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Make Decision for Selection Enterprise Resource Planning by Defines Key Performance Indicators (KPIs) and Analytic Network Process (ANP)

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Abstract. The purpose of all service institutions, including banks is to provide appropriate services for the customers' satisfaction. In fact, the key to the success of these organizations relates to the customer-orientation and focus on the quality of services. Since the organizations providing financial service, especially banks operate in an environment with indistinct products, their quality services are known as the first competitive weapon. Therefore, due to the importance of quality in service industries and its significant effects on customer satisfaction, the question arises: how the quality of service can be evaluated? This case study also sought to assess the quality of banking services using failure mode and effect analysis (FMEA) techniques in Fuzzy environment in one of the branches of Melli Bank of Rafsanjan. In FMEA Technique the risk priority number (RPN) index was used for rating the failure items, which is

the Multiplication of three risk factors: occurrence of failure, severity of failure and detectability of failure. In FMEA technique, the weights of risk factors weight are not taken into account such that the same weight value is assumed for each of those factors. To overcome this weakness, much research has been performed, recently. This paper uses of Wang and colleagues model in a Fuzzy Environment. The results illustrate that one of the most significant failure items is Lack of a good place to park the customers' car. Banks are one of the financial firms that different decisions are always minor system. An example of automation systems for human resources, finance, internal controls and so named. That is why banks are looking for a comprehensive system to integrate its activities are concentrated. So the Enterprise Resource Planning system (ERP) is one of the important applications of information technology in organizations, especially the banking industry of the country. There are a lot of providers of ERP software package inside and out so it is important to select suitable ones which cover all needs and aspects of our organization. We need to build a complete network of all factors involved in the decision and use right method to identify factors into the network. We have used Analytic Network Process to make decision and Balanced Score card to identify effective factors .we have connected the two methods together by using questionnaires to the experts and professionals in bank and implementing experts of this software package in Iranian companies. We have applied SPSS and Super Decision software to solve proposed model and make valid research results. As a result, an ERP software package of SAP Company is proposed as the most appropriate one for Bank.

Key words: Enterprise Resource Planning, Key Performance Indicators, Analytic Network Process.

1. Introduction

In twenty-first century, one of the most critical needs of any organization is effective use of information technology and information technology capabilities to develop and improve services to clients. Today's banking business increasingly is formed by competitive phenomenon which causes a considerable pressure on the banks to adapt

to new conditions. Enterprise Resource Planning [1]system is one of the important applications of information technology in organizations. It is necessary to select the best ERP system, selection and evaluation criteria that are commensurate with the strategic goals and enable to give complete and comprehensive picture of the performance of the system to the management. Many methods are proposed to evaluate investment on the ERP system and performance IT circles. What the significance of this research is how an ERP system can be selected from among several existing systems, so that the choice made, is the best choice from all aspects. This study aim to develop an approach based on Balanced Score Card[2] and the Analytic Network Process[3] for selecting an ERP system. Case study has been made in Tejarat bank. In recent years, ERP has been proposed as the best solution to integrate all the data. Traditional systems have just focused on operation in production part while ERP entirely attends to all resources of organization. All prepared and pre-engineered software packages which are designed to process information interaction within the organization and to facilitate the integration of information to plan well and respond fast to customer needs (Mojtaba, 2011).Implementing ERP systems cost about millions dollars to organizations and smaller organizations must cost to establish an ERP system about ten percent of the annual income (Adel, 2001).Supplier of these systems believe that the cost of information systems decrease and operational efficiency of organization increases when ERP is established, so, it will be affordable. Before taking any decision, it is necessary to ensure choosing an ERP software package properly, in order to avoid wasting valuable resources in organizational ERP implementation and more importantly protect against possible hazards of implementing these systems (Joseph, 2008). Bank Tejarat of Iran has acted like an island except some special cases now. Every part or area of organization in bank collects essential information. If another part needs this information, they may be generally unavailable and also they may report wrong information to that part. These have caused many problems, decreasing productivity and also waste a lot of time and money in the

[1] ERP
[2] BSC
[3] ANP

banking system and relevant organizations. Therefore, this research is used an approach based on ANP and BSC to select an ERP system in Bank Tejarat of Iran to solve this problem. Because the BSC has framework for performance evaluation. It provides a comprehensive perspective on the business performance of a company with a set of financial and non-financial criteria. It seems to be a good solution. BSC helps to find key objectives, interests and expectations before implement. Key effective Indicators are identified and the expectations of the ERP will be clear. After determining strategies, ERP project team can focus on implementing ERP and Key effective Indicators (Ufuk, 2009). According to this criterion can influence on each other and the importance of these interactions can influence on the final selection, so we used ANP to investigate between criteria, sub criteria.

2. Literature Review

Implementation of ERP systems is one of the most difficult investment projects due to the complexity, high cost and risks of adaptation. Companies spend millions dollars and a lot of hours in order to set up ERP software systems. Therefore, accurate selection software and election of product based on organization needs causes to reduce time and cost of implementation and also successful establishment of the system increases (Yusuf et al, 2004). Jacques et al, presented “A six-stage model of the buying process for ERP software ". This model explained six step of supplying software which include planning, information seeking, and first choice, evaluate options, best selection and negotiation (Jacques et al, 2006). Also CJ Stefano wrote a paper entitled “Organizational Key Success Factors for Implementing SCM/ERP Systems to Support Decision Making “.This article evaluate and select ERP software in two group of strategic operational criteria. These criteria are listed in Table 1 (Stefano, 2001).

Table1. Effective Criteria for Evaluation of ERP

Factors in ERP evaluation at the strategic level	Factors in evaluating at the performance of ERP
ERP share in business prospects	ERP effects on:
Flexible ERP solution in changing terms	Business networks
Adaptation to business terms	Time to complete the transaction
Integrates information and business processes	Information sharing within the organization
Identification of project risks	Estimated costs:
ERP effects in decision making	Staff strength
The estimated total cost of ERP ownership	Training of staff
Analysis selectable options	External consultants

Alanbay, Turkish researcher, researched a paper titled “ERP selection using expert choice software “.He set evaluation criteria in three groups which include vendors criteria, users and technical criteria to select ERP system . Alanbay used Analytic Hierarchy Process (AHP) method to evaluate proper system (Oyku, 2005). Chan Wei in 2004 presented a paper titled “A comprehensive framework for selecting an ERP system“. Wei used Fuzzy Multiple Attributes Decision Making (FMADM) method to present a new conceptual framework for proper ERP selection. Indicators in this study was collected through interviews with the ERP system vendors These evaluation indicators was classified in three groups which include project factors and factors related to system and vendor. After a year, he improved his ex-model with titled “An AHP-based approach to ERP system selection” which was a systematic approach to select the ERP system (Chun-Chin et al, 2005, 2004) .Chand in an article entitled “A balanced scorecard based framework for assessing the strategic impacts of ERP systems “showed ERP implementation in the organizations, can influence strategic business goals of the company. In this study, the SAP software package has been successfully implemented at a manufacturer of aircraft engines. The results show that ERP implementation will improve all aspects of the BSC (Chand, 2005). In another study, Chang et al. a paper offered with titled “A neural network evaluation model for ERP performance from SCM perspective to enhance enterprise competitive advantage ". Case

study in this research did in a textile company in Taiwan. He discussed some criteria like time, cost, quality, flexibility and service to evaluate ERP systems (Chang, 2008). In 2002, Kumar extracted the criteria for selecting a vendor software package through survey of companies which used ERP system as follows: (Kumar, 2002).

- Applicability Systems
- Reliability of systems
- Having the best approach in system
- Integration between software components
- Using the latest available technology
- Vendor reputation
- provide and availability of new versions
- compatibility with other existing systems.
- Support of software vendor
- Possibility of adapting software to existing processes
- lower costs
- Better compatibility with existing processes

Iran Information Technology development is one of the providers of ERP software packages in Iran. This company proposed a 10 -step model as follows:

1. Create future vision and define organizational goals.
2. Provide List of ERP applications and their properties.
3. Prepare the list of first candidates for securing software.
4. Limit Candidates from 4 up to 6 new candidates.
5. Preparing RFP (request for proposal)
6. Review and Evaluation of Proposals
7. Select the three top options (end suppliers)
8. Explain and demonstrate each of the softwares by their suppliers
9. Final supplier selection
10. Negotiate for Contract and experiment execution

(Iran Information Technology development, 2005).

Another study did with entitled "Surveying guideline selection to establish ERP system "to evaluate different guideline selection in 2007. In this study, at first they examined implementing different strategies, then identification of critical success factors for ERP systems to define

proper criteria for evaluation establishment strategies (Somayeh et al, 2007).In 2006, research related to ERP systems did with titled "Surveying of ERP systems and the feasibility of implementing these systems in the automotive industry "whose aim was to identify the needs and critical success factors to implement ERP and stages of its implementation. Also researcher presented a model to implement the feasibility of these systems in the automotive industry. In this study were identified some factors associated with the automotive industry's readiness to implement ERP systems (Babak, 2006).

We have used an integrated model to select an appropriate ERP software package which guarantees to access strategies and objectives bank. Organizations which want to utilize ERP systems due to the diversity of these systems will have difficulty making decisions and optimal choice. In this research, we use a combination model of the two methods, BSC and ANP. We use four perspectives of BSC, which include financial perspective, customer perspective, internal process perspective, and learning and growth perspective, as the main criteria to extract key indicators in selecting an ERP software package. Actually, this model is organized a combination of BSC and ANP.To perform model, we collect necessary data in Tejarat bank and then effective key indicators are defined as regards bank strategy and four prospective of BSC by distributing questionary between banking experts and domestic producers of ERP systems and also experts who work for implement consulting firm. Before starting process, we should identify central goals and expectations. What's more, sellers, who are suitable regarding effective key indicators, selected. Finally, in this research utilize Super Decision software and ANP method, which is a multiple criteria decision making technique, to investigate the relative importance of effective key indicators and paired comparisons in order to introduce the best seller of ERP software package .In analysis section is showed research model that is combination of ANP and BSC.

3. Method

This study aim to develop an approach based on ANP and BSC for selecting an appropriate ERP system in Tejarat bank of Iran. We totally can categorize objectives of this study as follows:

- A framework for selecting an appropriate software package for Tejarat bank of Iran.
- Identification of effective key indicators in selecting an appropriate software package through the balanced scorecard approach.
- Prioritization of key indicators regarding the importance of these factors in choosing the best ERP software package.

To achieve optimum package is posed a series of questions in this study as follows:

- What are the Key indicators as regards strategies and four prospective of BSC in Tejarat bank of Iran?
- What are the effective key indicators in selecting appropriate ERP software package in Tejarat bank of Iran?
- How much is the important rate of each key by using ANP?
- How is the appropriate model in selecting ERP software package?
- Which vendor does an appropriate ERP software package offer to Tejarat bank?

In addition to this information, statistic population include experts in different part of human resource management office in Tejarat bank of Iran and some experts who are domestic producers of ERP systems and work for implement consulting firm. Then questionary sent to experts .The sample size is 15 experts and sampling method is objective. We use questionary to collect data. In this study is applied the ideas of experts to evaluate and ensure the validity of (reputation) questionnaires and indicators. Although the framework of questionary conforms to ANP's questionnaires, we try to avoid complicated terms and phrases as much as possible. Cronbach's alpha is used to evaluate the reliability of questionnaires. Cronbach's alpha is a coefficient of reliability and consistency and measure internal consistency of the model. Since the reliability of the results of the questionnaire are closely related to their consistency judgment responders. Therefore, we can also ensure the reliability of the results of these questionnaires by computing inconsistency rate of decision matrices.

4. Findings

The objective is to select a suitable software package; thus, the software must be selected that adopted bank's strategy and goals. According to the model, this consists of 4 levels (the objective decision, four aspects of BSC, effective key indicators and decision options). At first, we extract key indicators by using the four perspectives of balanced scorecard (financial, customer, internal process, growth and learning) and also interviews with experts and literature research and strategic goals of bank which is described in table 2.

Table 2. Key Indicators

Financial perspective	Purchase and implementation cost of software packages, receipts and payments of bank, budget control and finance, Accounting for branches, financial control of contractor agreement, banking and debt management, investment management, payroll management, employee welfare services management, management in estate and tenement of bank.
Customer Perspective	Customer Relationship Management (CRM), complaint management and call recording and referral automatic of customers request, customers credit management,
Internal process perspective	Easy usability of software, software compatibility with previous systems, flexible software package, marketing, document management, bank services support, projects management, purchasing and tenders management, quality management in all sectors and branches, employee attendance management system, maintenance management
Learning and growth perspective	Employee personnel information management, recruitment and selection human resource management, training management and performance evaluations.

Then, another questionnaire is distributed among the population to identify effective key indicators that have been described in Table 3. Cronbach's alpha gets 86% of all answers; in this way questionary has reliability. In questionnaires, we use the Likert scale of 1 to 9 to determine the importance of indicators. After calculating, average of all answers is 6.5 and we use this mean as a base to select effective key

indicators, so, indicators whose average is above 6.5, were select as effective key one.

Table 3. Effective Key Indicators (sub criteria)

Financial perspective	Purchase and implementation cost of software packages (A1), budget control and finance (A2), financial control of contractor agreement (A3), banking and debt management (A4).
Customer Perspective	Complaint management and call recording and referral automatic of customers request (B1), customers credit management (B2).
Internal process perspective	Easy usability of software (C1), software compatibility with previous systems (C2), marketing (C3), projects management (C4).
Learning and growth perspective	Recruitment and selection human resource management (D1), training management and performance evaluations (D2).

The suitable software package sellers, which have a proper cover on strategic objectives of the Bank and four prospective BSC, were select through a screening table and interview with experts who work for internal implement consulting firm. After collecting data and computing, the appropriate sellers have identified like SAP, MISYS, and Douran which is Iranian company. Addition to this information, we should determine interdependency between first-level criteria and effective key indicators. In this research, a relation matrix has been used and distribute among experts to give their opinions about interdependency. In table 4 and 5 show relation between them and ✓ refer two criteria which have relation together.

Table4. Interdependency between Four Prospective of BSC

Criteria	**Criteria**			
	1	2	3	4
1. Financial perspective		✓	✓	✓
2. Customer Perspective	✓		✓	✓
3. Internal process perspective	✓	✓		✓
4. Learning and growth perspective	✓	✓	✓	

Table5. Interdependency between Effective Key Indicators

Effective Key Indicators	**Effective Key Indicators**											
	A1	**A2**	**A3**	**A4**	**B1**	**B2**	**C1**	**C2**	**C3**	**C4**	**D1**	**D2**
A1**. Purchase and implementation cost of software packages**		✓										
A2. **budget control and finance**	✓		✓	✓								
A3. **financial control of contractor agreement**		✓		✓								
A4. **banking and debt management**		✓	✓									
B1. **Complaint management and call recording and referral automatic of customers request**						✓						
B2. **customers credit management**					✓							
C1. **Easy usability of software**									✓	✓		
C2. **software compatibility with previous systems**									✓	✓		
C3. **marketing**							✓	✓		✓		

Effective Key Indicators	Effective Key Indicators											
	A1	A2	A3	A4	B1	B2	C1	C2	C3	C4	D1	D2
C4. **projects management**							✓	✓	✓			
D1. **Recruitment and selection human resource management**												✓
D2. **training management and performance evaluations**											✓	

After determining interdependency between first level of model and effective key indicators, the model of research have presented in figure1.As detail of model is explained in research model section.

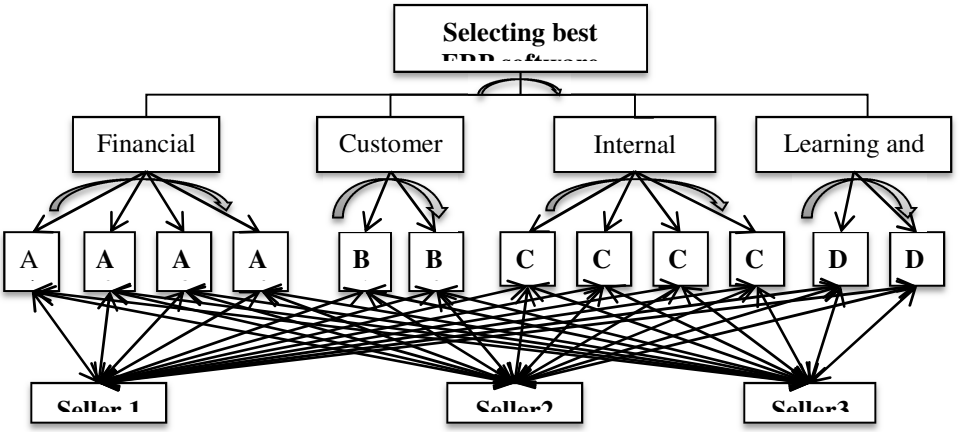

Figure1. Combination Model of ANP and BSC

Then three questionary based on network ANP are distributed among experts to do paired comparisons. We use Super Decision software to form network and analysis data. The inconsistency rate get less than 0.1 for all group decision matrixes and the weighted super matrix show in table 6.

Table6. Weighted Supper Matrix

Weighted supper matrix		alternatives			Selecting ERP software package	Financial sub criteria				Customer sub criteria		Internal process sub criteria				Learning & growth sub criteria		Criteria			
		Douran	Misys	SAP	GOAL	A1	A2	A3	A4	B1	B2	C1	C2	C3	C4	D1	D2	Financial	Customer	Internal process	Learning & growth
alternatives	Douran	0	0	0	0	0.074	0.105	0.055	0.042	0.193	0.081	0.111	0.118	0.070	0.073	0.218	0.248	0	0	0	0
	Misys	0	0	0	0	0.154	0.306	0.099	0.377	0.094	0.367	0.119	0.112	0.271	0.146	0.196	0.139	0	0	0	0
	SAP	0	0	0	0	0.272	0.589	0.346	0.081	0.213	0.052	0.270	0.270	0.159	0.281	0.085	0.114	0	0	0	0
Selecting ERP software package	GOAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Financial sub criteria	A1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.104	0	0	0
	A2	0	0	0	0	1	0	0.393	0.392	0	0	0	0	0	0	0	0	0.216	0	0	0
	A3	0	0	0	0	0	0	0	0.108	0	0	0	0	0	0	0	0	0.077	0	0	0
	A4	0	0	0	0	0	0	0.107	0	0	0	0	0	0	0	0	0	0.103	0	0	0
Customer sub criteria	B1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.301	0	0
	B2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.199	0	0
Internal process sub criteria	C1	0	0	0	0	0	0	0	0	0	0	0	0	0.293	0.304	0	0	0	0	0.093	0
	C2	0	0	0	0	0	0	0	0	0	0	0	0	0.073	0.136	0	0	0	0	0.170	0
	C3	0	0	0	0	0	0	0	0	0	0	0.162	0.155	0	0.1	0	0	0	0	0.092	0
	C4	0	0	0	0	0	0	0	0	0	0	0.338	0.345	0.134	0	0	0	0	0	0.144	0
Learning & growth sub criteria	D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.301
	D2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.199
criteria	Financial	0	0	0	0.572	0	0	0	0	0	0	0	0	0	0	0	0	0	0.315	0.354	0.293
	Customer	0	0	0	0.128	0	0	0	0	0	0	0	0	0	0	0	0	0.150	0	0.087	0.048
	Internal process	0	0	0	0.249	0	0	0	0	0	0	0	0	0	0	0	0	0.282	0.140	0	0.082
	Learning & growth	0	0	0	0.052	0	0	0	0	0	0	0	0	0	0	0	0	0.068	0.045	0.059	0

After calculating weighted vectors between criteria, important criteria and scores for vendor companies, final score and ranking have done. Table 7 referred the importance of effective key indicators and ranks them according to main criteria.

Table7. The Importance of Effective Key Indicators

Criteria	Effective Key Indicators	Weight
Financial perspective	A1	0.449
	A2	0.263
	A3	0.186
	A4	0.102
Customer perspective	B1	0.528
	B2	0.472
Internal process perspective	C1	0.277
	C2	0.276
	C3	0.227
	C4	0.219
Learning and growth perspective	D1	0.562
	D2	0.438

5. Conclusions

What in this study has been achieved based on analysis and key indicators and effective key indicators extracted according to Table 2 and 3. Then we do paired comparisons between criteria and sub criteria. Finally weights of each criterion which include financial, customer, internal process and learning and growth, respectively, 0.571, 0.127, 0.248, 0.05, is obtained. As a result, financial criterion has the most effective than the other criteria in selecting software package. As well as, internal processes criterion has more effective rather than customer and learning and growth. One of the results obtain from the model, is the importance of effective key indicators in each criterion. According to Table 5, for example budget control has more effective than other indices in financial criteria to choose a suitable package. Finally, SAP with normal weight 0.377 can present better coverage than other alternatives on main criteria, sub criteria and standards goals and strategies of Tejarat Bank. Although Misys Company isn't also very different from SAP Company, this company can be a good software package based on goals and strategies Bank. Table 8 shows ranking of vendors.

Table8. Ranking of Vendors ERP Software Packages

Alternatives	Weight	Normal Weight	Rank
SAP	0.126	0.377	1
MYSIS	0.121	0.363	2
DOURAN	0.08	0.259	3

Some suggestions are given as follows:

1. Selection process of these systems is very difficult and troublesome. If we don't do one or more stages of the selection process, it may cause the selected system not to overlap with the needs of organization.
2. Using "Analytical network process" that was used in this study had some limitations and problems. Internal interdependency may make a lot of paired comparison. Because of that, selection process can make long and complicated. It is necessary to pay attention this issue in future research.

3. Future researcher recommended using this model in uncertainty or Fuzzy situation.

4. The model of research can be applied in general issue so other banks and organization are proposed to utilize this model to select suppliers.

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