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Application of analytical network process for business intelligence performance assessment

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Abstract

Since the effective evaluation of information systems' efficiency is a key element in the success of any system, this study assesses the business intelligence performance which is the most developed information system. Therefore, the basic model of research with five major criteria including the compliance with the business and users' requirements, system performance, fulfilling the requirements of organization and the ability to integrate, system flexibility and integrating the experiences and requirements was developed with 14 sub-criteria after investigating the research literature and background. The Analytical Network Process was applied for system evaluation according to the impact and dependency of numerous factors on BI performance. Accordingly, the decision-making issue was structured in a network at three levels and then the main data of research was collected through the pairwise comparison questionnaire developed based on studies by Lin (2009) and Haghighat-Monfared (2010) and analyzed by Super Decision Software. The results indicate that the business intelligence system performance with the normal weight of 0.287 has the highest priority. The business requirements criterion is also put in the second priory with the importance equal to 0.252. The system flexibility criterion is put in the third priority and the ability to integrate had the lowest important. The results of this study can be as the guides and complementary to the implementation of business intelligence, thus the organization can allocate both its financial and time resources according to the priorities of system performance evaluation in order to achieve and improve the organizational objectives.

Keywords: Business intelligence systems, Analytical Network Process, fuzzy logic, fuzzy network analysis

Introduction

Nowadays, leading to have the powerful infrastructures including the IT information systems is among the strategic challenges of organization due to the development of information technology in the organizations; so that, the managers are making attempts to acquire the appropriate knowledge of operation in the system through implementing a variety of ISs in the organization during different periods. Evolution of ISs in the organization has been led to the emergence of TPSs in the first years of ISs creation until the creation of business intelligence systems in the current era in a way that most of the current organizations have at least the initial information systems. The business intelligence has been introduced not only as a tool, product or system, but also as a new approach in the organizational architecture based on the speed of information analysis to make the intelligent and accurate business decisions as the solution for today organizations in the shortest possible time.

Application of business intelligence process declares that "what happens in the system?" The current information processing responds to this question: "Why did this event happen?" Finally, it can be predicted according to the managers' decision that: "What will happen?" (English, 2005). On the other hand, the IT projects are often led uncontrollably or in the best condition through utilizing the project management because of new IT industry and its continuous and sustainable changes. In such these projects, the performance evaluation subject is strange due to its imperceptible features compared to other types of projects and we should have the accurate evaluation of performance of these systems including the business intelligence in the IT projects in order to avoid incurring the additional costs and to create the proper performance in the program and achieving the target objectives. Therefore, this study evaluates

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the performance of BI systems according to the importance of subject and the research gap in this regard and based on the previous studies and applying Delphi method (in Behsaman Tadbir company, Khuzestan province) through 5 main criteria including the compliance with the business and users' requirements, BI system performance, system flexibility, fulfilling the organizational requirements and the ability to integrate the experiences and requirements. On the other hand, the BI system performance evaluation is a complex process due to being affected by numerous qualitative and quantitative factors. The Analytical Network Process has been applied to deal with these complexities, thus the main objective of this study is to provide the evaluation model of BI systems performance through the Analytical Network Process. It is expected that this research will theoretically develop the knowledge and literature of business intelligence systems especially the way of their performance evaluations, will identify the factors which affect the success of business intelligence systems in the organizations which produce the software based on the previous research, and provide the field for more research on developing the knowledge of BI contemporary systems and the required incentives for organizations in applying the system because in the case of using the business intelligence systemin the organizations and companies,the employees' whole tasks will be done through the portal and it will be no need to check the input inbox and different software separately or work with different files, etc.

In the methodology and empirical section of research: The functional model is presented based on the network analysis to evaluate the performance of BI systems.

Theoretical Principles

To survive along with the technology advances, the organizations should consider the mastery over the new technologies such as the business intelligence in businesses as the unavoidable necessity. The Business Intelligence (BI) was first introduced by Howard Dresner from Gartner Group in 1989 in order todescribe aset ofdesignedconcepts and technologies with the aim to improve the decision making in the business through applying thefacts and fact-based systems (Alan, 2003).

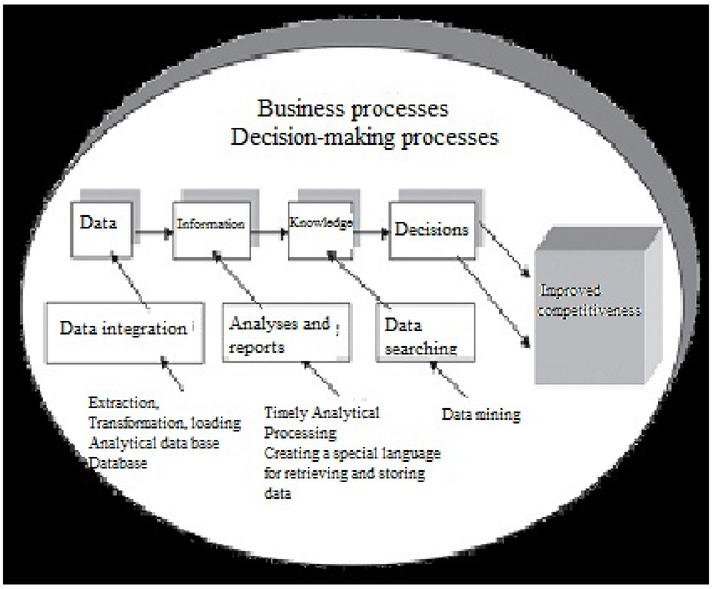


Figure 1. The role of Business Intelligence in Decision Making

Jalonen and Lonnqvist (2009) argued that the business intelligence creates the analyses and reports about the business environment processes and internal issues of organization and these analyses can be automatically and systematically (or based on the specific demands or conditions) prepared or be associated with the content of a particular decision, and the knowledge obtained by the decision maker can be appliedat different levels of organization.

The BI provides the timely and appropriate business information and the ability to reason and understand the hidden meaning of business information (Azoff& Charlesworth, 2004).

In a full meaning, the business intelligence is considered not only as a product or system, but also as a new architecture approach which includes a set of applied and analytical programs which obtain and help decision making for business intelligence activities basedon the operational and analytical database (Moss & Atre, 2003).

The need for business intelligence presence starts from the highest corporate hierarchies and the sense of BI presence is created at the highest level of management hierarchy and transferred to the lower levels. While, we should start from the lowest levels of organization in order to establish the business intelligence in the business because the generated target data and business intelligence tools start from the lower layers.

The first layer of Business Intelligence architecture includes the service provider of analytical data warehouse which is a database system interface. This layer extracts the required data from the operational data, external resources and flat files, etc in order to create the data warehouse. The middle layer includes aservice provider of online analytical processing by which the multidimensional cubes can be constructed. The online analytical processing is a powerful, fast and appropriate tool for reporting. The last layer consists of thereporting, analysis and data mining tools. To implement a data warehouse, each of the layers should be properly implemented. Figure 1 shows the data warehouse process.

As shown in the figure, the data is initially collected from different electronic or textresources and is sent to the next stage, which is "Cleansing and Integrating" after extraction, transformation and loading; these two stages are usually called the "Display zone". The data cleansing stage is one of the key sections of this stage to access to "A reliable data source".

Then the "Data Storage" is done in order to store and classify data. This "Data Classification" is on the basis management issues and is among the major features of this stage. The subsequent stage, known as the "Decision Support Systems" includes the queries, reports and online analytical processing, and "Statistical and thematic analyses". The last layer consists of thedata "Display andPresentation" in the form of data dashboard and performance management. (Inmon, 2005).

The Business Intelligence in the organization considers all users and their relationships in order to perfectly cover the value chain of enterprise; with respect to this logic, under which if the wrong or incomplete information is given to each analyst in the form of a system or organization, its output will never be evaluated properly and if the best mechanisms are not available for the individuals, they will not have the significant performance and their useful work life will be reduced, thus the organization should investigate the business intelligence performance according to the criteria to prevent from the irreparable damages to the output in spite of spending the high time and cost for making the overall changes since it is impossible to return to the first status and correct mistakes or change again in the case of failure.

Therefore, since the selection and application of business intelligence is a new approach, the managers and senior managers need to verify the reasonableness and appropriateness of their selection through evaluating this system. According to this important point, a little effort have been made for evaluating the business intelligence and it has been often considered as a single system not in a organizational system framework.

Furthermore, Lonnqvist and Pirttimki (2006) designed the set of business intelligence function criteria in a research; before them the researchers had conducted the studies with the aim at justifying and proving the need for investment and business intelligence value Elbashir *et al.* (2008) focused in a research on the effect ofbusiness intelligence systems on the business processes and provided a measurement method of effect.

In a research entitled as "Financial business intelligence", Rahnama Roodposhti and Azedi Tehrani (2010) described the theoretical and practical concepts of financial business intelligence, procedures, processes, key indicators, models and methods of choosing the appropriate tools for implementing and improving the business intelligence in the organizations and concluded that the research findings can lead to an appropriate model for measuring the financial business intelligence in the organizations

Lin *et al.* (2009) developed the performance assessment model of a single business intelligence system through the Analytical Network Process (ANP), but again they studied the business intelligence independently on the organizational system. 12 experts' viewpoints have been applied in this research in order to determine the sub-criteria. The results of this research indicate that the main factors affecting the efficiency of aBI system include: The output and data accuracy, compliance with the requirements, and protecting the organizational efficiency. Moreover, Rohani and Ghazanfari (2012) conducted an article entitled as "The assessment of business intelligence resulted from the organizational systems with the fuzzy multi-criteria approach" with the aim at pursuing the new theories in the field of replacing the Decision Support Systems with the Business Intelligence resulted from the organizational systems. According to the survey data in this research, a tool (expert system) is designed and implemented in order to determine the business intelligence of system through a Fuzzy Topsis approach and the systems' intelligence is evaluated in five areas or main bases through applying 34 assessment criteria.

In general, the application of business intelligence assessment follows two main objectives. The initial and most usual objective of business intelligence assessment is to prove its value for investment (Sawka, 2000). It helps to develop the business intelligence process and ensure that the business intelligence products provide the organization and users' real requirements. The organizational intelligence measurement and assessment is the second objective. The multi-criteria decision-making techniques are applied for business intelligence assessment due to the impact of numerous factors on the business intelligence performance. The way of choosing and applying themulti-criteria decision-making techniques has been an important step in the research and a rule for choosing this technique is introduced by Kirytopoulos *et al.* (2008). Kirytopoulos proposed the questions by which the user is finally guided to use the target methods. They created a framework of 7 questions which should be responded in order to choose the most appropriate MCDM method for each decision making issue:

1. Is the decision making environment reliable or not?
2. Does thedecision making allow toexchange (replacement) among the criteria?
3. Is the issue structure hierarchical?
4. How is the shape of data (quantitative, qualitative or combined)?
5. Is the target method easy in terms of understanding and application?
6. Is it possible to display (present) the results numerically andgraphically?
7. Is the target method compatible with the human thinking way?

According to the response to thequestions above, the ANP in the fuzzy environment is the most appropriate method. The term"ANP"is the abbreviation of the Analytical Network Process which means the Analytical Network Process. The Analytical Network Process (ANP) is a developed and general way for the analytic hierarchy process (AHP) method; the dependency in theanalytic hierarchy process should be linear and from up to down or vice versa, but if the dependency is bilateral, meaning that the weight of criteria is associated with the weightof optionsand vice versa, then the case will not have thehierarchical mode and the analytic hierarchy formula should not be used. Saaty(1996) introduced the developed analytic hierarchy process (AHP) method. To model the case, a network, in which the available nodes areequivalent to the purpose, criteria and options,is drawn. The directional vectors, which link these nodes to each other, indicate the direction of effect of the nodes on each other.

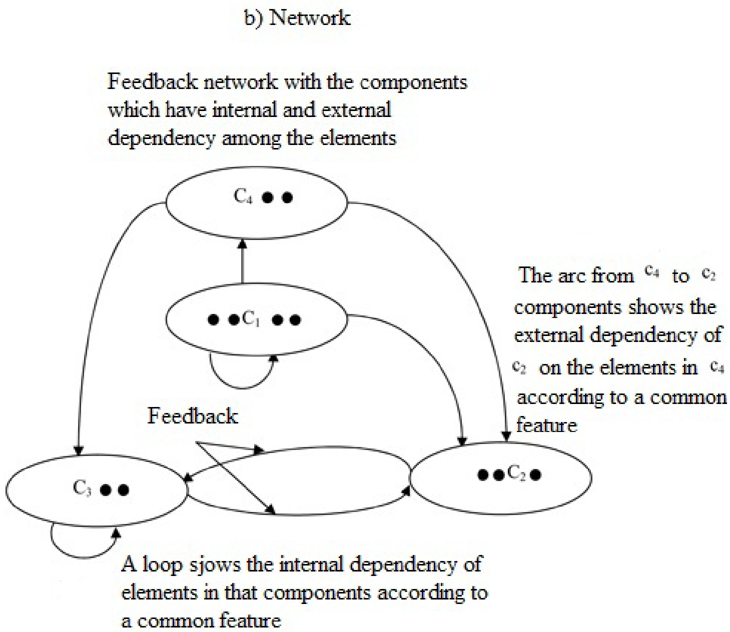


Figure 2. Network Analysis Structure

The objective is at the first level of network and the main factors are at the second level. The main factors have the internal dependency and are put at the third level of subsidiary factors.

To form the super-matrix, first the pair-wise comparison is done on the main criteria based on the objective: W21

The pair-wise comparison is done on the main criteria based on each criterion: W22

The pair-wise comparison is done on the sub-criteria based on each criterion: W32

The pair-wise comparison is done on the set of available sub-criteria: W33. Thisset of calculation makes the asymmetric supermatrix structure as drawn in the following figure.

$$\begin{array}{l} \begin{array}{ccc}\text{Sub-criteria} & \text{Criteria} & \text{Objective}\end{array} \\ \left(\begin{array}{ccc} \cdot & \cdot & \cdot \\ \cdot & W_{22} & W_{21} \\ W_{33} & W_{32} & \cdot \end{array}\right) \begin{array}{l}\text{Objective}\\ \text{Criteria}\\ \text{Sub-criteria}\end{array}\end{array}$$

Figure 3. Supermatrix Structure

The unweighted supermatrix becomes the weighted supermatrix (normal) through applying the concept of normalization. The sum of components in all columns is equal to 1 in the weighted supermatrix. The weighted supermatrix is extracted from Super Decision software. Ultimately, the limit supermatrix is calculated. The limit supermatrix is calculated through exponentiation of all weighted supermatrix components. This process is repeated until the entire supermatrix components become similar; in this case, all supermatrix entries are zero and only the entries associated with the sub-criteria arenumerical and repeated for each row. The limit supermatrix, calculated by Super decision software, canlead to the ultimate priorities of indexes and options.

Materials and Methods

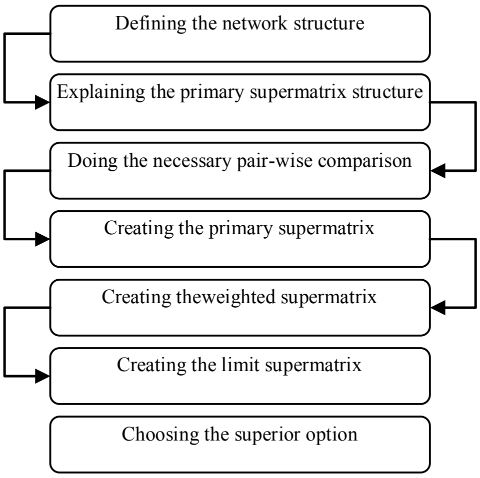
This study is "Applied" in terms of objective and "descriptive-exploratory" based on the data collection; it is descriptive since it includes a set of methods with the aim at describing the studied phenomenon or phenomena. The description and introduction of business intelligence performance are done through enumerating the features, dimensions and limits of that phenomenon; and it is a kind of modeling since it seeks to provide the model for the model by applying the ANP.

The statistical population of this study contains all software manufacturer companies and theexecutives of intelligent-making projects in the educational centers of Khuzestan province. The targeted sampling is applied in this study since thedata is collected on the basis of individuals' skill and expertise in the field of Business Intelligence. The targeted sampling is the best way to acquire the experts' viewpoints in a particular field. Thus, 11 experts and professional were identified in the field of business intelligence implementation.

Two library and field methods are applied for data collection in this research. Various magazines, conference papers and academic reliable websites are applied through the library method for writing the research literature (theoretical principles and research background), and choosing the research criteria and indices. The main research data is obtained through distributing the questionnaire among the experts and based on Delphi technique in order to investigate the research questions. The questionnaire of this research consists ofthree sections: First section- The pair-wise comparison of main criteria with the objective; Second Section-The pair-wise comparison of main criteria with each other (interaction of main criteria Main with each other);Third Section- The pair-wise comparison of selected indices with main criteria. The questions are designed in a way that the respondents can select one of the options 1 to 9 foreach question.

Delphi technique is applied for evaluating the content validity of questionnaire which was verified by the experts after implementing this technique. The content validity means that the designed questions measure the variable for which it is prepared. Its evaluation method is often based on the experts' professional judgments and experiences. The structure validity seems obvious since the research process is based on a theoretical framework and it seems that the validity of prediction is obtained because the extraction of factors depends on a large number of theses and articles.

To measure the reliability of this research, the inconsistency rate of consensus of experts is measured as well as applying the calculation associated with the inconsistency rate of each expert's response, thus the research reliability as confirmed. After collecting the questionnaires, the questionnaire data was classified, and the ANP technique was applied in order to weight each of the indexes. Then, the obtained data is imported to Excel and the research model is designed according to the following flowchart through applying Super-Decision software.



Flowchart 1- Stages of implementing the Analytical Network Process model

First stage:

At the first stage, the appropriateanalytical network model is designed in Super-Decision software according to the research objective and initially basedon thecriteria and sub-criteriaas shown in Table 1. Based on this model,theAnalytical Network Process (ANP) diagram will be according to the Figure 4.

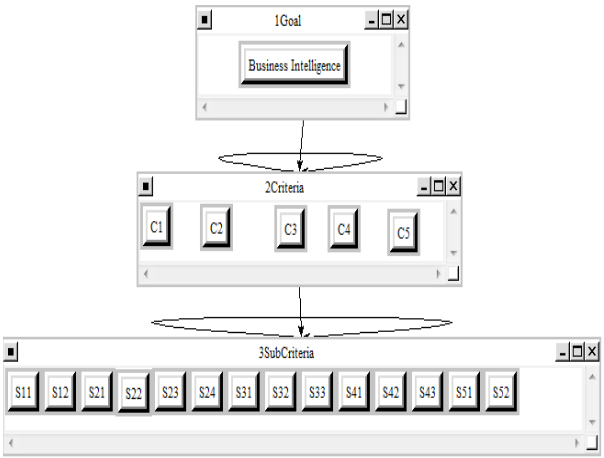


Figure 4. Network Structure of Research

Table 1.Research criteria and sub-criteria

Main criteria		Indexes (Sub-criteria)	Symbol
Compliance with business and users' requirements	C1	Fulfilling the users' requirements	S11
		System consistency with strategic goals	S12
Business Intelligence system performance	C2	Factors of application simplicity and data visualizing	S21
		Accuracy of output data	S22
		System Security	S23
		System response time	S24
System Flexibility	C3	Simplicity of applying the system changes	S31
		Flexibility and output reports	S32
		System development	S33
Fulfilling theorganizational requirements	C4	The factors of user participation	S41
		Supporting the efficacy of organization	S42
		Decision-making Support	S43
The ability to integratetheexperiences and requirements	C5	The rate of applying the consultant'sexperience	S51
		Integrating the executives' information requirements	S52

At the second stage, the primary structure of supermatrix is explained based on the Figure 3 and there is a need for creating the eigenvectors W21, W22, and W33 which are formed at the third stage through thepair-wise comparison associated with these vectors. First, the comparison of main criteria is compared with the objective.

Table 2. Pair-wise comparison matrix of main criteria

Main criteria	C1	C2	C3	C4	C5
The business and users' requirements	1	0.809	2.044	1.028	3.017
Business Intelligence system performance	1.236	1	1.028	3.473	2.218
System flexibility	0.489	0.972	1	1.658	2.976
Fulfilling the organizational requirements	0.972	0.288	0.603	1	4.564
The ability to integrate	0.331	0.451	0.336	0.219	1

Vector 1 - W_{21} Vector

$$W_{21}=\begin{pmatrix} 0.252 \\ 0.287 \\ 0.215 \\ 0.172 \\ 0.074 \end{pmatrix}$$

The output of Super-Decision software is shown in Figure 5 for prioritizing the main criteria based on the research objective.

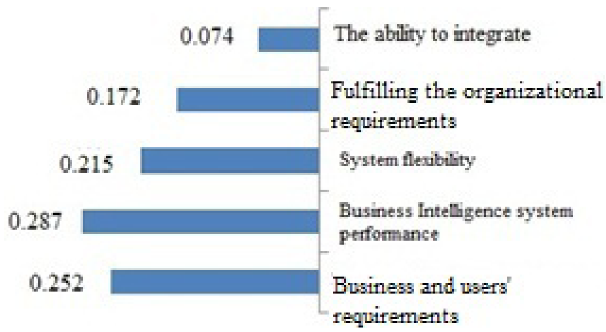


Figure 5. Prioritizing the main criteria based on the research objective

As shown in the figure, the business intelligence system performance with the normal weight of 0.287 has the highest priority according to the research objective. The criterion of business and users' requirements is put in the second priority with the importance equal to 0.252. The system flexibility is put in the third priority and the ability to integrate has the least importance. The inconsistency rate was obtained equal to 0.089 indicating that the pair-wise comparison was appropriate.

Based on the research model, the next stage is to calculate the interrelation of main criteria for obtaining W_{22} super-matrix. Since the previous conducted studies suggested that the business intelligence assessment elements of affect each other, the pair-wise comparison should be done on different elements of Business Intelligence according to Figure 6.

The results of pair-wise comparison and determined priority of these criteria are presented in Table 5. In the pair-wise comparison of several criteria, first one of the criteria is considered constant and then other items are compared according to the constant item.

Therefore, we will have five matrixes and the final W_{22} matrix is extracted from combining the eigenvector of these five matrixes. Thepair-wise comparison is initially performed on the components of Business Intelligence performance assessment based on the business and users' requirements. The results of this comparison are shown in the following table.

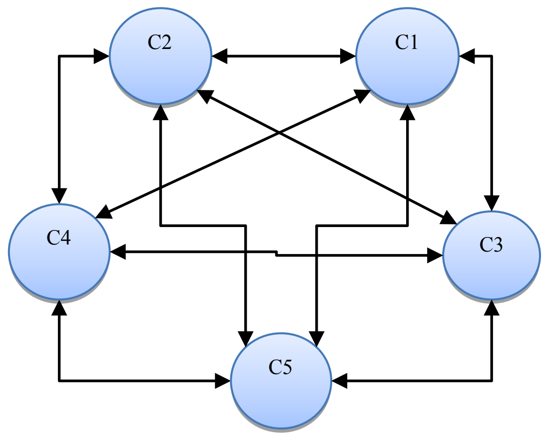


Figure 6. The relationship between the business intelligence assessment elements

As the pair-wise comparison is done on the factors, it is possible to determine thereasonableness of performed comparison in this model. In other words, the consistency of performed comparison on the factors can beexamined through measuring the consistencyrate (C.R). IfC.R £ 0.1, the comparison is accepted as the consistent comparison.

Table 3. The pair-wise comparison matrix of interrelation between the main criteria based on the business and users' requirements

	C2	C3	C4	C5
Business Intelligence system performance	1	0.900	1.072	1.807
System Flexibility	1.111	1	1.807	2.203
Fulfilling the organizational requirements	0.933	0.553	1	2.199
The ability to integrate	0.553	0.454	0.455	1

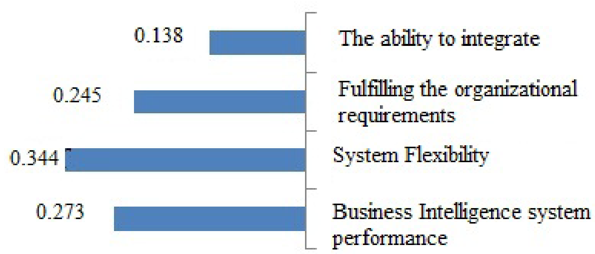


Figure 7. Prioritizing the main criteria based on the business and users' requirements according to the eigenvector of Table 3

Based on the obtained results, the system flexibility criterion has the highest priority. The BI system performance is put in the second priority and theability to integrate has the lowest priority. The inconsistency rate of calculations is also obtained equal to 0.019, thus the results are reliable.

Table 4.The pair-wise comparison matrix of interrelations among the main criteria based on the business intelligence system performance

	C1	C3	C4	C5
Business and users' requirements	1	1.154	1.374	0.609
System Flexibility	0.866	1	0.609	3,300
Fulfilling the organizational requirements	0.728	1.642	1	4.418
Ability to integrate	1.642	0.303	0.226	1

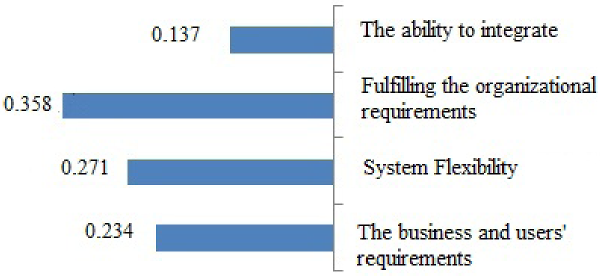


Figure 8.Prioritizing the main criteria based on the business intelligence system performance according to the eigenvector of Table 4

Based on the obtained results, the criterion of fulfilling the organizational requirements has the highest priority. The system flexibility is put in the second priority and theability to integrate has the lowest priority. The inconsistency rate of calculations is also obtained equal to 0.076, thus the results are reliable.

After the pair-wise comparison stage, thepair-wise comparison is done on the business intelligence system assessment elements based on thesystem flexibility. The obtained results of comparison are shown in Table 5.

Table 5. The pair-wise comparison matrix of interrelations among the main criteria based on the system flexibility criterion

	C1	C2	C4	C5
The business and users' requirements	1	2.329	3.084	1.828
Business Intelligence system performance	0.429	1	1.828	4.983
Fulfilling the organizational requirements	0.324	0.547	1	3.860
Ability to integrate	0.547	0.201	0.259	1

Based on the obtained results, the criterion of business and users' requirements has the highest priority. The criterion of business intelligence system performance is put in the second priority and theability to integrate has the lowest priority. The inconsistency rate of calculations is obtained equal to 0.089, thus theobtained results are reliable.

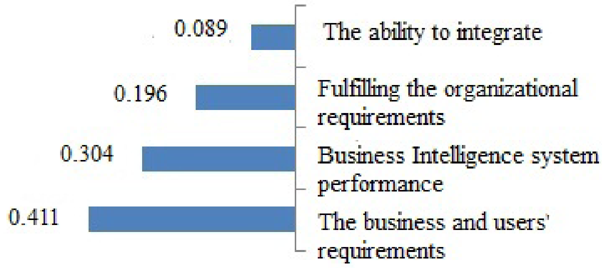


Figure 9. Prioritizing the main criteria based on the system flexibility according to the eigenvector of Table 5

Then, the pair-wise comparison is performed on the elements of business intelligence system performance, the business and users' requirements and system flexibility according to the criterion of fulfilling the organizational requirements. Based on the obtained results according to thementioned criterion, thebusiness intelligence system performance has the highest priority. The criterion of business and users' requirements is put in the second priority and theability to integrate has the lowest priority. The inconsistency rate of calculations is obtained equal to 0.085, thus the results are reliable.

Finally, the pair-wise comparison is performed on the elements of business intelligence system performance, the business and users' requirements and system flexibility according to the criterion of ability to integrate. Based on the obtained results, the system flexibility has the highest priority. The criterion of business intelligence system performance is put in the second priority and thecriterion of business and users' requirements has the lowest priority. The inconsistency rate of calculations is obtained equal to 0.083, thus the results are reliable. According to theeigenvector of each pair-wise comparison, the final W_{22}matrix is as follows:

Vector 2 - W_{22}vector

$$\begin{pmatrix} 0 & 0.234 & 0.411 & 0.279 & 0.210 \\ 0.273 & 0 & 0.304 & 0.369 & 0.265 \\ 0.344 & 0.271 & 0 & 0.255 & 0.302 \\ 0.245 & 0.358 & 0.196 & 0 & 0.223 \\ 0.138 & 0.137 & 0.089 & 0.097 & 0 \end{pmatrix}$$

At the third stage, the pair-wise comparison is done on the research sub-criteria. At this stage, the pair-wise comparison is also done in five steps. The pair-wise comparison is done on the sub-criteria of each main criterion of business intelligence assessment. To avoid the prolongation of paper, a sample of performed comparison is presented as follows.

After the third stage, the pair-wise comparison is performed on each BI system performance. The obtained results of this comparison are presented in Table 6.

Table 6.The pair-wise comparison matrix of business intelligence system performance

	S21	S22	S23	S24
Simplicity of application	1	0.546	0.287	0.663
Accuracy of output data	1.833	1	0.663	0.905
System Security	3.483	1.508	1	1.004
System response time	1.508	1.104	0.996	1

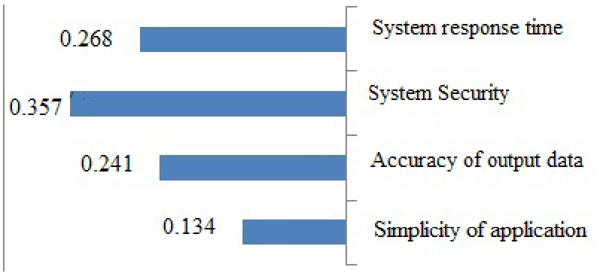


Figure 10. Prioritizing the business Intelligence system performance according to the eigen vector of Table 6

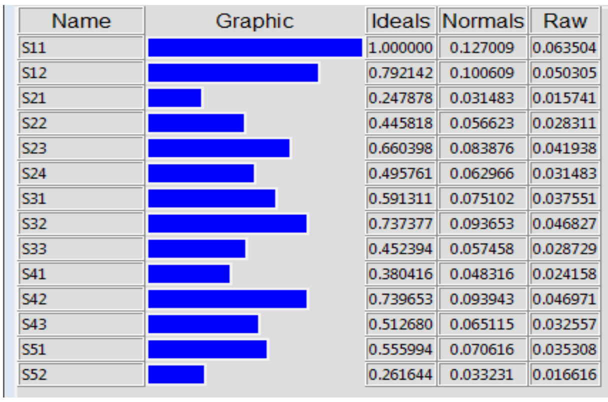
The output of Super-Decision software for prioritizing the BI five indexes is as follows:

Vector 3 - W_{32}vector

$$\begin{pmatrix} 0.558 & & & & \\ 0.442 & & & & \\ & 0.134 & & & \\ & 0.241 & & & \\ & 0.357 & & & \\ & 0.268 & & & \\ & & 0.332 & & \\ & & 0.414 & & \\ & & 0.254 & & \\ & & & 0.233 & \\ & & & 0.453 & \\ & & & 0.314 & \\ & & & & 0.680 \\ & & & & 0.320 \end{pmatrix}$$

To obtain the overall priorities in a system with mutual effects, the internal priority vectors (i.e. the calculated Ws) are added to the appropriate columns of a matrix. Therefore, a supermatrix (in fact a divided matrix) is obtained and each section of this matrix indicates the relation of two clusters in a system.(Momeni,2006). In other words, the supermatrix is a matrix of relationships between the network components and is obtained from the priority vectors of these relations. This matrix provides a framework for determining the relative importance of items after doing the pair-wise comparison. Then the unweighted supermatrix becomes the weighted (normal) supermatrix by applying the normalization concept. The sum of items in all columns becomes equal to 1 in the weighted supermatrix. The next step is to calculate the limit supermatrix. The limit supermatrix is obtained by the exponentiation of all items of weighted supermatrix. This operation is repeated until all items of supermatrix become similar. In this case, all entries of supermatrix become zero and only the entries of sub-criteria become a number which is repeated in all rows. The calculated limit supermatrix by Super-Decision software is as follows:

Furthermore, According to the calculations, limit supermatrix, and the output of Super-Decision software, it is possible to determine the final priority of criteria and sub-criteria. The final priority of main criteria is shown in Figure 11 based on the limit supermatrix.



Name	Graphic	Ideals	Normals	Raw
S11		1.000000	0.127009	0.063504
S12		0.792142	0.100609	0.050305
S21		0.247878	0.031483	0.015741
S22		0.445818	0.056623	0.028311
S23		0.660398	0.083876	0.041938
S24		0.495761	0.062966	0.031483
S31		0.591311	0.075102	0.037551
S32		0.737377	0.093653	0.046827
S33		0.452394	0.057458	0.028729
S41		0.380416	0.048316	0.024158
S42		0.739653	0.093943	0.046971
S43		0.512680	0.065115	0.032557
S51		0.555994	0.070616	0.035308
S52		0.261644	0.033231	0.016616

Figure 11.The final prioritization of model indexes by the ANP

Discussion and Conclusions

The Business Intelligence should result in the decisions which lead to the higher profitability of business and improved quality of trade. Therefore, the Business Intelligence cannot individually lead to the business development, thus it can be detrimental in

		1Goal	2Criteria				3Subcriteria														4Alternatives	
		Goal	Place	Price	Product	Promotion	1mandegari	2zayeat	3behdasht	4arzesh	5tariff	6ghimat	7hashhle	8canal	9hami	10packaging	11pishbord	12ravabet	13foroosh	14tamayoz	1Native	2Modem
1Goal	Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2Criteria	Place	0.040429	0.040429	0.040429	0.040429	0.040429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Price	0.092516	0.092516	0.092516	0.092516	0.092516	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Product	0.099366	0.099366	0.099366	0.099366	0.099366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Promotion	0.017689	0.017689	0.017689	0.017689	0.017689	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3Subcriteria	1mandegari	0.053757	0.053757	0.053757	0.053757	0.053757	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2zayeat	0.02514	0.02514	0.02514	0.02514	0.02514	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3behdasht	0.01252	0.01252	0.01252	0.01252	0.01252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4arzesh	0.007949	0.007949	0.007949	0.007949	0.007949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5tariff	0.011009	0.011009	0.011009	0.011009	0.011009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6ghimat	0.039874	0.039874	0.039874	0.039874	0.039874	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7hashhle	0.041632	0.041632	0.041632	0.041632	0.041632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8canal	0.018355	0.018355	0.018355	0.018355	0.018355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9hami	0.018112	0.018112	0.018112	0.018112	0.018112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10packaging	0.003962	0.003962	0.003962	0.003962	0.003962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	11pishbord	0.009658	0.009658	0.009658	0.009658	0.009658	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	12ravabet	0.00207	0.00207	0.00207	0.00207	0.00207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	13foroosh	0.00092	0.00092	0.00092	0.00092	0.00092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	14tamayoz	0.005041	0.005041	0.005041	0.005041	0.005041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4Alternatives	1Native	0.337197	0.337197	0.337197	0.337197	0.337197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2Modem	0.162803	0.162803	0.162803	0.162803	0.162803	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 12. Limit Supermatrix

the case of proper understanding by the managers; hence, it is essential to pay more attention to processes of its implementation and definition for the managers in order to not create the unreasonable expectations of Business Intelligence in their Businesses. The results of this study, under which the business and users' requirements has the highest priority among the main criteria and the Business Intelligence system performance is put in the second priority and thecriteria including the system flexibility, fulfilling the organizational requirements and the ability to integrate are in the next priorities, confirm this fact.

The results, obtained from the weights of indexes in Figure 12, can be applied as the Business Intelligence dashboard based on which the response to the users' requirements is the most important priority in business intelligence assessment. The factors including the simplicity of applying the system changes, and supporting the efficacy of organization are put in the next priorities. The system security is put in the fourth priority. The factors including the rate of applying the consultant's experience, simplicity of application, and data visualizing have the lowest priorities.

The results of this study can provide the extremely useful information for decision-makers and the information technology managers in the organizations in order to gain a full understanding of business intelligence dimensions and reduce the costs and risk of failure in the establishment of such this system.

In the other hand, this research indicates that despite the fact that the Analytical Network Process has a systematic approach in determining the priorities and analyzing the objectives and criteria and the degree of criteria weight and importance is determined based on the individual judgment rather than the optional or conventional and it can consider all tangible and intangible criteria of model, the ANP creates the pair-wise comparison matrix and calculates the eigenvectors corresponding to each pair-wise comparison matrix and then puts them in a proper position of super-matrix;

Therefore, application of this technique in calculating the interrelation of elements requires alarge number ofpair-wise comparison matrixes and this leads to the complexity and spending more time to solve the issue. DEMATEL technique can be utilized in order to deal with this limitation. In compared to the ANP, the DEMATEL technique needs a small number of pair-wise comparison matrixes in order to calculate the interrelation of elements and components. It is suggested that the Analytical Network Process and DEMATEL method will be integrated in order toutilize the advantages of both techniques in future studies.

References

Alan, H. (2003). *Business Intelligence Tools: Perspective.* Gartner Research. DRPO-93784.

Azoff, M., & Charlesworth, I. (2004). *The New business intelligence*. A European Perspective, Butler Group, White Paper.

English, L. P. (2005). *Business Intelligence* Defined, retrieved December 20, 2007, from http://www.b-eye-network.com/view/1119

Elbashir, M., Collier, P., & Davern, M. (2008). Measuring the effects of business intelligence systems: The relationship between business process and organizational performance. *International Journal of Accounting Informati Systems, 9*(3), 135-15.

Ghazanfari, M., Jafari, M., &Rohani, S. (2011). The business intelligence assessment requirements in (ERP) case study: Trade Promotion Organization of Iran. *Quarterly Journal of Economics and modern business, 13,* 22-45.

Inmon, H. (2005). *Building the data warehouse*, 4th Edition.

Jalonen, H., & Lonnqvist, A.(2009). Predictive business—fresh initiative or old winein a new bottle. *Management Decision, 47*(10), 1595-1609.

Kirytopoulos, K., Greece, C., Leopoulos, V., & Voulgaridou, D. (2008).Supplier selection in pharmaceutical industry: An analytic network process approach, National Technical University of Athens, Athens, Greece; *Benchmarking: An International Journal, 15,* 4, 494-516.

Lin, Y., Tsai, K., Shiang, W., Kuo, T., & Tsai, C. (2009). Research onusing ANP toestablish a performance assessment model for business intelligence systems. *Expert Systems with Applications, 36,* 4135–4146.

Lonnqvist, A., & Pirttimki, V. (2006). The measurement of business intelligence Information *Systems Management, 23*(1), 32 – 40.

Momeni, M. (2006). *New topics of research on the operations,* University of Tehran, Faculty of Management.

Moss, L. T., &Atre, S. (2003). Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications: Addison-Wesley Professional

Rahnama-Roodposhti, F. and Azedi-Tehrani, S. (2010). *The financial business intelligence.* The first national conference on the business intelligence

Saaty, T.L. (1996).*Analytical Network Process*. Pittsburgh: RWS Publications.

Sawka, K. (2000). Are We Valuable? *Competitive Intelligence Magazine, 3,*2.