohebat, 2009). As each factor, studied several references, the detail of these factors were used to create a questionnaire. The questionnaire was sent to IT and management experts for conformation. At first, we intended to gather information by sending questionnaire, but CIO of ESCo advised us to collect information by using interview technique, to get better and more complete results. Hence, a structured interview was planned. In all factors except 'user involvement' there was no need for sampling as the society was limited. In the case of 'user involvement', we selected those employees that started their work in the organization before ERP implementation and were still working there. Unfortunately, this research was carried out when six years had passed from ERP implementation in the organization and a few key users and some of the end users had retired or left their job. This made the process of finding users difficult, but finally 30 users were selected. We had this problem with organization's ERP consultants as well. ESCo had used two consultants, one Iranian and one foreign as stated before. We used on-line questionnaire for foreign counselors, nevertheless, we only got one answer. We asked questions about all factors except 'user involvement' from project team (consultants, project manager, interior team members). In each case, we omitted questions concerning performance of the group themselves and only permit each group to judge other groups. In questions about 'user involvement' we only investigated role of users in ERP implementation. The questions provided in Farsi and then translated to English for foreign consultants.

4. Research Framework

In this research we will evaluate success of ERP implementation at Esfahan Steel Company base on CSF. As stated in literature review section, a lot of CSFs are detected by different researchers around the world; we decided to select five of factors that have more citation in the stated resources. These factors are: top

management support, team composition, project management, BPR and user involvement. Based on these factors our main hypothesis in this research is as follows;

H1: ERP Implementation was done successfully in Esfahan Steel Company.

4.1 Top Management Support

The support of top management has been widely recognized, which is called as "the head engineering" (Jing & Qiu, 2007). If there is no support of top management, there will be no investment and no resource to be used for the project. Without commitment of resources from higher level management, the ERP system is not going to get very far(Jing & Qiu, 2007). 'Top management support' was the most frequently cited CSF for ERP implementation (Alizadeh & Hanifizadeh, 2006; Bhatti, 2005; Boon, Corbett, & Peszynski, 2009; Ehie & Madsen, 2005; Fang & Patrecia, 2005; Jafari et al., 2006; Jing & Qiu, 2007; Kamhawi, 2007; Lam, 2005; Nielsen, 2002; Ramirez & Garcia, 2005; Rasmy et al., 2005; Sanchez & Bernal, 2007; Saremi, mousakhani, & Abedini, 2007; Soja, 2006; Woo, 2006; Yinjia, 2005). The ERP project must receive approval and support from top management before it can be started. As ERP projects span divisional boundaries and affect many stakeholders in an organization, senior executives need to mediate between various interest groups to resolve political conflicts when necessary (Ngai, Law, & Wat, 2008). Top management support in ERP implementation has two main facets: providing leadership; and providing the necessary resources (Jafari et al., 2006). Somers and Nelson (2001) specified the roles of top management in IT implementations include developing an understanding of the capabilities and limitations of IT, establishing reasonable goals for IT systems, exhibiting strong commitment to the successful introduction of IT, and communicating the corporate IT strategy to all employees (Somers & Nelson, 2001).

H2: Management had a appropriated support of ERP implementation.

4.2 Team Composition

It has also been repeatedly mentioned throughout the literature that there is a critical need to put in place a solid, core implementation team that is comprised of the organization's best and brightest individuals (Finnery & Corbett, 2007). An ERP project includes all functional areas of an enterprise. The effort and cooperation of technical and business experts is necessary for the success of an ERP implementation. Therefore involving people with both business and technical knowledge into project is essential for success. The best people in the organization should make part of the implementation team in order to foster innovation and creativity that are important for success (F. F. H. Nah & Delgado, 2006). Decision maker in the project team should be empowered to make quick and effective decisions (Ngai et al., 2008). Team members need to be assigned full time to the implementation. The team member should be given compensations and incentives for successfully implementing the system on time and within the assigned budget (Kalbasi, 2007). The team should have a mix of consultants and internal staff so the internal staff can develop the necessary technical skills for design and implementation (Sumner, 1999). Many researchers have advocated the need to include an ERP consultant as part of the implementation team. However, as part of this relationship, it is imperative to arrange for knowledge transfer from the consultant to the company (Finnery & Corbett, 2007). Consultants may have experience in specific industries, comprehensive knowledge about certain modules, and may be better able to determine which suite will work best for a given company (Somers & Nelson, 2001).

With respect to importance of team composition, our next hypothesis is given below:

H3: Team project had an acceptable performance during ERP implementation.

4.3 Project Management

Project management refers to the ongoing management of the implementation plan. Therefore, it involves not only the planning stages, but also the allocating of responsibilities to various players, the definition of milestones and critical paths, training and human resource planning, and finally the determination of measures of success (F. F. Nah & Lau, 2001). Successful implementation is highly dependent on an effective ERP project management. Project management involves the use of skills and knowledge in coordinating the scheduling and monitoring of defined activities to ensure that the stated objectives of project are achieved (Jing & Qiu, 2007). Another decisive element of ERP implementation success or failure is related to the knowledge, skills, abilities, and experience of the project manager as well as selection of the right team members, which should not only be technologically competent but also understand the company and its business requirements (Somers & Nelson, 2001).

Project management activities span the life of the project from initiating the project to closing it. The contingency approach to project management suggests that project planning and control is a function of the

project's characteristics such as project size, experiences with the technology, and project structure. (Somers & Nelson, 2001). Project management goes beyond one single factor because management is required through all the implementation period. If we look at the ERP as a large project, we have some areas that we should consider, such as scope, time, cost, quality, human resource, communication, risk, and procurement. Usually if we balance and control all the factors correctly, the project will be successful (Yinjia, 2005). The hypothesis related to this factor is defined below.

H4: Project management accomplished successfully in ERP project.

4.4 Business Process Reengineering (BPR)

BPR is defined by Hammer et al as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed" (Bhatti, 2005). The need to conduct BPR and software configuration was the third most commonly cited CSF. BPR results in a complete description of how the business will operate after the package is in use (Finnery & Corbett, 2007). A certain level of BPR should be involved for the implementation of ERP, as the packaged software may be incompatible with the needs and business processes of the organization. In order to improve the functionality of the software in accordance with the needs of the organization, an organization should reengineer business processes to fit the software instead of trying to modify the software to fit the organization's current business processes (Ngai et al., 2008). Jafari et al knows the dimensions of BPR in company's willingness to reengineering, company's readiness for change, and company's capability of reengineering (Jafari et al., 2006). To achieve the greatest benefits provided by an ERP system, it is imperative that the business processes are aligned with the ERP system. Both the reengineering literature and the ERP literature suggest that an ERP system alone cannot improve organizational performance unless an organization restructures its business processes (Somers & Nelson, 2001). Our next hypothesis which is related to BPR is stated below.

H5: BPR was implemented successfully at Esfahan Steel Company.

4.5 User Involvement

End users are the front line soldiers of the organization who have direct contact with the ERP system (Rasmy et al., 2005). User involvement is effective because it restores or enhances perceived control through participating the whole project plan. There are two areas for user involvement when the company decides to implement an ERP system: (1) user involvement in the stage of definition of the company's ERP system needs, and (2) user participates the implementation of ERP systems (Zhang, Lee, Zhang, & Banerjee, 2002). Lack of user training and failure to completely understand how enterprise applications change business processes frequently appear to be responsible for ERP implementation problem and failures [Somers, 2001]. Taking in to account the importance of this factor, our last hypothesis is given below.

H6: Users involved adequately in during ERP implementation.

5. Data Analysis

We succeed to do interview with 14 key users of Esfahan Steel Company who had a important role during ERP implementation and 10 consultants who participated in this project. Questionnaires were completed during the interviews and data was extracted and analyzed by SPSS 16. In order to answer our main hypothesis (H1) we should first analyze the other hypothesis (H2 to H5) and then conclude the answer of H1, using the results of those hypotheses.

For exploring the role of top management in this project we provided 11 (as shown in appendix B) questions and offered these questions to project manager, consultants and interior team members. As Table1 shows most of the respondents was satisfied with support of top management. To show the final result, average of these 11 questions were calculated and named 'MQ_Average'. In Table 2 you can see that Mean of 'MQ_Average' is 3.57 and this means that top management had an appropriate support of ERP implementation. can conclude that according to the related statistical rules our second hypothesis (H2) is accepted.

For investigating team composition we should study roles of interior team members, project manager and consultants. We designed five questions for interior team members, four questions for investigating consultants' roles and three questions for project manager (see Appendix B). Each group only answered questions about roles of other groups except interior team members that enabled to assessing their coworkers. Results of quality for interior team members are shown in Table 3. In order to conclude the final result of this section we made the average of these results in variable TQ_Average and the result is represented in Table 4. The mean value 3.03 for this variable showed that the role of interior team member was mediocre.

The results questions about the role of consultants are classified in Table 5. As you can observe, consultants' role was not hopefully because most of the participants evaluated it as bad or near it. The final results are shown in variable named CEQ_Average with mean value of 2.53 which means bad performance of consultants during this project.

The last element of team composition, the role of project manager, evaluated approximately well. As depicted in Table 7 and Table 8 the mean value of the results is more than 3 thus, we can conclude that project manager had a good performance during this project. Based on these three sets of results from interior team members, consultants and project manager, we can conclude that in general team composition was in an intermediate state and we can accept our third hypothesis (H3).

In order to study project management factor we designed seven questions (see Appendix B) and all of the key users answered them except project manager himself because this factor was firmly related to his role and performance. The results of these questions are gathered in Table 9. It is clear that question 1, 4, 7 were assessed as bad, but the results of other questions are pretty good, we calculated the mean value of these seven questions which is 3.02 for variable PM_Average. This result shows that project management has had a mediocre performance; therefore, our H4 hypothesis is not rejected.

BPR factor was investigated by seven questions. As shown in Appendix B, consultants, project manager and interior team members answered these questions. Unfortunately, the execution of BPR was weak in this project as the mean value 2.58 in Table12 proves it. Based on this result our hypothesis H5 is rejected which means that factor BPR was not successful during ERP implementation in this company.

For 'User Involvement' factor we accomplished our survey by 30 users who were working at ESCo before ERP implementation as well as after development of ERP in the company as we wanted to investigate this factor with experienced users. Unlike others factors which almost all member of our society participated in the evaluation, in this factor we used a sample of users so we had to use inferential statistics instead of descriptive statistics.

In this section we had designed seven questions as expressed in Appendix B. We decided to investigate this hypothesis utilizing t-test so we changed our hypothesis to mathematical form:

H6: $\mu >= 3$

H´6: $\mu < 3$

The first condition for t-test is that our sample should be normal. In Table 13 with Kolmogorov-Smirnov test we checked it. In distance of 95% confidence we concluded that:

Sig>α, .200>0.05

So it means our population is normal. Due to of normal population, we accomplished t-test in 95% confidence interval. The result of this test has showed in Table 14. As it has shown, Sig p-value=0 < α=.05 therefore, it is concluded H6, is rejected and adverse hypothesis is accepted. Thus, 'User Involvement' failed in during ERP implementation in ESCo.

6. Limitation

One of the biggest problems we had during this research it was that about six years has passed from ERP implementation in ESCo and access to some key users and consultants members was impossible. Some of them were retired and others had left their organizations for different reasons. We sent our questionnaires to those inaccessible members but unfortunately we did not receive expected respond from them. Moreover, foreign consultant's members had left Iran. We tried to communicate them but unfortunately they did not respond. In addition, extracting appropriate indexes was very difficult. Although, many resources have mentioned CSFs, however we encountered with shortage of indexes and tested questionnaire for investigation of each CSF. Finally, convincing ESCo users and managers to participate in this research was very difficult. They did not like to participate in any research. This issue related to their culture organization and former studies that other researchers had accomplished on ERP in ESCO. They had lost their motivation to take part in such investigation. Some of them did not participate and our cases decreased.

7. Conclusion

The main object of this study was evaluation of the ERP implementation in Esfahan Steel Company based on CSF. In order to this goal we investigated five selected CSFs in this company and it revealed that this organization was successful in three of these factors and failed in others. ESCo had an appropriate top management support during ERP implementation. Among team composition project manager and interior team members acted well, but consultants was weak, Nevertheless team composition had acceptable performance

generally. Project Management accomplished well, but unfortunately BPR and User Involvement was not efficient. Based on these results we can conclude that ERP implementation was successful in ESCo based on our five studied Critical Success Factors. We should not forget that companies implement information system to satisfy their users. Companies cannot impose any information system to their users. Eventually, end users should work with ERP or every IS in every organization. Training is very important to getting ready end users to accept new system. A training plan must be defined, bearing in mind the users' know-how, their needs, technology, etc (Francoise, Bourgault, & Pellerin, 2009). Therefore, their satisfaction is vital to success of ERP project. In computer world there is a famous word that "garbage in, garbage out". None information system can make miracle spontaneously. Before implementation of every information system including of ERP, improving and customizing processes should be concentrated. Schniederjans and kim(2003) after investigating ERP implementation in an US electronic company discovered that execute BPR and TQM with ERP has very positive impact on success of business performance. Consequently, companies should start BPR before ERP or simultaneous with it. Process improvement should be considered as one the most important priorities of organization in ERP implementation.

References

Alizadeh, A., & Hanifizadeh, p. (2006). Review the critical success factors in ERP Implementation and their ranking. *Faslname Elmi- Pajooheshi Sharif [Persian]*, 36, (pp. 87-99).

Asemi, A., & Moohebat, M. R. (2009). In Gupta, O.K (Ed), *A Comparative Study of Critical Success Factors (CSFs) in Implementation of ERP in Developed and Developing Countries*. Ninth International Conference on Operation and Quantitative Management (pp. 262-273). Los Angeles, USA

Bhatti, T. R. (2005). *Critical Success Factors For The Implementation Of Enterprise Resource Planning (ERP): Empirical Validation*. Proceedings of the Second International Conference on Innovation in Information Technology (IIT"05). (pp. 1-10). Dubai, UAE

Boon, O., Corbett, B., & Peszynski, K. (2004). *Reassessing critical success factors for ERP adoption - a case study*, in Wei, Chih-Ping (eds), PACIS 2004: Proceedings of the Eighth Pacific Asia Conference on Information Systems, (pp. 2184-2190), Shanghai, Shanghai, China

Ehie, I. C., & Madsen, M. (2005). Identifying critical issues in enterprise resource planning (ERP) implementation. *Computers in Industry*, 56(6), (pp. 545-557).

ESCo. (2010). Esfahan Steel Company Pioneer in Steel Industry of Iran. [Online] Available: http://www.esfahansteel.com/steel_form.php?pge1=about&type=1&pge=profile (December 19, 2010)

Esteves-Sousa, J., & Pastor-Collado, J. (2000). *Towards the unification of critical success factors for ERP implementations*. Proceedings of the 10th Annual Business Information Technology (BIT) Conference, (pp. 5-19), Manchester, UK.

Fang, L., & Patrecia, S. (2005). Critical Success Factors in ERP Implementation. (Master thesis, Jànkàping International Business School).

Finnery, S., & Corbett, M. (2007). ERP implementation: a compilation and analysis of critical success factors. *Business Process Management Journal*, 13(3), (pp. 329-347).

Francoise, O., Bourgault, M., & Pellerin, R. (2009). ERP implementation through critical success factors' management. *Business Process Management Journal*, 15(3), (pp. 371-394).

Gartner. (2004). The Gartner Glossary of Information Technology Acronyms and Terms, [Online] Available: www.gartner.com/6_help/glossary/Gartner_IT_Glossary.pdf , Gartner. (December 20, 2010)

Holland, C. P., & Light, B. (1999). A critical success factors model for ERP implementation. *IEEE Software*, 16(3), (pp. 30-36).

Ifinedo, P. (2006). Extending the Gable et al. enterprise systems success measurement model: a preliminary study. *Journal of Information Technology Management*, 17(1), (pp. 14-33).

Jafari, S. M., Osman, R. M., Tang, Y., & Tang, S. H. (2006). ERP Systems Implementation In Malaysia: The Importance Of Critical Success Factors. *International Journal of Engineering and Technology*, 3(1), (pp. 125-131).

Jing, R., & Qiu, X. (2007). *A Study on Critical Success Factors in ERP Systems Implementation. International Conference on Service Systems and Service Management*. Chengdu: IEEE.

Kalbasi, H. (2007). *Assessing ERP implementation critical success factors.* (Master Thesis, Lulela University of Technology).

Kamhawi, E. M. (2007). Critical Factors for Implementation Success of ERP Systems: An Empirical Investigation from Bahrain. *International Journal of Enterprise Information Systems*, Vol. 3, (pp. 34-49).

Lam, W. (2005). Investigating success factors in enterprise application integration: a case-driven analysis. *European journal of information systems*, 14(2), (pp. 175-187).

Laudon, K. C., & Laudon, J. P. (2005). *MANAGEMENT INFORMATION SYSTEMS: Managing the Digital Firm.* Prentice Hall.

Markus, M. L., Tanis, C., & Van Fenema, P. C. (1999). Enterprise resource planning: multisite ERP implementations. *Communications of the ACM*, 43(4), (pp. 42-46).

Nah, F. F. H., & Delgado, S. (2006). Critical success factors for enterprise resource planning implementation and upgrade. *Journal of Computer Information Systems*, 46(5), 99.

Nah, F. F., & Lau, J. L. (2001). Critical Factors for successful implementation of enterprise system. *Business Process Management Journal*, 7(3), (pp. 285-296).

Ngai, E. W. T., Law, C. C. H., & Wat, F. K. T. (2008). Examining the critical success factors in the adoption of enterprise resource planning. *Computers in Industry*, 59, (pp. 548–564).

Nielsen, J. (2002). Critical success factors for implementing an ERP system in a university environment: A case study from the Australian HES, (Bachelor Project, Griffith University).

Ramirez, P., & Garcia, R. (2005). Success of ERP Systems in Chile: An Empirical Study. Proceedings of European, Mediterranean & Middle Eastern Conference on Information Systems.

Rasmy, M. H., Tharwat, A., & Ashraf, S. (2005). *Enterprise Resource Planning (ERP) Implementation in the Egyptian Organizational Context.* European and Mediterranean Conference on Information Systems, Cairo, Egypt.

Rockart, J. F. (1979). Chief executives define their own data needs. *Harvard Business Review*, 57(2), 81.

Saarinen, T. (1996). An expanded instrument for evaluating information system success. *Information & Management*, 31(2), (pp. 103-118).

Sanchez, N. G., & Bernal, L. E. (2007). Determination of Critical Success Factors in Implementing an ERP System: A Field Study in Mexican Enterprises. *Information Technology for Development*, Vol. 13, (pp. 293-309).

Saremi, M., mousakhani, M., & Abedini, M. (2007). extract and evaluvation related index with preperation Auto industry for implementation ERP. *Management Knowledge* [Persian], 77(20), (pp. 47-60).

Schniederjans, M. J., & Kim, G. C. (2003). Implementing enterprise resource planning systems with total quality control and business process reengineering: survey results. *International Journal of Operations & Production Management*, 23(4), (pp.418-429).

Soja, P. (2006). Success factors in ERP systems implementations: lessons from practice. *Journal of Enterprise Information Management*, Vol 19, (pp. 646-661).

Somers, T. M., & Nelson, K. (2001). *The impact of critical success factors across the stages of enterprise resource planning implementations.* 34th Hawaii International Conference on System Sciences, Hawaii (HICSS-34), vol. 8, (pp.8016), Hawaii, USA.

Sumner, M. (1999). *Risk factors in enterprise wide information management systems projects.* Proceedings of the 2000 ACM SIGCPR conference on Computer personnel research, (pp.180-187), April 2000, Chicago, Illinois, United States .

Turban, E., McLean, E., & Wetherbe, J. (2004). *Information technology for management: Transforming organizations in the digital economy.* Wiley Text Books.

Wallace, T. F., & Kremzar, M. H. (2001). *ERP: making it happen: the implementers' guide to success with enterprise resource planning.* Wiley.

Woo, H. S. (2006). Critical success factors for implementing ERP: the case of a Chinese electronics manufacturer. *Journal of Manufacturing Technology Management*, Vol. 18, (pp. 431-442).

Yinjia, J. (2005). *Critical Success Factors in ERP Implementation in Finland.* (Master thesis, The Swedish School of Economics and Business Administration).

Zhang, L., Lee, M. K. O., Zhang, Z., & Banerjee, P. (2002). *Critical success factors of enterprise resource planning systems implementation success in China.* The Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03), Volume 8, p.236, Hawaii, USA.

Appendix A

Table 1. Results of questions of top management Supports

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MQ1	24	2.00	5.00	3.7613	.74326
MQ2	24	3.00	5.00	3.7083	.62409
MQ3	24	2.00	5.00	3.3750	.82423
MQ4	24	1.00	5.00	2.9542	1.12210
MQ5	24	1.00	5.00	3.3333	1.16718
MQ6	24	2.00	5.00	3.3333	.63702
MQ7	24	2.00	5.00	3.9688	.90983
MQ8	24	2.00	5.00	3.9167	.77553
MQ9	24	1.00	5.00	3.6250	.82423
MQ10	24	1.00	5.00	3.0049	1.08033
MQ11	24	2.00	5.00	4.2917	.85867
Valid N (listwise)	24				

Table 2. Average of all questions related to top management support

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
MQ_Average	24	2.73	4.91	3.5789	.57740	.333
Valid N (listwise)	24					

Table 3. Results of interior team member quality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
TQ1	24	1.00	5.00	3.0417	1.08264
TQ2	24	1.00	5.00	3.6250	.82423
TQ3	24	2.00	5.00	3.1667	1.00722
TQ4	24	1.00	4.00	2.2191	.93051
TQ5	24	2.00	5.00	3.1099	.80330
Valid N (listwise)	24				

Table 4. Final result for the role of interior team member in ERP implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
TQ_Average	24	2.20	4.20	3.0325	.49207
Valid N (listwise)	24				

Table 5 Question results related to consultants role in ERP implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Consultant effect1	13	1.00	3.00	2.2308	.72501	.526
Consultant effect2	13	1.00	4.00	2.6154	.86972	.756
Consultant effect3	13	1.00	4.00	2.3077	.85485	.731
Consultant effect4	13	1.00	4.00	3.0000	.81650	.667
Valid N (listwise)	13					

Table 6. Final results for consultant's role in during ERP implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
CEQ_Average	13	1.25	3.50	2.5385	.60248	.363
Valid N (listwise)	13					

Table 7. Role of project manager in project

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
RPMQ1	23	2.00	5.00	3.2609	.68870	.474
RPMQ2	23	2.00	5.00	3.1739	.88688	.787
RPMQ3	23	2.00	5.00	3.4348	.99206	.984
Valid N (listwise)	23					

Table 8. Final results of project manager role in during implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
RPMQ_Average	23	2.00	5.00	3.2899	.69851
Valid N (listwise)	23				

Table 9. Results of project management quality questions

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PM1	23	1.00	5.00	2.8732	1.09702
PM2	23	2.00	5.00	3.3182	.76196
PM3	23	2.00	5.00	3.4091	.93001
PM4	23	1.00	4.00	2.6364	1.06794
PM5	23	2.00	4.00	3.1364	.75651
PM6	23	1.00	5.00	3.0000	1.00000
PM7	23	1.00	5.00	2.8182	.83320
Valid N (listwise)	23				

Table 10. Final result for quality of project management

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PM_Average	23	1.86	4.29	3.0273	.69621
Valid N (listwise)	23				

Table 11. Results of BPR questions

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPR1	24	1.00	4.00	2.1670	.81643
BPR2	24	1.00	4.00	2.5496	.87942
BPR3	24	1.00	5.00	2.5000	1.10335
BPR4	24	1.00	5.00	2.7747	.89224
BPR5	24	1.00	4.00	3.0076	.97062
BPR6	24	1.00	4.00	2.3799	1.02657
BPR7	24	1.00	4.00	2.7219	1.04297
Valid N (listwise)	24				

Table 12. Final result for BPR

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPR_Average	24	1.29	4.00	2.5858	.74111
Valid N (listwise)	24				

Table 13. Kolmogorov-Smirnov Test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
User_Involvement	.099	30	.200[*]	.962	30	.349

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Table 14. Result of the t-test for user involvement

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
UserInvovement	-5.700	29	.000	-.93254	-1.2671	-.5979
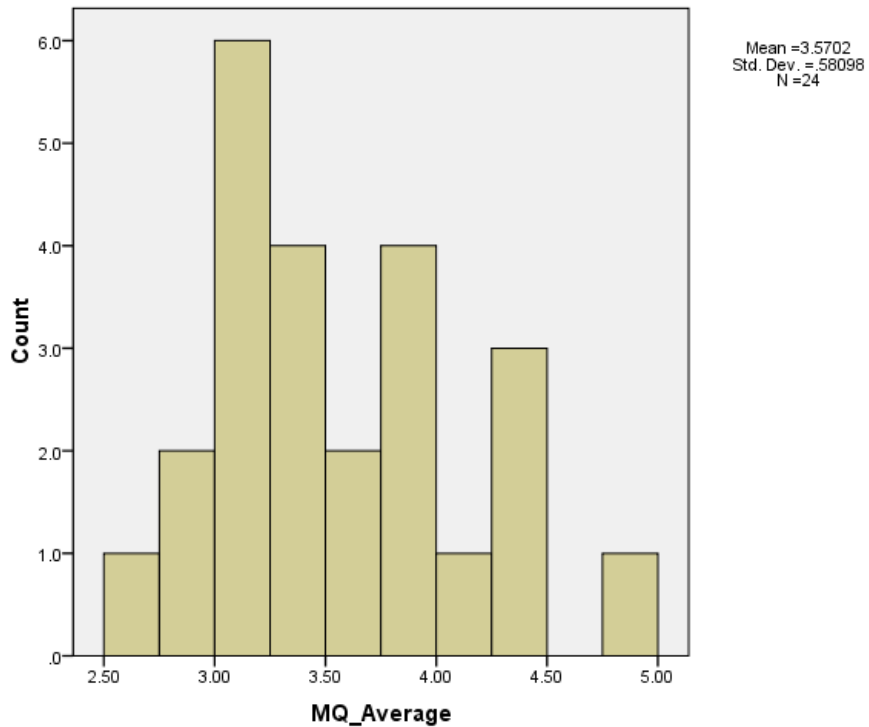
Figure 1. Histogram of final result of top management support
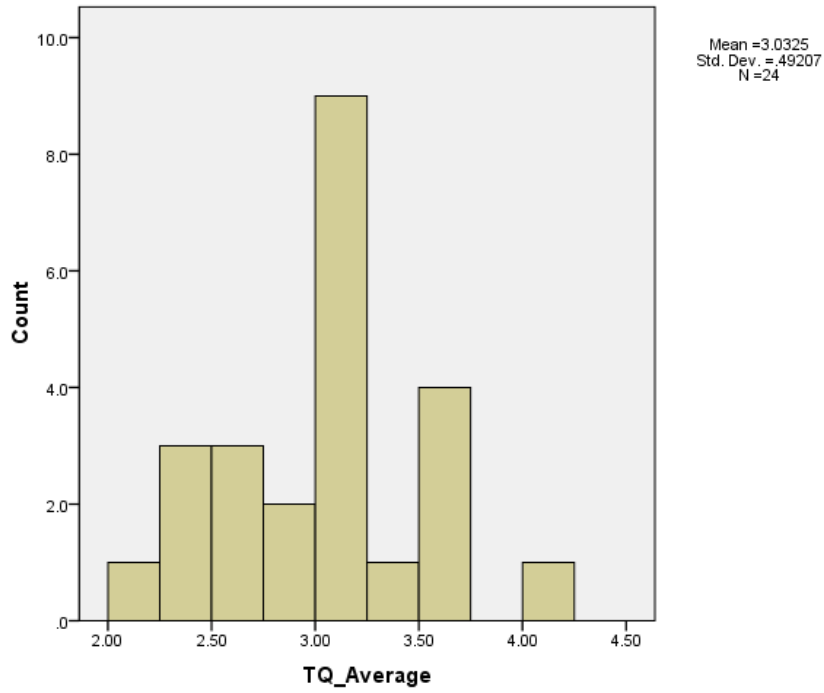
Figure 2. Histogram of the role of interior team member in during ERP implementation
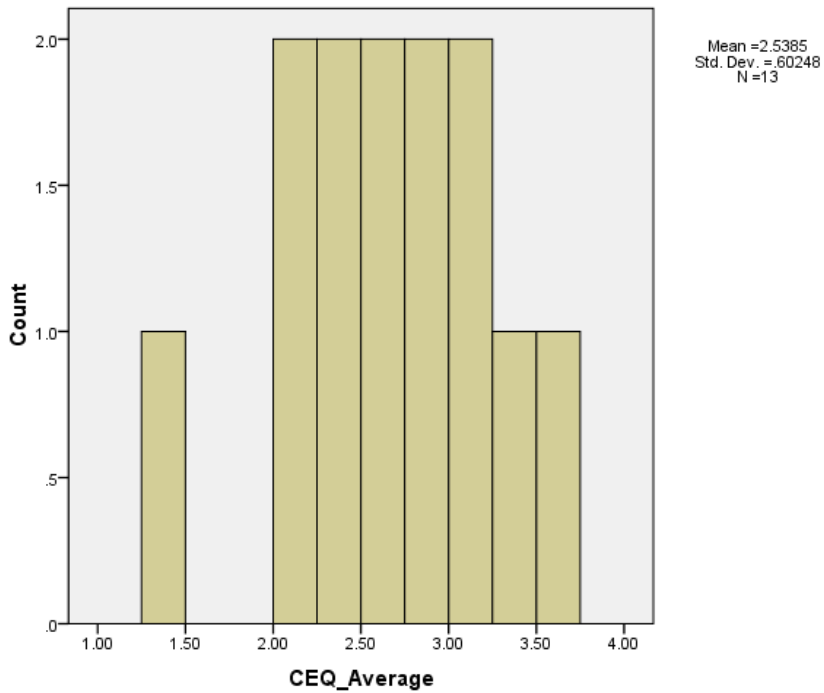
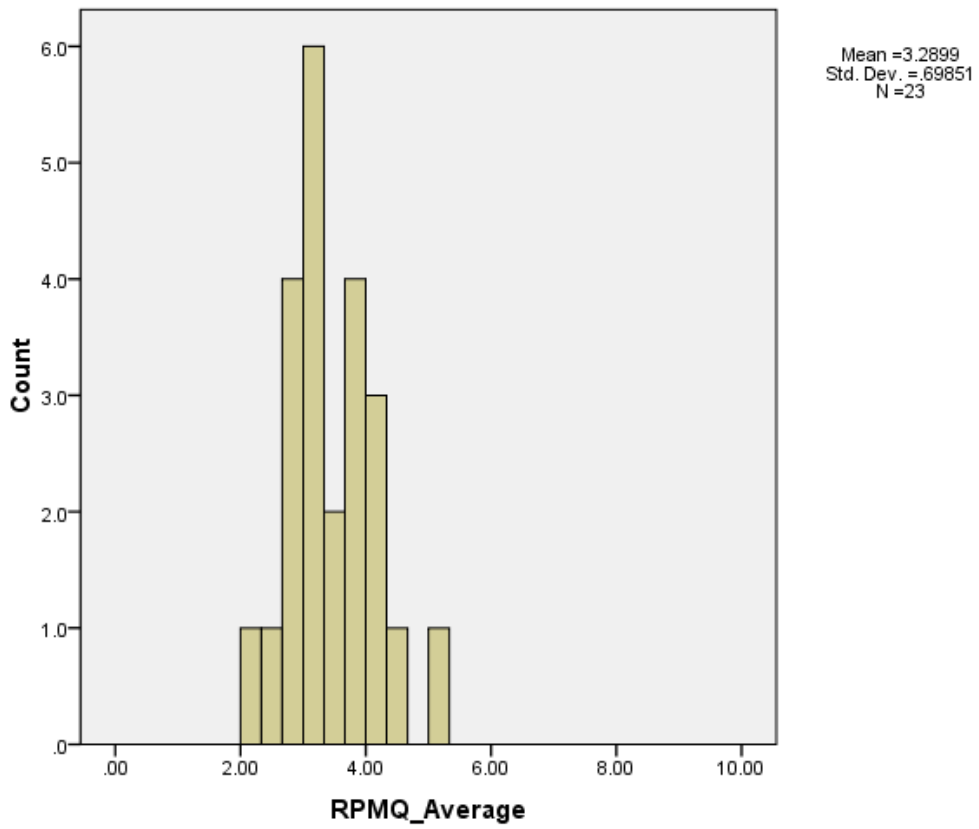Figure 3. Histogram of role of consultants in during ERP implementation

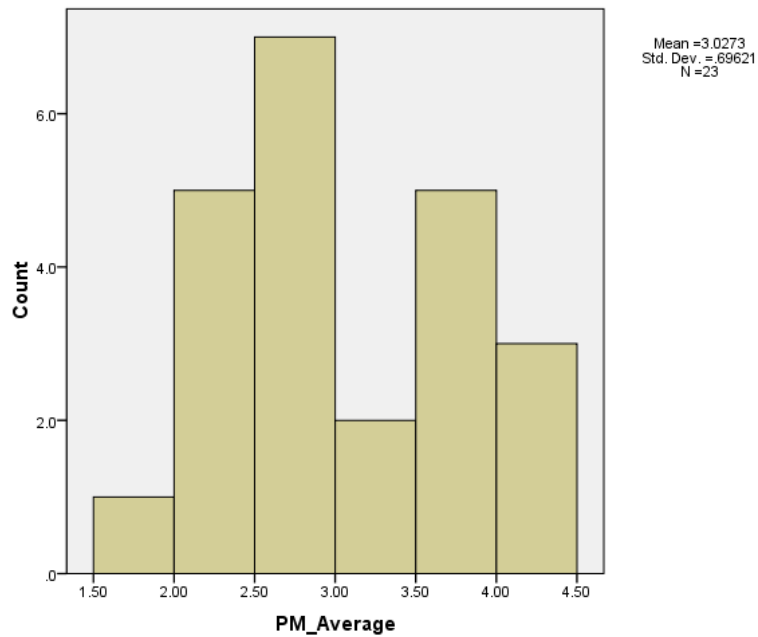Figure 4. Histogram of project manager role in project

Figure 5. Histogram of project management quality in during implementation
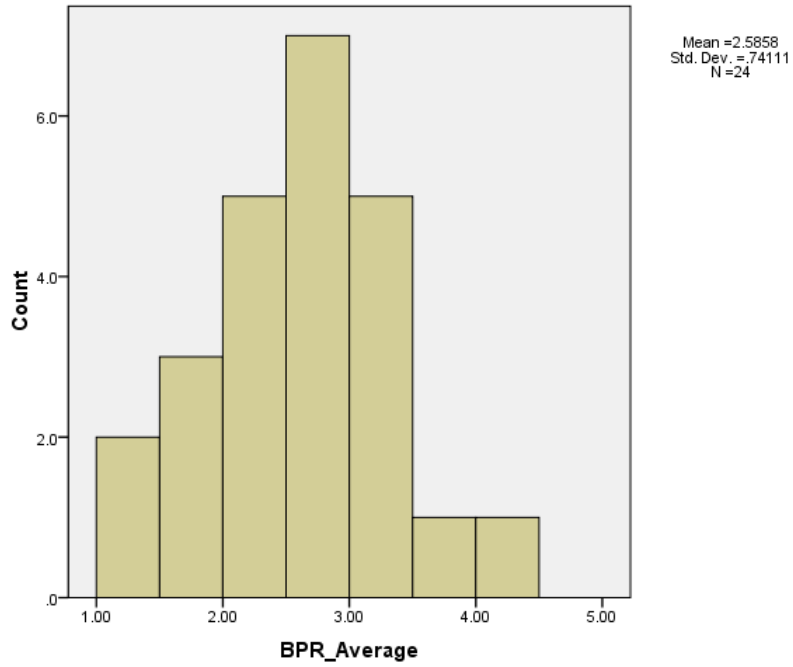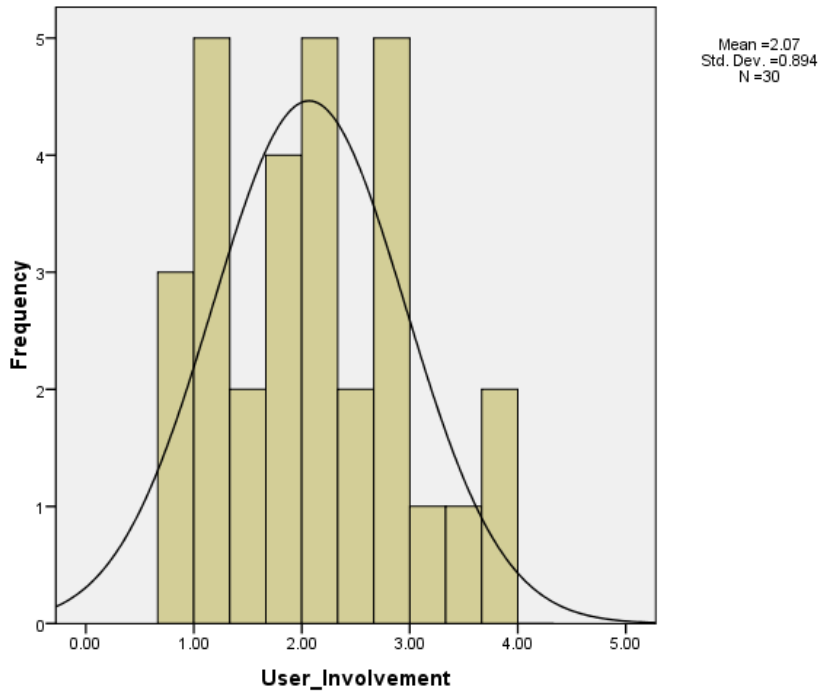
Figure 6. Histogram of BPR result in during ERP implementation

Figure 7. Histogram of User Involvement