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A COMPARATIVE ANALYSIS OF EVALUATION METHODS FOR READINESS OF BUSINESS INTELLIGENCE PROJECT

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Abstract

Identifying the right evaluation methods for building a model to assess readiness of organizations in implementing Business Intelligence projects is an area of considerable interest to both academics and practitioners. Hence, this paper offers a summary of the most common evaluation methods which can be used to build the model. We believe it is valuable to compare these methods, particularly in the areas where they lead to similar conclustions.

The objective of this paper is to provide a better understanding of the current similarities and differences of these proposed methods and it is to compare the methods based on their features and suggest a suitable method for building a model to evaluate readiness of firms in implementing BI projects.[1]

1 Introduction

In rapid technological and economic growth era, managers of companies which are involved in implementing Business Intelligence (BI) projects face to evaluate readiness of their organizations before launching the project and in pre-implementation stage. Farrokhi et al. (2012) depict risk of failure in implementing BI project is high. Evaluation of BI readiness is necessary because it permits us for reaching two important goals. First, by showing gaps areas where company is not ready to proceed with its BI efforts, we can avoid wasting time and resources. Second, the evaluation guides us about our needs for closing the gaps and implement BI with a high probability of success. We can define evaluation as a systematic review and assessment of the benefits, quality, and value of a program or activity, or organization as a whole. In evaluation process, an important choice to be made is which evaluation method to use.

[1]Mathematical Subject Classification(2008):*00A69, 90B50 , 90C29*
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If an available method is chosen arbitrarily, it may result in misleading or even wrong conclusions. To avoid this problem, it is necessary to develop some formal procedures or guidelines for the selection of the readiness evaluation method for a specific readiness decision problem. In this paper, we present a framework for the comparative analysis of readiness evaluation methods. Its purpose is to help the authors gain insight into the strengths and weaknesses of the various categories of readiness evaluation methods in order to apply for building a model to evaluate the readiness of those companies which want to implement BI projects.

This paper is organized as follows: in the next section, we review the available evaluation methods and suggest a classification scheme for the methods. In the third section, we describe a general framework for comparative evaluation of readiness evaluation methods. The results of the evaluation are depicted in the fourth section. Finally, section five presents the conclusions and prospective.

2 Review and classification of the evaluation methods

Before we begin to review and classification the methods, it is better to define evaluation methods, readiness and BI. As we mentioned in previous section, evaluation is the systematic review and assessment. On the other hand, methods are used to identify the 'value', or represent semantic relationships between one or more concepts in a model. Hence, evaluation methods are various procedures, schemes, algorithms, etc. which can be applied in the systemic review and assessment. In fact, BI readiness means that the essential prerequisties for BI success are in place. Finally, Turban et al. (2011) presented BI as an architechture, tool, technology or system that gathers and stores data, analyzes it using analytical tools, facilities reporting, querying and delivers information and/or knowledge that ultimately allows organizations to improve decision making.

Methods for readiness evaluation may be broadly classified into three main categories, namely probabilistic method, Multiple Criteria Decision Making (MCDM) methods and hybrid methods. The probabilistic method is an important and remarkable technique/way for proving the existence of combinational objects with specified properties. It can be applied to specific problems which involves sophisticated combinatorial arguments. MCDM can be defined as disciplines aimed to study methods and procedures by which concern about multiple conflicting criteria to help and support decision makers and takers. A literature review from 1999 to 2009 on MCDM methodologies and applications is done by Toloie-Eshlaghz et al. (2011), and based on it, we categorized these methods by regarding to their fuzzy and crisp nature and their applications into the readiness evaluation area.

The analytic hierarchy process (AHP) as a MCDM method is to help decision-maker facing a complex problem with multiple conflicting and subjective criteria. The AHP forms a problem into a hierarchy and the criteria and the relevant fac-

tors are decomposed hierarchically for better understanding of the situation. The levels typically include the overall goal at the top, which follows by the criteria contributing to the goal, sub-criteria (if any), and finally the alternatives at the lowest level. A series of pairwise comparisons at each level of the hierarchy are performed to produce local weights. Then a set of global weights or priorities for the alternatives are produced by combining these local weights and using an additive value model. Based on the computed global weights, the alternatives may be ranked. The Analytic Network Process (ANP) is a generalization of the AHP, by considering the dependence between the elements of the hierarchy. Many decision problems involve the interaction and dependence of higher-level elements in a hierarchy on lower levels-elements. Therefore, they cannot be structured hierarchically and for this reason, ANP is represented by a network, rather than a hierarchy. The Analytical Hierarchy Framework (AHF) established by Wang et al. (2009) to help small and medium enterprises (SMEs) predicting implementation success as well as identifying the actions necessary before implementing B2B e-commerce to increase e-commerce initiative feasibility. This method considers only $n-1$ judgments whereas the traditional analytic hierarchy approach (that is AHP or FAHP) uses $\frac{n(n-1)}{2}$ judgments in a preference matrix with attributes or alternatives. The creators of this approach believe that application of the proposed approach is clearly faster and more efficient than the conventional analytic hierarchy methodologies.

The MCDM methods are based on crisps values and the main limitations of them are that, they cannot handle the vagueness and uncertainty and this limitation has lead to the fuzzy based approach.

The complexity and dynamics of real-world engineering, financial and economical problems require advanced methods to build hybrid assessment tools. There are a wide range of hybrid methods that have been developed but we mean those hybrid methods combine probabilistic method with the MCDM methods. The hybrid methods take advantage of the "rich" information provided by probability distributions, while retaining the multiple decision criteria and multiple decision alternatives character of MCDM methods as well as the conservative character of fuzzy calculus.

3 Framework for comparing readiness evaluations

We adopt the AHP method as a framework for comparative analysis of readiness evaluation methods. The AHP can be applied in a wide variety of practical setting to model complex decision problems.Its ability to compare and rank decision alternatives based on both qualitative and quantitative factors is one of its major strengths. Concerning this ability, we apply this method for a comparative analysis of the evaluation methods. As mentioned in the previous section, AHP has the advantage of permitting a hierarchical structure of the criteria.

The first step to built framework is to structure the hierarchy. Figure 1 depicts

the AHP hierarchy for our comparative analysis of the evaluation methods. We intend to perform a comparative study of the eight methods identified in the previous section and are enumerated at Level 4 of the hierarchy in Figure 1. At the highest level, we define the goal which is the identification of the ideal or best evaluation method for readiness evaluation. Level 2 lists eight major criteria or factors which are essential in determining the effectiveness of readiness evaluation methods.

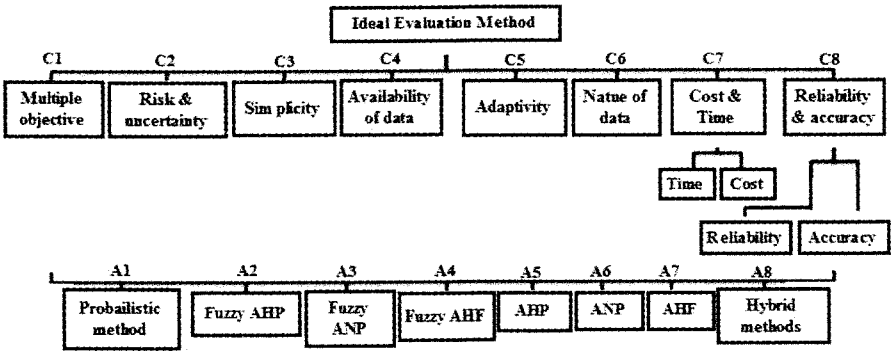

Figure 1: Hierarchy for the comparative analysis of the AHP method

4 Comparison of the readiness evaluation methods

In this step, we shall compare the criteria at Level 2 with respect to the overall goal at top level by assessing the importance of each criterion in relation to the choice of evaluation methods. Following the AHP methodology, the authors performed pairwise comparison to obtain the relative importance of the factors. Based on the actual characteristic of the methods, whenever possible, the weights are determined. Otherwise, the authors provided their best judgments based on their experiences in using methods as well as with inputs from an experienced IT manager. We should notify that the exact result of the study could be different if different people with different backgrounds and experiences did the pairwise comparisons. Table 1 shows the pairwise comparison matrix for the eight Level 2 criteria with respect to the goal. This analysis indicated that the criterion 'Multiple objective' has the highest weight of 25.5 %, followed by criteria 'Reliability and Accuracy' and 'Risk and Uncertainty' which have weights of 19.5 % and 18 %. This prioritization is consistent with the very nature of real-world readiness evaluations are usually multiple objective and a company usually has more than one objective in evaluation program. The quality of being reliable and accurate is a necessity for every evaluation method. Also, the readiness evaluation methods usually incorporate risk and uncertainty in analysis.

Now, we are proceeding down the hierarchy and perform pairwise comparisons on the alternative methods with respect to each criterion at Level 2 except the 'Cost and Time' and 'Reliability and Accuracy' which have two Level-3 sub-criteria. The alternatives are also likewise pairwise compared with respect the four Level-3 criteria. Table 2 depicts a summary of the normalized relative weights for the

Matrix	M.O.	R.&U.	S.	A.o.D.	Ad.	N.o.D.	C.&T.	R.&Ac.	N.P.E.
M.O.	1	1	3	3	4	5	6	2	25.5%
R.&U.	1	1	2	2	3	4	6	1/3	18.0%
S.	1/3	1/2	1	1	2	3	4	1/3	9.1%
A.o.D	1/3	1/2	1	1	1	2	2	1	9.9%
Ad.	1/4	1/3	1/2	1	1	2	3	1/2	7.2%
N.o.D.	1/5	1/4	1/3	1/2	1/2	1	2	1	6.6%
C.&T.	1/6	1/6	1/4	1/2	1/3	1/2	1	1/2	4.2%
R.&Ac.	1/2	3	3	1	2	1	2	1	19.5%
				Eigenvalue	λ	8.798			
				Consistency Ratio	CR	8.1 %			

S.–Simplicity, A.o.D– Avialability of Data, Ad.–Adaptivity, N.o.D–Nature of Data,
M.O.– Multiple Objective,R.&U.–Risk & Uncertainty,R.&Ac.–Reliability & Accuracy
N.P.E.– Normalized Principal Eigenvector

Table 1: Pairwise comparison of criteria with respect to the goal

	CRITERIA									
	M.O.	R.&U.	S.	A.o.D	Ad.	N.o.D.	C.&T.	R.&Ac.		
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8		
Mth.	0.255	0.180	0.091	0.099	0.072	0.066	0.042	0.195	Pri.	Ra.
Prob.	0.055	0.096	0.330	0.242	0.033	0.090	0.164	0.120	0.124	2
AHP	0.087	0.055	0.196	0.242	0.050	0.153	0.240	0.123	0.122	3
ANP	0.087	0.055	0.118	0.133	0.073	0.146	0.173	0.127	0.103	8
AHF	0.142	0.055	0.087	0.087	0.100	0.128	0.096	0.133	0.108	6
FAHP	0.087	0.153	0.110	0.125	0.079	0.170	0.117	0.081	0.110	5
FANP	0.087	0.153	0.070	0.079	0.168	0.170	0.095	0.081	0.107	7
FAHF	0.157	0.153	0.050	0.053	0.163	0.087	0.058	0.091	0.115	4
Hyb.	0.297	0.280	0.039	0.039	0.333	0.058	0.058	0.245	0.211	1

Mth–Method, Ra.–Rank, Pri.– priority, Hyb.–Hybrid, Prob.–probabilistic

Table 2: The overall results of the comparative study

eight evaluation methods with respect to the eight Level-2 criteria. In the last two columns of the table, we also indicated the overall weights for the eight readiness evaluation methods and their ranks, respectively.

The above analysis depicts that the hybrid methods have the highest weight of 0.211, and with large gap, we have probabilistic method in the second rank with a weight of 0.124, and it is closely followed by the AHP with a weight of 0.122. The rest of the readiness evaluation methods in decreasing importance have approximately equal weights which means there is not any meaningful difference among them.

5 Conclusions and Prospective

Selecting the right evaluation method is an important step in building a model to assess readiness of organizations before launching Business Intelligence projects. Although many evaluation techniques have been developed, but there are few methods applicable for evaluation of readiness. Application of different methods may lead to

different results and hence different decisions. Therefore the choice of appropriate evaluation methods would be crucial to both academics and practitioners like Business Intelligence project managers and consultants. Based on the criteria proposed by the authors as well as the subjective judgments made by them, this comparative study depicts that the hybrid methods are the most favorable methods for building the evaluation models. The hybrid methods combine probabilistic methods with MCDM methods and take the advantages of both methods. This paper has provided a framework for the comparative study and selection of readiness evaluation methods which will use in the related scientific research. During this research, the authors will work out a model to evaluate the readiness of companies in implementing BI projects.

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