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Ranking the Driving Affecting Factors on Management Accounting: Business Intelligence Approach

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Abstract: The current paper with the purpose of ranking the driving affecting factors on management accounting with fuzzy TOPSIS technique was done in a society includes 52 people of accounting and finance department of Behnoosh Company. After designing the questionnaire and proving its validity and reliability, it was distributed among the samples. The results show that optimization techniques, notification and simulation models were selected as the most important group decision making, databases and intelligence factors were chosen as the least important ones sub criteria. Finally some suggestions will present for the managers and future researchers.

Key words: Management accounting · Business intelligence · Fuzzy TOPSIS technique

INTRODUCTION

Nowadays by improving technology and utilizing information technology in complex environment, information has been applied for decision making and setting activities plans and changing data into business intelligence. Now accountants can play an important role in their organizations by extract business intelligence, planning and controlling marketing activities. So the phrase "knowledge is power" has been more tangible for managers than before. Accountants and finance managers cooperate in marketing activities in terms of customer-oriented in 4 fields:

- Identifying necessary information like finance one, because accountants are familiar to gathered finance data.
- Gathering information in many methods, because the required data has been provided by multi dimensional data bases.
- Studying the data by applying advanced analytical techniques.
- Utilizing the information for setting activity plans.

In result, finance managers and accountants access to the saved information in data bases [1].

In recent years, managers have been aware the important of attention to knowledge management and human capital in their organizations. So by utilizing these intangible assets, they have been able to do their work better by knowledge storage, utilization, acquisition and sharing.

Today people can record the entire firm's transaction and perpetrate their required financial and accounting records. An intelligence system can be reliable for accountants, because it helps them to solve their probable problems and do their work easily. Also it can provide required skills for new expert specially who use rational interpretations. The intelligence systems save the user's time by removing time consuming and routine works. Applying the new system not only leads to cost and time saving, but also creates competitive advantage for the organizations against their rivals [2].

In the current paper we are trying to identify and prioritize the driving affecting factors on business intelligence in accounting management.

Literature Review

Business Intelligence: Business intelligence is a set of tools, processes and technologies which interfere on process of changing the data to information, knowledge extraction of the knowledge and decision making optimization [3-6].

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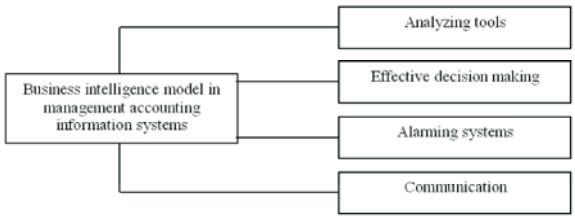

Conceptual framework of research [9]

Nowadays it can be claimed that utilizing business intelligence solutions will increase organizations' competitive strength and make them more distinct of the others. These solutions enable organizations by applying information technology utilize competitive advantage [7].

It makes organizations to perceive customers needs and wants, create better relationship with them and feel positive or negative changes of the environment [8].

Conceptual Model of the Research and Research Question: Attending to research literature, the conceptual model below can be chosen for the purpose of the present study. This model considers business intelligence dimensions in accounting management.

The main criteria are: analyzing tools, effective decision making, alarming systems and communication.

Research Methodology: Samples for this research were chosen from 52 employees of Behnoosh Company (an Iranian one) in accounting and finance department. Whereas this number seems to be too much, the sampling strategy has chosen as counting method. Current study can be considered as a descriptive survey if to view from data collection aspect and as an applied research if to investigate the goals of the research. To collect the data library method (to refer to books, articles, theses, etc...) and fieldworks (questionnaire) was being applied.

The questionnaire was designed with 17 questions with 7 point scale and distributed among the samples.

To analyze the data fuzzy TOPSIS technique was utilized. The management experts were being requested to evaluate the validity of questionnaires. For this mean, the questionnaires were given to some professors and experts in management field and after their acceptance were being applied and they confirmed it, the questionnaire was given to the sample. To determine the questionnaires' reliability, the 'Cronbach Alfa technique' was applied. For calculating Cronbach Alpha, 30 people were chosen by r andom (from the samples) and the questionnaire was given to them. The value (0.84) supports the reliability of questionnaires, because the calculated results for Cronbach's alpha were more than 0.7.

Fuzzy TOPSIS Technique: Technique for order performance by similarity to ideal solution (TOPSIS), one of known classical MCDM method, was first considered by Hwang and Yoon (1981) for solving MCDM problems. TOPSIS is defined as one of the most classical MCDM methods, which is based on the idea, that the chosen alternative should have the shortest distance to the positive ideal solution and on the other side the farthest distance to the negative ideal solution. The TOPSIS-method will be utilized to a case study, which is described in detail. In classical MCDM methods, the ratings and the weights of the criteria are known precisely [10-12].

Decision making process steps by fuzzy TOPSIS technique are shown below:

Step 1: Calculating weights vector w~j
Step 2: Normalizing the calculated matrix

$$\tilde{R} = \left[\tilde{r}_{ij}\right]_{m\times n}$$

$B \subseteq \{1,...,n\}$ is related to benefit-based indices and $C \subseteq \{1,...,n\}$ is related to cost-based indices.

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{d_j^*}, \frac{b_{ij}}{d_j^*}, \frac{c_{ij}}{d_j^*}, \frac{d_{ij}}{d_j^*}\right), \quad j \in B \tag{2}$$

$$\tilde{r}_{ij} = \left(\frac{a_j^-}{d_{ij}}, \frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right), \quad j \in C \tag{3}$$

Step 3: So normalized weighted matrix is calculated as formula 4:

$$\begin{aligned} &\tilde{V} = \left[\tilde{v}_{ij}\right]_{m\times n}, \quad i = 1,2,...,m, \ \ j = 1,2,...,n \\ &\tilde{v}_{ij} = \tilde{r}_{ij} \otimes \tilde{w}_j \end{aligned} \tag{4}$$

Step 4: Determining the fuzzy positive ideal solution $\tilde{v}_j^*$ (FPIS) and fuzzy negative ideal solution $\tilde{v}_j^-$ (FNIS) (formulas 5, 6):

$$\tilde{v}_j^- = \begin{cases} \min\limits_{i=1,...,m} \tilde{v}_{ij}; j \in B \\ \max\limits_{i=1,...,m} \tilde{v}_{ij}; j \in C \end{cases}$$

$$\tilde{v}_j^* = \begin{cases} \max\limits_{i=1,...,m} \tilde{v}_{ij}; j \in B \\ \min\limits_{i=1,...,m} \tilde{v}_{ij}; j \in C \end{cases}$$

Table 1: Linguistic variables for the importance weight [13]

Very Low	VL	(0, 0, 1, 2)
Low	L	(1, 2, 2, 3)
Medium Low	ML	(2, 3, 4, 5)
Medium	M	(4, 5, 5, 6)
Medium High	MH	(5, 6, 7, 8)
High	H	(7, 8, 8, 9)
Very High	VH	(8, 9, 10, 10)

$$FNIS = \{\tilde{v}_j^- \mid j = 1, \ldots, n\} \tag{5}$$

$$FPIS = \{\tilde{v}_j^* \mid j = 1, \ldots, n\} \tag{6}$$

Step 5: Calculating the alternatives from positive and negative ideal by applying formulas 8,9:

$$d_i^* = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^*), \; i = 1, \ldots, m \tag{7}$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^-), \; i = 1, \ldots, m \tag{8}$$

Step 6: Calculating the relative closeness to the ideal solution:

$$Cc_i = \frac{d_i^-}{d_i^- + d_i^+} \tag{9}$$

In real-word situation, because of incomplete or non-obtainable information, the data (attributes) are often not so deterministic, there for they usually are fuzzy /imprecise. So, we try to extend TOPSIS for fuzzy data to categorize the driving factors affecting on accounting system [10-12]. Linguistic variables for the important weight of each criteria are shown in Table 1:

Data Analyzing: After distributing questionnaire among statistical society people and gathering data, decision making matrix with fuzzy weights were calculated as Table 1:

As Table 6 shows, the samples selected "alarming systems" and "communications" as the most important criteria of creativity and innovation strength (Very High).

Also fuzzy weighted normalized matrix was calculated by applying formula 2, 3 and 4.

It is necessary to mention because of extra volume of calculation, weighted normalized matrix was ignored and finally by applying formulas 7, 8 and 9, fuzzy positive ideal solution, negative ideal solution and the relative closeness to the ideal solution were determined which are shown in Table 3:

As Table 3 shows optimization techniques, notification and simulation models were selected as the most important indices. Meanwhile group decision making, databases and intelligence factors were chosen as the least ones.

Conclusion and Suggestions: Up to now, just a few researches have been accomplished in field of management accounting information systems with focus on business intelligence. The innovation of the current research is combination of management accounting information systems and their applications with business intelligence.

Table 1: Decision making matrix and fuzzy weights

	Analyzing Tools				Effective Decision Making				Alarming Systems				Communication			
Variables	5	6	7	8	7	8	8	9	8	9	10	10	8	9	10	10
P1	7	8	8	9	8	9	10	10	4	5	5	6	2	3	4	5
P2	8	9	9	10	5	6	7	8	7	8	8	9	5	6	7	8
P3	7	8	8	9	4	5	5	6	7	8	8	9	8	9	10	10
P4	8	9	10	10	2	3	4	5	1	2	2	3	1	2	2	3
P5	5	6	7	8	5	6	7	8	4	5	5	6	2	3	4	5
P6	4	5	5	6	4	5	5	6	7	8	8	9	5	6	7	8
P7	8	9	10	10	7	8	8	9	8	9	10	10	7	8	8	9
P8	7	8	8	9	2	3	4	5	5	6	7	8	8	9	10	10
P9	8	9	10	10	5	6	7	8	4	5	5	6	2	3	4	5
P10	0	0	1	2	0	0	1	2	2	3	4	5	8	9	10	10
P11	7	8	8	9	7	8	8	9	8	9	10	10	8	9	10	10
P12	5	6	7	8	8	9	10	10	7	8	8	9	1	2	2	3
P13	0	0	1	2	2	3	4	5	7	8	8	9	4	5	5	6
P14	4	5	5	6	5	6	7	8	8	9	10	10	4	5	5	6
P15	0	0	1	2	2	3	4	5	7	8	8	9	8	9	10	10
P16	1	2	2	3	7	8	8	9	5	6	7	8	7	8	8	9
P17	4	5	5	6	4	5	5	6	7	8	8	9	7	8	8	9

Table 2: Fuzzy weighted normalized matrix

Variables	Analyzing tools				Effective decision making				Alarming systems				Communication			
P1	0.35	0.48	0.56	0.72	0.56	0.72	0.8	0.9	0.32	0.45	0.5	0.6	0.16	0.27	0.4	0.5
P2	0.4	0.54	0.63	0.8	0.35	0.48	0.56	0.72	0.56	0.72	0.8	0.9	0.4	0.54	0.7	0.8
P3	0.35	0.48	0.56	0.72	0.28	0.4	0.4	0.54	0.56	0.72	0.8	0.9	0.64	0.81	1	1
P4	0.4	0.54	0.7	0.8	0.14	0.24	0.32	0.45	0.08	0.18	0.2	0.3	0.08	0.18	0.2	0.3
P5	0.25	0.36	0.49	0.64	0.35	0.48	0.56	0.72	0.32	0.45	0.5	0.6	0.16	0.27	0.4	0.5
P6	0.2	0.3	0.35	0.48	0.28	0.4	0.4	0.54	0.56	0.72	0.8	0.9	0.4	0.54	0.7	0.8
P7	0.4	0.54	0.7	0.8	0.49	0.64	0.64	0.81	0.64	0.81	1	1	0.56	0.72	0.8	0.9
P8	0.35	0.48	0.56	0.72	0.14	0.24	0.32	0.45	0.4	0.54	0.7	0.8	0.64	0.81	1	1
P9	0.4	0.54	0.7	0.8	0.35	0.48	0.56	0.72	0.32	0.45	0.5	0.6	0.16	0.27	0.4	0.5
P10	0	0	0.07	0.16	0	0	0.08	0.18	0.16	0.27	0.4	0.5	0.64	0.81	1	1
P11	0.35	0.48	0.56	0.72	0.49	0.64	0.64	0.81	0.64	0.81	1	1	0.64	0.81	1	1
P12	0.25	0.36	0.49	0.64	0.56	0.72	0.8	0.9	0.56	0.72	0.8	0.9	0.08	0.18	0.2	0.3
P13	0	0	0.07	0.16	0.14	0.24	0.32	0.45	0.56	0.72	0.8	0.9	0.32	0.45	0.5	0.6
P14	0.2	0.3	0.35	0.48	0.35	0.48	0.56	0.72	0.64	0.81	1	1	0.32	0.45	0.5	0.6
P15	0	0	0.07	0.16	0.14	0.24	0.32	0.45	0.56	0.72	0.8	0.9	0.64	0.81	1	1
P16	0.05	0.12	0.14	0.24	0.49	0.64	0.64	0.81	0.4	0.54	0.7	0.8	0.56	0.72	0.8	0.9
P17	0.2	0.3	0.35	0.48	0.28	0.4	0.4	0.54	0.56	0.72	0.8	0.9	0.56	0.72	0.8	0.9

Table 3: Final indices ranks

Dimensions	d_i^+	d_i^-	Cc_i	Ranks
Prototyping	*1.7028404*	*2.13437802*	*0.556230526*	12
Simulation models	*1.207451309*	*2.538408953*	*0.67765714*	3
Fuzzy optimization	*1.376951566*	*2.590368281*	*0.652926505*	5
Databases	*1.954038737*	*1.348732358*	*0.408363861*	16
Data mining	*1.616591572*	*1.837811813*	*0.532020036*	13
immediate analysis process	*1.560879018*	*2.146909127*	*0.579026914*	10
Optimization techniques	*0.994964974*	*2.914446323*	*0.745494936*	1
Abbreviating	*1.631428635*	*2.35760217*	*0.591021299*	8
Flexible models	*1.45191847*	*2.007871912*	*0.58034496*	9
Group decision making	*2.562509338*	*1.417812777*	*0.356205537*	17
Notification	*1.06730376*	*2.950046006*	*0.734326404*	2
Information models	*1.150931372*	*2.174803691*	*0.653931732*	4
Intelligence factors	*1.949987741*	*1.629958965*	*0.455302578*	15
Graphic reports	*1.369752012*	*2.245429642*	*0.621111152*	6
Mobile and Web services	*1.949987741*	*2.027163963*	*0.509702449*	14
Interaction with other systems	*1.656607043*	*2.192367916*	*0.569597864*	11
Forward-backward argument	*1.560879018*	*2.273415234*	*0.592916215*	7

- In current paper, we tried to categorize the driving affecting factors on management accounting with focus on business intelligence. The research was done in a society includes 52 people of accounting and finance department in Behnoosh company.
- The conceptual model included 4 main dimensions (analyzing tools, effective decision making, alarming systems and communication) which were considered as the criteria.
- The results of applying fuzzy TOPSIS technique show that optimization techniques, notification and simulation models were selected as the most important sub criteria.
- From the other side group decision making, databases and intelligence factors were chosen as the least important ones.
- Finally the managers are suggested that allocate more budgets for new accounting management information systems and employ the skilful people who are

familiar with Information technology in accounting management and are expert in business intelligence systems, try to achieve more efficiency and also the future researchers are advises to do parallel researches with utilizing new other techniques like fuzzy Analytical Network Process, fuzzy Analysis Hierarchy Process and fuzzy DEMATEL.

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