The Journal of Mathematics and Computer Science

Integration of Fuzzy Analytic Hierarchy Process (FAHP) with Balance Score Card (BSC) in order to Evaluate the Performance of Information Technology in Industry

Hamid Reza Feili[1*], Nazanin Vasheghani Farahani[2],Naghme Vesaghi[3]

Hrfeili@gmail.com
Ramayana.1986@gmail.com
Na_vesaghi@yahoo.com

Abstract

The degree of effectiveness of information technology (IT) in industry and the way it aids organizational goals are considered as very key sensitive points in industry's communications and interactions in the worldwide scale. In fact information technology has got various functions in different sectors of industry most of which are not simply quantifiable.

Usually a large quantity of the information we deal with in industrial atmospheres are ambiguous and in a way fuzzy. That's why it makes it almost impossible to utilize common ways of decision-making in this area.

In this research due to integrity of decision-making approach, evaluation of information technology will be based on FAHP and BSC approaches. Ways forward for BSC to express organizational hierarchy are divided into four main sections (financial, buyer, the function's internal process, and training & rate of progress). These factors are considered as functional indicators for each section to be evaluated. The FAHP approach here is mainly advised to be used to clarify the ambiguity of the information.

In conclusion this integrated methodology facilitates planning in information systems and gives some clues to create a viable system of information technology in industry. That means provision of ways forward for improvements in performance of information technology in Industries.

Keywords: Fuzzy Analytic Hierarchy Process (FAHP), Balance Score Card (BSC), Information Technology, Industry.

[1*.] Assistant Professor, Industrial Engineering, Alzahra University
[2.] B.S, Industrial Engineering, K.N.T University
[3.] B.S, Industrial Engineering, K.N.T University

1. Introduction

IT includes computers, software and utilities, but it is useful when it merges these elements to achieve organizational goals. As a need for collecting, processing, storage and release of growth data, the importance of IT sector is constantly increased. Although recent studies on companies show that a large part of mental and financial capabilities of companies in the IT   and communication services sector have been invested, but some companies began to keep a fixed budget. Incomplete reports about the investments made and the uses of these funds has been a big problem for companies, because reports in a clear and tangible resources used for planning, development, implementation and operation of information systems Based on computer is difficult. One of the questions raised by managers is that whether the investments made in IT departments and information systems are valuable? have applications made in your IT department   been successful. According to what was said measuring the value of IT implementation and evaluation of information systems is important is highly enjoy. Various methods and techniques for evaluating investments in information technology and information systems over the years has been suggested that after a brief in this case. [1]

2. BSC and analytic hierarchy of stages (AHP)

As we know there are no certain tools to link policies and strategies of   organizations with daily performance . Board of Directors , Managing director senior managers determine goals and   Vision , Mission of Organization during sessions   and study variety of sources such as external environment , weaknesses and strong points ... Organizations must reach its goals and this means that each activity which is done in organization and each financial and non-financial resources which is allocated must be in line with supporting policy and strategy of organization. [2]

This hard work. so far different tools have been presented to fill this gap such as Balanced Score Card or BSC which were   presented in year 1996 by two theoreticians in   strategic management . Noun BSC means to keep score of a set of measurements which   a balance between Short and long term objectives, between financial and non-financial measurements and between important indicators and between internal and external aspects of the executive aspects.

Balanced Scorecard can assess performance of organization with considering satisfaction of different stakeholders. Balanced Scorecard is a combined from assessment scales which includes current , past and future performance . [3]

Balanced Scorecard presents information to managers. Organizations   can evaluate   the effects of strategic decisions on profitability and customers.

Kaplan& Norten says that the   balanced scorecard is: " financial criteria which include past evens are not success factors to evaluate performance of companies in industrial era . but these factors are effective to guide and evaluate performance of companies in present day which creating value and wealth by investment is done by investing in affairs of   suppliers, employees, processes, technology but it is not sufficient .

Balanced Scorecard method evaluates companies aspect of for dimensions   : financial aspect, customer satisfaction, employee satisfaction, internal processes of how organizations provide conditions for education, continuous development.

1- Financial: accounting numbers as a significant financial information with non-financial information are   considered   as important factors of evaluation. Balanced scorecard evaluates performance using scales such as profit amount circulation, saving, cash flow, additional economic value.

2-Buyer: Customer Satisfaction as a major success in activities of   organization. In case of dissatisfaction customers   find new suppliers gradually. Effective   Factors   on customers' satisfaction are   product quality, price, services offered in Organization .weak performance of

organization creates undesirable situation for the future in this context for company . Management of predicated objectives determined customer and market. For example, the original measurements are: customer satisfaction, retaining customers, attract new customers, market position, market share, quality of service targets are in the ring.

3- Training & rate of progress: fast trend of scientific changes in environment organization is obviously and this requires to replace current forces with staff with new knowledge in organization, Particularly in organizations which their activities need high skilled staff. This aspect in fact has a reducing role between goals and reality of human, systems and working practices is feasible measures included in this section are: the total amount of sales of workers, new technology costs, training costs and lead time to introduce innovation to market.

4- The function's internal process: operations of organizations or company set of processes which are related to organization directly or in directly . The purpose of this aspect is satisfying shareholders .customers through excellence in work procedures by which have the most feedback.

Balanced Scorecard processes emphasizes on processes which have considerable effects in improving relations with customers .Determining goals and methods at first must analyze unit value chain. A stage operation should be understood the scales for clients goals and financial criteria and Should be able to remove problems of present and future needs . Internal value chain consists of three main stages : innovation, operation and after sales-service.

BSC makes Organization to monitor measuring indicators in four financial items, customers, internal processes and learning. in this way some key function indicators (KPI) are selected . This indices must be defined strategy against organization .

BSC describes situation of organization against its strategies.

Analytical hierarchy process was introduced by Saty drsal in year 1971 to meet the needs of scarce resources allocated for the military planning . [4] Since introducing the AHP decision (MCDM) has been used widely. This method is used for grading and scoring occasionally for social and economic analysis may also be used. In This method before any action data must be standardized.

After this stage, Order of the population parameters we established Edit for forming the first matrix should be given weight to the indicators of this stage each index score is added.

Thus, weight of each indicator is calculated by multiplying weight of each index in the same index number and the index score is added .

Method of AHP is to identify elements and making decision and giving them priority which contains elements of different ways of doing work and giving priority to measures .

First stage: building a hierarchical tree.

Second stage : determining importance coefficient of criteria and weighing and replacing under the alternative is to weight .

The third stage: combining importance coefficient of options- combining weights

The fourth stage : adaptability test

In the First stage : in AHP process a hierarchical structure is created which objectives, standards and criteria under options and the relationship between them are shown.

Secondly: measures are placed in a matrix and then determination of the importance of (weight) standards and criteria are done : we compared them Two by two then using formal method to unify all measures .

Table 1: prominence of AHP

Value	COMPARISON
۱	same
۲	Relatively more similar to
۳	Or more relatively weak
۴	Relatively more to further
۵	Or more strong
۶	More so much more
۷	Much more or very strong
۸	Or more& more stronge
۹	Hundred percent reference

weighting Operations of factors are performed as follow [5] :

1-Using expert knowledge

In this way, using the experience and knowledge of experts in the field of application or considering range of studies ,weighting factors are determined. Advantages of this method

Simple. But this method has disadvantages such as the likelihood of making mistakes in determining the weight of expert problem of standardization and measurement units they are subjective, is.

2-using Knowledge of data

Knowledge-based data information in question is the answer. In data knowledge using existing solutions in location finding problem and calculate the amount of each factor dependent response can be related to the weight of each factor can be determined . In this way the probability of error is less appearing correctly, but its performance depends on the accuracy and precision are the basic answers.

3- Using expert knowledge and data simultaneously

In this method , according to the results of knowledge and experiences of experts and using available information each   factor receives weight. In this way the firstly weights through expert knowledge and data are calculated separately and then compared with optimal weight value. Finally the occurrence of incorrect weights is reduced will be closer to reality.

3. Fuzzy set theory:

Fuzzy theory was introduced by professor lotfali zadeh in year 1965 called fuzzy sets. He was famous professor in control theory before that .he noted "mode" concept which is the basis of modern control theory . In 1962 Asgarzadeh wrote something about biological systems: we needs new Mathematics , Mathematics which is not described by distributions or probabilities . he presented his method in fuzzy theory in an article named "Fuzzy sets" .

1960 s created challenges and rejected fuzzy theory and no research center did not it seriously.

but 1970s, fuzzy theory is considered perfectly and problems were removed .

In year 1965 professor Lotfi Zadeh introduced fuzzy set than introduced concepts of fuzzy algorithm in year 1968 and fuzzy decision making in year 1970 and fuzzy order in year 1971 he based principle of fuzzy control in year 1973.

1980s had slow progress but application of Fuzzy control strengthened Fuzzy theory.

Fuzzy set theory has been developed in different aspects such as:

fuzzy set as a targets subject to mathematical rules which are defined for classical logic   and linguistic perspective.

Logic is that principled view linguistic values are correctly set and fuzzy inference rules are more approximate to the objective.

A triangular fuzzy number, a special case of trapezium fuzzy number and is   famous Fuzzy Application (Chart 2 is shown.)

$$
\begin{cases}
\frac{x-a}{b-a} & a \leq x \leq b \\
\frac{c-x}{c-b} & b \leq x \leq c \qquad \infty < a \leq b \leq c < \infty \\
0, & Otehrwise
\end{cases}
$$

Strongest degree of membership that is the parameter b $1 = f\_\mu$ (b) is, while c and a are lower and higher limits . One important concept of fuzzy set is the α-cut. For a fuzzy number μ, and that any number α ∈ [0,1], α-cut, c_α set is determined.[6]

$$C_x = \{x | C(x) \geq \alpha\}$$

α-cut is   a fuzzy number μ, definitive set of μ α, that all elements of the universal set U μ degrees in a stronger or equal value are included. (Chart 2 is shown.)

Determining the confidence interval in a level , triangular fuzzy number can be defined as follows:[7]

$$\tilde{M}^x = [a^x, c^x] = [(b-a)\alpha + a, -(c-b)\alpha + c], \quad \forall \alpha \in [0,1]$$

Distance between two triangular numbers can be determined by   Ross method:

μ _ (1 =) (a1, b1, c1) and) μ 2 = (a2, b2, c2 two triangular fuzzy numbers are taking the distance between them is the following:

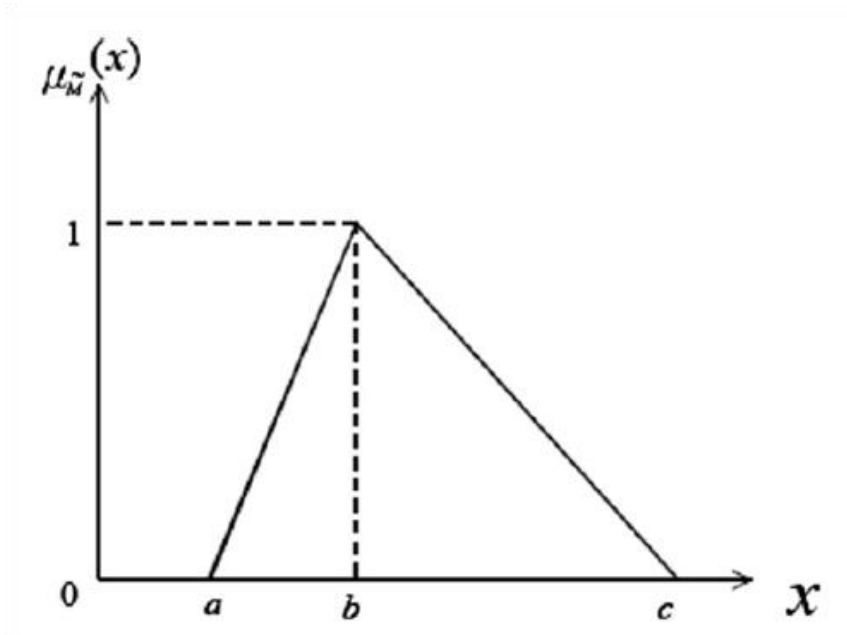$$d[\tilde{M}_1, \tilde{M}_2] = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}$$

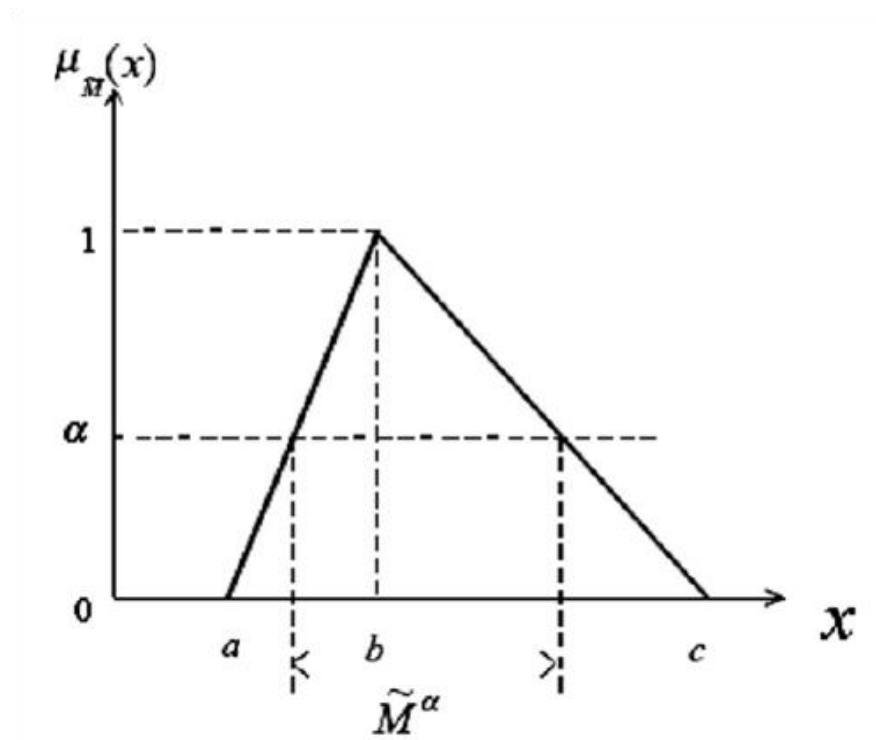**Chart 1, membership function of triangular fuzzy number μ = (a, b, c)**

Chart 2, α-cut of triangular fuzzy number μ

Different method ever invented for categories are fuzzy numbers and each method has particular advantages and disadvantages. A known method, is the method of Classification intuitive fuzzy numbers by drawing a triangle membership function curves which are classified. Human understanding prefers a higher mean value and extent of the lower fuzzy numbers. A category known as other, is α-cut method. Classification Method Center for classified access also fuzzy numbers are often used. A broad approach and fuzzy mean by "Lee" in 1988 with overall average and standard error measurements based on fuzzy probability event was proposed. An appropriate decision model must justify ambiguous or fuzzy. Because this ambiguity has common features in many decisions Host. Since that decision makers often give non-definitive answer instead of true values so converting qualitative estimates may be not clear . AHP requires selecting .

Since the fuzzy linguistic approach can contain the optimism and pessimism of decision makers so expected in the accounts, the linguistic values of membership function is usually described by triangular fuzzy numbers to gauge superior rate instead of recommended numerical equivalence .finally Fuzzy AHP can therefore very appropriate and effective than conventional AHP in actual experience, which pairs comparisons uncertain environment are included . While "Ngy" and "Chan" in year 2005 presented a conventional application of AHP to select the best tools to keep data management (KM), "Chang" and "Wang" in 2006, planed a analytical hierarchal model based on fuzzy preference relations proved necessary to determine success factors for an organization in implementing KM, KM anticipated project and determine the necessary steps before launching KM. "Bozbora ",Baskes in 2006 suggested a FAHP method to improve the quality priority large-scale human-dominated fuzzy measure. T zang , Chiang and Lee in 2006, planed a generalized quantitative evaluation model of their design criteria in making the wholesale and fuzzy subjective perception. Factor analysis to show the relationships of independent evaluation criteria and laboratory testing and evaluation of decision-making method (DEMATEL) has been used to investigate the relationship is dependent factors.

AHP and fuzzy integral methods are used to reach the final impact of the Internet learning programs.

4. BSC's conjunction with other methods, and application of BSC in the fields of IT and IS:

conjunction of   BSC with other methods in   fields of IT and IS some methods in this regards are reviewed . [8] "Bankertal" shows An BSC analysis in application   of   metric in American Telecommunications . four metric performances are used in this regard . means that   return of assets (ROI) ,number connection to each employing and percentage of working network for processing domestic financial innovation and customers better envelopment analysis about DEA)) [1].to check the communication boundary between Financial performance metrics (ROA) and three non-financial performance metrics is planned. Ravy , Shankar in year 2005 analyzed solutions in inverse calculation for computers by ANP and BSC.

Problems of ANP related to   option inverse calculations occurs in organization. by ANP, dependencies between criteria and secondary criteria minor determiners can be considered by BSC financial and non-financial factors can be connected. Thus a combination of BSC in all fields such as IT and IS has been used. "Kaplan" "Norton" 1992 used an IT company to explain BSC Use by creating Framework BSC for some purpose of   management.[2] "Viclaks and "Lester" 1994 organized a BSC Framework   for specific needs in assessing Investment IT in a big European motorboat company . "Martynstal   " 1992 and "Martynsvnstal" in 1999, suggested BSC application   to help managers in assessing investment of IT and performance of IS organization . "Auburn" "Buglione" 2003 concluded that traditional BSC cannot integrate   all   aspects .a multi-dimensional executive model has been suggested to integrate BSCs for organization using by (QEST) for BSC.[1] "Milis" and "Mercken," in year 2004   reviewed Technology Assessment Investment old static like investor (PP) Accounting income ARR)) ROL and the IRR and NPV for communications technology and information projects . A multi-layer Assessment process mixture of BSC and multilayered evaluation has been suggested as tool within BSC .[9]

So Previous knowledge of users is valuable in creating framework but little variety of BSC make us to use a new method for estimating scales. Integration In performance   must be performed by BSC users. AHP can with BSC to removed problems . incomplete   hierarchy may result incompetent since that BSC estimates performance of companies so a combination of BSC and AHP can minimize executive problems perfectly. "Stuart" and "Mohamd" in 2001 suggested the framework of BSC for evaluating performance of IT and IS in combining   AHP and (MAUT) . AHP is used to organize the hierarchy and relative executive aspects   and MAVT is use to facilitate converting executive   sizes to proper units.[10]

Measuring performance improvement of final IT & IS   can be resulted in each rank of decision making. "Clinton", "Weber" and "Hsl" In 2002 used AHP in performing a BSC .[11]

The first level of BSC hierarchy includes four aspects of BSC and the second level of the hierarchy includes metric AHP can be used to Select   BSC metrics and support to understand the relative importance of metrics.

"Sohn" and "Yu" and "Lee" in 2003 studied the relation between unique strategies of Environmental pressure and executive measuring BSC.[12]

AHP is used to calculate relative weights in executive measurement also "Srsy" in 2004 merged AHP and BSC to study the matching rate between the rankings of four aspects of BSC   of Management and strategic innovation for companies., "Chiang" in 2005, suggested a dynamic approach based on AHP and BSC for the problems in selecting seller .[13]

5.ProposedModel:

In this study, to prepare a list of executive indicators assessment   four aspects of BSC is considered as bases and then to correct the list , an expert in IT department of industrial companies in Iran is interviewed. A questionnaire is designed according to conventional AHP   questionnaire and includes four aspect of BSC and Executive indicators. Questionnaire is distributed among senior managers of IT

department in industry and its results are analyzed through the FAHP program .the results of research provide suggestions for IT department of industrial companies in promoting strategy .

5-1-collectingdata

performance Evaluation Hierarchy of IT as in table 2 is planned based on the concept of BSC and performance of IT and interview with IT experts .this questionnaire is designed like conventional AHP questionnaire. forty questionnaires will be distributed. among seiner IT managersinindustry.

Table 2: performance Evaluation of hierarchy of IT department in factory industry.

Target	Aspect	Performance indicators
It executive assessment division	Financial	*Capital efficiency*
-	-	Net present value
-	-	Cost of buying
-	-	Network costs
-	Customer	Internal compliance
-	-	Maintain the amount of time using computer system
-	-	Health info
-	Internal work	Average system functionality and stability
-	-	The number and quality of simplification of internal procedures
-	-	Events towards solving problems
-	-	Project completion period
-	Growth and learning	Initiatives on the old systems
-	-	Develop new systems
-	-	Number of it personnel training work vsaat

☒5 -2- Fuzzy analytic hierarchy process (FAHP):

FAHP is used to create weighing BSC executive indicators. there are six important steps :

1. Planning structure of hierarchy with decision making elements for example, partial scales from each decision maker to be noted the relative importance of two elements of decision in a level by 9-point scale , and to collect compare pair scores to create compare pair for each decision maker of K.
2 : analyzing coordination: Priority for elements can be determined by amount and vector of properties which (W) is determined vector and weight vector of R matrix and MAX is the largest amount of R :[14]

Table 3: Random Indices (RI)

N														
	3	4	5	6	7	8	9	10	11	12	13	14	15
RI														
	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.15	1.51	1.48	1.56	1.57	1.59

which N is the number of cases which are compared in the matrix R and RI index is random. Average coordination of index, the random matrix the same size as comparison pairs are shown in table 2. The values of CR is the upper threshold for a matrix 3 × 3, 0 / 05 and for a matrix of 4 × 4 is 0 / 08 and for greater matrices is 0 / 10.

3. Unknown positive projection matrices. Scores of pairs Comparison to linguistic variables by positive on known have been listed in table 3. According to "Balks" curve , positive phase inverse matrix is defined as follows:

$$\tilde{R}^K = [\widetilde{r_{ij}}]^K$$
$$\widetilde{r_{ij}} = 1 \quad , \qquad \forall i = j$$
$$\widetilde{r_{ij}} = \frac{1}{\widetilde{r_{ij}}} \qquad , \forall \, i \, \& \, j = 1,2,3, \dots, N$$

4- Calculating unknown weights. Based on LAMBD _MAX method , average of "Balks" and "Sotora " is recommended and unknown weights of dissection elements are calculated as follow:
deploying α-CUT, 1 = α to access decision positive matrix K, R _ (b) ^ K = (r _ij) _b ^ K and 0 = α to achieve within the lower and upper limits so :
Weight of matrix is calculated as weight calculation which is proposed in AHP approach.

Table 4- triangular fuzzy numbers.

Linguistic variables	Positive triangular fuzzy numbers	Positive reverse triangular fuzzy numbers
Very very strong	(9,9,9)	(1.9,1.9,1.9)
Middle class	(7,8,9)	(1.9,1.8,1.7)
Very strong	(6,7,8)	(1.8,1.7,1.6)
Middle class	(5,6,7)	(1.7,1.6,1.5)
Strong	(4,5,6)	(1.6,1.5,1.4)
Middle class	(3,4,5)	(1.5,1.4,1.3)
The firm	(2,3,4)	(1.4,1.3.1.2)
Middle class	(1,2,3)	(1.3,1.2,1)
Equally strong	(1,1,1)	(1,1,1)

$$W_c^K = \left(\tilde{r}_{ij}\right)_c^K, W_b^K = \left(\tilde{r}_{ij}\right)_b^K, W_a^K = \left(\tilde{r}_{ij}\right)_a^K \qquad , i = 1,2,3, \dots,$$

To decrease weight of fuzzy M_c^k و M_c^k is selected as follows :

$$M_a^k = Min \left\{ \frac{w_{ib}^k}{w_{ia}^k} \, ; 1 \le i \le n \right\}$$

$$M_{ac}^k = Min \left\{ \frac{w_{ib}^k}{w_{ic}^k} \, ; 1 \le i \le n \right\}$$

In lower and upper limits , weights are defined as follow :

$$W_{ia}^{*k} = M_a^k W_a^k$$
$$W_{ic}^{*k} = M_c^k W_c^k$$

* By combining w_ia ^ (* k), w_ib ^ (* k), w_ (ic) ^ (* k), fuzzy weight matrix for K can be obtained and is defined as follows:

   i = 1,2,3, ..., n, w _i ^ k = (w_ia ^ (* k), w_ib ^ (* k), w_ (ic) ^ (* k)) are defined.

5- Comments collected decision, the geometric mean for the combining weights of fuzzy decision receivers are used as follow :

$$\widetilde{W}_i = \left(\prod_{k=1}^{k} \widetilde{w}_i^k \right)^{\frac{1}{k}} \qquad , \forall K = 1,2,3, ..., k$$

$\widetilde{W}_i$: combined Fuzzy weight of i and   K

w _i ^ k: Fuzzy weight of I and   K

K: number of decision makers

6- Final rank: Based on the equation that   "Chen"   offered it in 2000 ,a Precaution coefficient is defined to reach the rank order of elements of decision . Precaution coefficient is defined as follows:[15]

5 -3- Information Systems Planning of FAHP:

Computer software packages such as (Selecting Expert, EXPERT CHOICE)[16] is used to solve the problem of abundant in AHP. Although there is no commercial FAHP So we plan a FAHP information system with combining Terminals equipments and computer programs used by (POWER BUILDER), and (MYSQL) .

 POWER BUILDER is a 4GL rapid application as development tool in (RAD) industry by (SYBASE)[17] has been obtained for the system construction. Because it develops productivity and capabilities through the integration of modeling, the design development and management.   (MYSQL 500)[18] is One of the most popular open source database has been accepted because of the exponential characteristics of the new company to develop more productive and more expanded uses. laboratory Sample is used to help authors to build an information system intuitive and easy to manage by users. Important point is that ,this FAHP information system Not only can solved the problems but also it is used to solve   Public MCDM problems .

     Information System of performance evaluation designed by the exponential trend shown in Chart 3 is developed. Finally, the performance evaluation system by repeated testing on the initial sample has been expanded and includes five subsystems: the project, assessor   , data analysis, information search and managing   final user . functioning subsystems here is expressed in summary form

* Project's subsystem :

1. Adding a new project: a new project, including project name, target assessment, standards and detailed criteria which can be added.

2. Deleting a project: the project is no longer needed, the project includes all the contents can be removed.

* Assessor's subsystems:

1. Adding a new assessor : basic information of a new assessor are positive, such as name, coherence, title and contact number.

2. Deleting an assessor: basic information that a assessor no more is that the assessment can be eliminated.

3. Modifying information of assessor: basic information of an assessor can be a modified .

* The subsystem of data analysis :

1- Assessment structure : hierarchical structure of   problems can be planned.

2. Data: questionnaire responses are stored. Such as the importance of the two indices.

3. Test coordination: coordination of pairs compared matrices.
4. Comparison matrix: Based on data obtained from questionnaire data, positive matrices are formed unclear.
5. Weights Comparison: Based on the concept of FAHP, comparison matrix are formed as pair
6. Unknown matrix: gaining unknown weight by elements decided of decision and unifying the ideas of decision maker .
7. Rating: obtaining the final ranking of the decision elements.

Chart 3: development cycle of system

Background system:

1. Organizing maps performance evaluation system
2.work flow analysis performance assessment system
3.project work flow analysis
4.assessment indicators work flow analysis
5.building database analysis

System design:

1.interface layout system
2.design work flow system
3.construction project database
4.datas plan
5.datas processing design

System development:

1.sampel end-user management
2.sampel assessment
3.sampel calculation
4.sampel search
5.other sampel

Building system:

1.analysis programs
2.encoded programs

3.armaysh programs
4.correction programs
5. payment

Subsystem of information system
1. Creating Unknown weights: weights uncertain elements such as decision criteria, minor criteria are shown
2. Forming Rating : Rating Decision elements such as norms, standards and late component are shown.
* subsystem of managing final user :
1. Initial value to the database: database reset to initial conditions.
2. duplicate databases: getting copies of the current state of the database.
3. Supervising User: setting different optional limits for different users.
4-5 - Data and analysis:
collected Responses from questionnaires , the input system FAHP are analyzed by FAHP Some stages are as follow :   a new project can be made by selecting "" NEW sub option "FILE" : To remove a project option "DELETE" Select Please . The next step is planning hierarchy. Inserting aspects and Executive indices in questionnaires designed "building assessment" Subsystem data analysis, as four aspects of BSC are registered as scale.
Outcome of comparison pair of decision makers are filled out by selected nine-point scale numbers . after entering data system makes pair compare automatically . the highest amount of matrix is calculated by EQ . if coordination test is not passed questionnaires can be ignored by decision maker . unknown positive Matrices are made based on result of questionnaire and EQS is accepted subsequently to calculate decision elements of weights. Fuzzy weights of different decision makers ultimately are combined by EQ.
Super final weights and rating are obtained by the EQ .

7. Results
This article provides an approach based on FAHP and BSC to assess performance of IT department in industry. analytic hierarchy has been made by four aspects of BSC includes financial, customer, internal process and learning , followed by executive performance indicators . Because human decision-making process is ambiguous, FAHP is chosen to solve problems .
Some guidelines of this research are:
1. This study accepts the concept of BSC to develop executive evaluation building industry for IT department in factory industry. Based on literature and interview with IT experts we end this article with 14 Indices in IT The department.
2. This study considers a fuzzy set and AHP, to present performance assessment model to provide guidance for managers about IT evaluation section.
3. FAHP information system has been planned to assist calculations, the appropriate weights for the evaluation of performance in IT department .an IT department can accept it for daily performance evaluation . in the highest degree it is useful and it can be used for problem solving of MCDM with a fuzzy nature in real application .also there is no need Programming knowledge to use these information systems. user only needs AHP knowledge for hierarchical planning and entering questionnaires and the results are obtained with clicking on Signs.

References

[1] Abran,A.,&Buglion,L.(2003) " A multidimenson performance model for consolidating balanced score card " Advance in Engreening software ,34,339-349

[2] Kaplan , R.S,&norton,D.P.(1992)"The balanced scorcard : measures that drive performance ",70(1) , 71-79

[3]Kaplan , R.S,&norton,D.P.(1992)"The balanced scorcard to work " Harward business reviwe ,71(5) , 134-142

[4] Saaty, T. L. (1994). How to make a decision: the analytic hierarchy process. Interfaces, 24(6), 19–43.

[5] http://gis4.blogfa.com/post-24.aspx

[6]Klir, G. I., & Yan, B. (1995). Fuzzy sets and fuzzy logic theory and
applications. London: Prentice-Hall International

[7] Cheng, C. H. (1999). Evaluating weapon systems using ranking fuzzy numbers. Fuzzy Sets and Systems, 107, 25–35.

[8]Banker ,R.D.,chang , H.,Janakiraman. S.N,&konstans .C.(2004)." A balanced scor card analysis of performance metrics " european of operational resherach ,154,423-436

[9] Milis, K., &Mercken, R. (2004). The use of the balanced scorecard for the evaluation of information and communication technology projects. International Journal of Project Management, 22, 87–97.

[10] Stwart, R. A., &Mohamed, S. (2001). Utilizing the balanced scorecard for IT/IS performance evaluation in construction. Construction Innovation,1, 147–163.

[11] Clinton, D., Webber, S. A., & Hassel, J. M. (2002). Implementing the balanced scorecard using the analytic hierarchy process. Management Accounting Quarterly, 3, 1–11.

[12] Sohn, M. H., You, T., Lee, S.-L., & Lee, H. (2003). Corporate strategies,environmental forces, and performance measures: a weighting decisionsupport system using the k-nearest neighbor technique. Expert Systemswith Applications, 25, 279–292.

[13] Chiang, Z. (2005). A dynamic decision approach for long-term vendor
selection based on AHP and BSC. In D. S. Huang, X.-P. Zhang, & G.-
B. Huang (Eds.), ICIC, 2005, Part II, LNCS 3645 (pp. 257–265).
Berlin: Springer-Verlag

[14] Saaty, T. L. (1980). The analytic hierarchy process. New York: McGraw-Hill.

[15] Chen, C. T. (2000). Extensions of TOPSIS for group decision-making under fuzzy environment. Fuzzy Sets and Systems, 114, 1–9.

[16] Expert Choice (2006). Expert Choice. Available from: http://www.expertchoice. com/.

[17] Sybase (2006). PowerBuilder 10. Available from:
http://www.sybase.com/products/developmentintegration/powerbuilder/.

[18] MySQL (2006). MySQL 5.0. Available from: http://www.mysql.com/products/database/mysql/.