A Fuzzy AHP Approach to Identify and Prioritize the Components of Intellectual Capital (A Case Study: Telecommunication Company of Khuzestan Province, Iran)

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Abstract

Enterprises need to understand how to effectively manage their intangible assets through increasing, developing and implementing them within their organizations in order to gain and maintain the ability to compete in today's markets. It is important for a company to figure out how to manage its intellectual capitals while creating and maintaining an adequate balance between various components of intellectual capital. The present study aims to identify and determine the priorities of main components of intellectual capital in Telecommunication Company of Khuzestan province of Iran. The Analytic Hierarchy Process)AHP(approach is used under fuzzy conditions in order to tackle this task. Initially, main components of intellectual capital were identified through examining available literature in congruence with the study subject. Then a questionnaire was designed and distributed to 10 senior managers of Telecommunication Company in order to make benchmarking comparisons and consequently prioritize those components. Collected data were analyzed using the EXCEL software package. The findings have shown that effect of procedure and processes efficiency, innovation in process and products, and investments in R&D activities are the most important factors, respectively. Furthermore, managers are found to attach much higher level of importance to human capitals than to structural capital.

Keywords: : Intangible assets, intellectual capital, human capital, structural capital, fuzzy, AHP

Introduction

Most of the businesses have only a vague idea about how to manage the investments in Intellectual Capitals (IC) and what they should expect from those investments. Consequently, many companies act with nonchalance regarding the task of determining the status of IC since they invest overly on some components of IC while neglecting its other constituents. Nevertheless, evaluating the importance of various IC components is considered crucial for any company which has understood new rules of survival in knowledge-based economy. Particularly, it is important for a company to understand how to manage the IC, create the right balance between various IC components and maintain that balance. For example, if a service providing company overly elaborates on human capital while neglect structural capital, implicit knowledge may grow much more than explicit knowledge; and this in turn would subject the company to a

high risk due to personnel turnover.

Many components of IC are inherently intangible in a real-world business setting. Therefore, they can be difficult or even impossible to measure in quantitative scales. In practice, most of the experts provide linguistic descriptions instead of precise numbers when expressing their viewpoints regarding what are called intangible profits. Accordingly, evaluating intellectual capital would be addressed in the present study through implementing an Analytic Hierarchy Process (AHP) which helps to measure the contribution of each component of IC within the process of value creation in the company. This approach allows for benchmarking the companies within a certain industry and follows the perspective of improving IC management through benchmarking techniques. Indeed, this analysis aims to provide best practices which help decision makers to create and maintain a valuable balance between various dimensions of IC. Therefore, the main goal of the present study is to identify and prioritize components of IC within the structure of Telecommunication Company of Khuzestan province in Iran.

Theoretical ground and literature review

Theoretical basis

As Ducker - a well known scholar in management science - states in his 1993 work, "We are turning into a knowledge-based society in which the main economic resource is not more capital, natural resources, or more work force, etc… but the main resource would be knowledge". 21st century is the century of knowledge-based economy. Industrial form of economy was prevalent before the knowledge-based economy. In that type of economy, wealth making factors were a set of physical and tangible assets like land, work force, money, machinery, etc… and wealth was created through them. Usage of knowledge had been playing a faint role as a productive factor in that economy; However in knowledge-based economy, a much higher priority would be associated with the knowledge or Intellectual Capital (IC) as a wealth producing factor in comparison to other tangible and physical assets (Bontis, 1998). Intellectual assets and particularly human capital are considered as most important organizational assets in the concept of such economy, and the origins of potential success for organizations could be traced more in their intellectual abilities than in their tangible assets (Flamholtz et al., 2002). As the knowledge-based economy grows significantly, we are witnessing that intangible assets of companies evolve into an important factor to conceptualize and maintain sustainable competitive advantages when compared with other tangible assets in companies (Brennan, 2001).

IC management and Knowledge management are two different subjects. Although they share some similarities, but are essentially different. However, it should be mentioned that those two are complementary to each other. Both knowledge management and IC management cover various aspects of organizational activities, and include a wide spectrum of intellectual activities inside an enterprise. However IC management – in sense of creating knowledge or using the knowledge - is considered at the higher, strategic levels of an organization. IC management mainly emphasizes on creation and extraction of value. Its goal is to create intellectual capital and intellectual assets, and implement them in order to improve abilities and capabilities of value creation in a company within a strategic landscape. Knowledge management, on the other hand, is mainly concerned with operational and tactical implementation of activities pertaining to knowledge inside the organization. It is further engaged with details of knowledge-related activities in order to facilitate the creation, collection, transmission, and exploitation of knowledge. Its ultimate goal is to follow up with a smart organization through creating and maximizing the intellectual capitals.

Theories of Intellectual capital

In resource-based perspective, IC is considered as applied capitals (i.e. physical and financial assets) and intangible assets in form of a strategic resource. This theory acknowledges that organizations try to attain competitive advantage and better financial performance through acquiring and using strategic resources. Some theorists like Riahi and Blouki do not categorize applied capitals as strategic resources. They believe that an applied capital is a traditional and prevalent resource; while they categorize IC as a strategic resource which might create added value for the organization (Zeghal and Maaloul, 2010).

Reed et al. (2006) developed the theory of intellectual capitals. Reed and his colleagues account on their theory as a mid level one, since this theory emphasizes on a particular aspect of the more general theory of resource-based approach. Although this theory, like others, tries to explain companies' performance through efficient and effective use of resources available to the company, but the theory of IC regards the intellectual capital as the only strategic resource for the enterprise which might create added value for it (Zeghal and Maaloul, 2010). The IC approach to the shares and flow of intangible assets existing in the organization concentrates on the presumption that it is positively related to financial performance of the organization (Peng, 2011).

Definitions and models of IC

Different definitions for intellectual capital are provided so far. Russ believes that IC consists of the total knowledge of all members of an organization transformed into practical applications of their knowledge. Stewart believes that IC is the intellectual materials like knowledge, information, patents (intellectual assets), and the experiences which

would result in creating wealth, and no universal definition exist for it yet. In Bontis's perspective, IC is the effective search and following up the knowledge (finished product) in comparison to information (raw materials). Moritson believes that IC is the wide and broad organizational knowledge which is particular and exclusive to each company, which allows it to continuously adapt itself with ever changing conditions and evolutions. Other scholars have considered IC as the set of competencies of an enterprise which are mainly related to experience and expertise levels of people inside the organization. In fact, the knowledge and experiences of people inside the organization is the factor which creates value through knowledge transaction processes and creation of new knowledge. Note that those capabilities are not exclusively generated by the members and inside the organization, but they are created directly or indirectly from time to time by the environment in which the organization operates as well (Hamel at al. 1994).

Many models are proposed regarding the components of intellectual capital so far. However, it should be noted that like the definition of IC, there is still no universal categorization for the components of IC. Bontis (1998), initially indicated to three types of IC: human capital, structural capital, and customers; and revised his categorization as human capital, structural capital, communicational capital, and patents or intellectual ownership.

Human capital refers to the level of personal knowledge associated with every employee of the organization. This knowledge is generally in an implicit form. Structural capital refers to all non-human assets or organizational capabilities which would be used in order to fulfill the needs (requirements) of the market. And communicational capital includes all the knowledge deposited into relationships of the organization with its environment including customers, providers, academic societies, etc…. The author believes that the most important component of communicational capital is the customer capital, since organizational success depends on its customers as a form of capital. Intellectual ownership refers to those intangible assets which are legally recognized, identified and protected, like copy right, patents and franchises (Bontis, 1998). As we examine the current literature regarding the IC, it seems that most models of IC have been trying to cover three components through a set of common characteristics (Edvinsson, 1997) Some of the proposed models are: approach of intellectual capital index (Sveiby, 1997), Scandia guiding model (Edvinsson and Malone, 1997), Stewart's model (1997), Russ and colleagues model (Roos and Roos, 1997), Bontis's model (1998), Petti and Guthrie (2000), Chen et al. (2004) and Lim and Dallimore (2004).

Making decisions

All of us make various conscious or unconscious decisions along our individual and organizational lives; i.e. we choose a solution among a number of solutions. In general, making a decision means to choose a solution over a range of different choices. Decision making is considered as a major responsibility for managers, to the extent that Herbert Simon deems the management to be identical with decision making. A group of other experts have also considered the concept of management to be similar to decision making and have defined both terms as synonyms. They did not differentiate between management and decision making; and believe that making decisions is the focal point of management.

Decision making models are categorized into two general sections: Multi-objective Decision Making (MODM) and Multi-Attribute Decision Making (MADM). In MADM models, a number of choices are analyzed, and some sort of prioritization is performed on them. Various models exist for MADM amongst which SAW, TOPSIS, ELECTRE and AHP are the most well known models.

Analytic Hierarchy Process (AHP)

In recent years, Multi Attribute Decision Making or MADM methods have found their niche in science of decision making which is mainly concerned with selecting one solution among available solutions or determining the priorities of various solutions. Amongst them, the AHP method has been used in relatively more cases by management scientists. Analytic Hierarchy Process is one of the most popular techniques of making multi-purpose decisions which was initially introduced by Thomas L. Saaty of Iraqi origin in 1970s. AHP reflects the normal behavior and human thinking process. This technique examines complicated problems through their mutual effects, simplifies them and tries to solve them.

AHP may be successfully used when making decisions in presence of multiple competing choices and decision criteria. The introduced criteria might be quantitative and/or qualitative. This type of decision making is essentially based on benchmarking. The decision maker starts with creating a tree of decision hierarchy. Decision hierarchy tree shows the factors to be compared and the competing choices to be evaluated. A series of benchmarking comparisons are performed then. In those comparisons, the weight of each factor associated with competing choices are considered in order to evaluate them in decision making scheme. Finally, the matrices obtained from mutual benchmarking comparisons are integrated into logic of AHP process that results in an optimal decision (Momeni, 2013).

Research background

Local research

Shahani and Khaef (2010) conducted a research titled "Examining the effect of intellectual capital on performance of Sepah Bank branches in Tehran".The results suggested that components of IC have had a positive effect on performance of those branches of the bank. They reported that the highest level of effect was associated to customer capital, while structural capital and human capital are ranked in next positions. Furthermore, as the most scientific contribution of that study, it is shown that customer capital plays an intermediate role in relation between structural and human capitals and organizational performance.

Madhoushi and Asgharnejad (2009) in their study titled "Measuring intellectual capitals and examining its relation with financial efficiency of companies" concluded that positive and significant relationships exist between IC and financial performance, IC and future financial efficiency, as well as between IC growth rate and future financial efficiency growth rate in investment companies which are members of Tehran stock Exchange market.

Mojtahedzade et al. (2010) reported a research titled "The relation between intellectual capitals and performance in insurance industry" for which the results suggest that intellectual, human, customer and structural capitals were shown to be related to performance when examined through separate and independent examinations; while simultaneous examination only reveals the significant relations of structural and human capitals with performance.

International research

Kiong Ting and Lean (2009) conducted a research titled "Intellectual capital performance of financial institutions in Malaysia" which was mainly aimed for examination of the relation between financial performance of institutes and IC in Malaysia. The required data were collected from annual reports of 20 financial institutes. Forty companies were active in financial sector of Malaysia by 2007; however the authors limited their sample to twenty due to limited access to data from companies. They used the polick model in order to measure the intellectual capital throughout their study. Results showed that a positive relation exists between IC and asset returns. The research suggests that human capital and applied capital are positively related to financial return as well. Meanwhile, the structural capital is only negatively related to financial return of the company.

Bontis (1998) has reported a study in his article titled "Intellectual capital: exploratory study that develops measures and models" in Canada. That study showed that mutual relationships exist between the components of IC; and all three factors of human, structural, and customer capitals contribute positively to the business performance.

Bontis et al. (2000) also studied service providing and non-service industries in Malaysia and reported their findings under the title "Intellectual capital and Business performance in Malaysian Industries". According to the authors, mutual relations exist between different components of IC, while those types of capital impose a relatively moderate effect of around twenty to thirty percent on the business performance.

Methodology

In perspective of applied objective, the present study aims for identification and determining the priorities amongst constituent components of IC in Telecommunications Company of Khuzestan province of Iran. It is a descriptive research in sense of data collection and analysis methods. The statistical population includes managers of Telecommunications Company of Khuzestan since the main objective for the study is to identify and prioritize the relevant components of IC in that company. For this task, AHP methodology was used in order to determine the priorities of IC components only after that the components (human capital, and structural capital) and their sub-criteria were identified in the company under examination. Accordingly, a questionnaire was designed using the extracted measures in order to collect the comments from managers and conduct the benchmarking comparisons between those measures. The questionnaire was distributed among the managers of the company.

Fuzzy logic

Logical and mathematical phenomena can be only in one of the two states of true or false. However, real phenomena are somehow fuzzy (uncertain or non-exact). In fact, various real phenomena are there which cannot be categorized into one specific way of being true or false of having the state of zero or one. Most of the concepts and characteristics which we deal with in our daily real life as well as in various fields of science, particularly social and humanistic sciences, are flexible concepts in nature. The theory of fuzzy sets is a modern mathematical framework to formulate and analyze those concepts and characteristics.

The fuzzy concept was initially introduced by Prof. Zadeh in 1965. He believed that human logic can benefit from concept and knowledge in which definitive borders are not strictly defined. The fuzzy logic covers a wide range of theories and techniques mainly based on four concepts: Fuzzy sets, Linguistic variables, likelihood distribution (membership function), and if-then rules (Wu and Lee, 2007). A fuzzy set is a set in which the members are associated to the set through a degree of membership (μ). This membership function for any number X is defined as the following when the numbers are in a triangle form in which (l,m,n) is a Triangular Fuzzy Number (TFN).

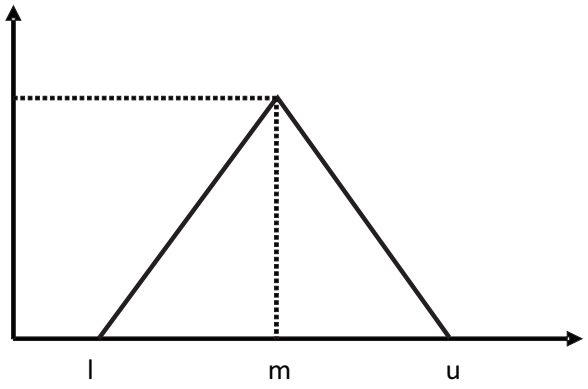

Figure 1: Triangular fuzzy numbers

$$\mu_A(x) = \begin{cases} (x-l)/(m-l), & l \le x \le m, \quad l \ne m \\ (x-u)/(m-u), & m \le x \le u, \quad m \ne u \\ 0, & otherwise \end{cases}$$

Methodology of fuzzy AHP

Laarhoren and Padrycz - two researchers from Netherlands - proposed a method for fuzzy AHP in 1983 which was based on the Logarithmic Least Squares technique. That method did not turn popular due to high computational volume and complicated phases of implementation. In 1996, another method called Extent Analysis Method (EA) was introduced by "Chang", a Chinese researcher. That approach uses triangular fussy numbers. Concepts and definitions in Fuzzy AHP based on EA method would bebriefly described here (Momeni, 2013).

Take two numbers of M1=(I1, m1, u1) and M2=(I2, m-2, u2) which are shown on the graph in Figure 2.

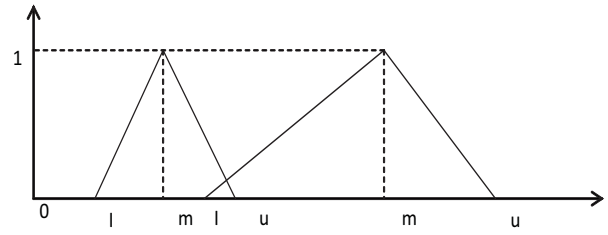

Figure 2: triangular numbers M1 and M2

Mathematical operators are defined for them as:

$$M1+M2 = (I2+I2,\ m1+m2,\ u1+u2)$$

$$M1\times M2 - (I2\times I2,\ m1\times m2,\ u1\times u2)$$

$$M1\text{-}1=\left(\frac{1}{u_1},\frac{1}{m_1},\frac{1}{l_1}\right), \qquad M2\text{-}1=\left(\frac{1}{u_2},\frac{1}{m_2},\frac{1}{l_2}\right)$$

Note that the product of two TFNs or the reciprocal of a TFN are not TFN anymore. These relations only state an approximation of real product of two TFNs or the reciprocal of a TFN. In EA method, a value of Sk is defined for each row of the mutual comparison matrix that itself is a triangular number. This value is calculated as:

$$Sk = \sum_{j=1}^{n} M_{KI} \times \left[\sum_{i=1}^{m}\sum_{j=1}^{n} M_{ij}\right]^{-1}$$

in which, k indicates the row number, while i and j are the choice number and index number, respectively.

The calculation of Sk values in EA method is followed by calculating their degree of relative greatness over each other. Generally, if M1 and M2 are two TFNs, the degree of greatness for M1 over M2 is shown as V(M1 >M2) which is defined as:

$$\begin{cases} V(M_1 \ge M_2) = 1 & \text{if } m_1 \ge m_2 \\ V(M_1 \ge M_2) = hgt\,(M_1 \cap M_2) & \text{otherwise} \end{cases}$$

Also,

$$Hgt\,(M1\cap M2) = \frac{u_1 - l_2}{(u_1 - l_2)+(m_2 - m_1)}$$

The degree of greatness for a TFN over K other TFNs would be given by the following relation:

$$V(M1\ge M2,\ldots,Mk) = Min[V(M1\ge M2),\ldots,\ V(M1\ge MK)]$$

The weight of indices inside the pairwise comparison matrix would be calculated in EA method as the following:

$$W'(xi) = Min\ \{V(Si \ge SK)\}, \qquad K=1,2,\ldots,n, \quad K\ne i$$

Therefore, the vector of weights for the indices would be:

$$W' = [W'(c1),\ W'(c2),\ldots,\ W'(cn)]T$$

which is identical to non-normalized Fuzzy AHP coefficients vector.

Linguistic phrases are used in order to compare the measures. Table 1 is the tool which is used to transform pairwise comparisons into Triangular Fuzzy Numbers (Wang et al., 2009.)

Table 1: Transforming linguistic phrases into fuzzy numbers

degree of importance	Linguistic Phrase	Fuzzy Numbers
1	equal	(1,1,1)
2	very low	(1,2,4)
3	relatively low	(1,3,5)
4	low	(2,4,6)
5	high	(3,5,7)
6	relatively high	(4,6,8)
7	very high	(5,7,9)
8	very very high	(6,8,9)
9	extremely high	(7,9,9)

Calculating consistency rate for fuzzy pairwise comparison matrices

It is necessary to check the problem for inconsistency before trying to solve the problem, since an inconsistent matrix might result in errors in output. Therefore the rate of consistency should be calculated for each matrix. This task is tackled by the present study using the method proposed in Gogus and Boucher (1998.)

Gogus and Boucher proposed that two matrices (middle number and fuzzy number limit) should be derived from each fuzzy matrix, and then the Consistency Rate (CR) of the matrix can be calculated using Saaty's method. The consistency rate for fuzzy pairwise comparison matrices would be determined as the following.

Step 1: The fuzzy triangular matrix is divided into two matrices. The first matrix is consisted of middle numbers of triangular judgments $A^m = [a_{ijm}]$ while the second matrix is consisted of upper and lower geometrical limits of triangular numbers $A^g = \sqrt{a_{iju} \times a_{ijl}}$.

Step 2: vector of weights for each matrix is calculated using Saaty's method as:

$$W^m = [W_i^m] \quad \ldots \quad W_i^m = \frac{1}{n}\sum_{j=1}^{n} \frac{a_{ijm}}{\sum_{i=1}^{n} a_{ijm}}$$

$$W^g = [W_i^g] \quad \ldots \quad W_i^g = \frac{1}{n}\sum_{j=1}^{n} \frac{\sqrt{a_{iju} \times a_{ijl}}}{\sum_{i=1}^{n} \sqrt{a_{iju} \times a_{ijl}}}$$

Step 3: The largest eigen value is calculated for each matrix as the following:

$$\lambda_{max}^m = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} a_{ijm}\left(\frac{W_j^m}{W_i^m}\right)$$

$$\lambda_{max}^g = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} \sqrt{a_{iju} \times a_{ijl}}\left(\frac{W_j^g}{W_i^g}\right)$$

Step 4: The Consistency Index (CI) is calculated using the following equations.

$$CI^m = \frac{(\lambda_{max}^m - n)}{n-1}$$

$$CI^g = \frac{(\lambda_{max}^g - n)}{n-1}$$

Step 5: In order to calculate the Consistency Rate (CR) , we need to divide the CI index by the value of Random Index (RI). The matrix is considered consistent and applicable if the resulted value is less than 0.1. Thus we need to calculate CR for those two matrices according to the following equations and compare them to the 0.1 threshold.

$$CR^m = \frac{CI^m}{RI^m}$$

$$CR^g = \frac{CI^g}{RI^g}$$

The fuzzy matrix is consistent if both calculated values are lower than the 0.1 threshold. If both values are higher than 0.1, the decision maker would be asked to reconsider the priorities. Finally, if only one of two values (CRm or CRg) is higher than 0.1, then the decision maker is to reconsider the values of middle numbers (limits) of fuzzy judgments (Ramezani et al., 2013).

Data analysis

After reviewing the literature and examining the studies in the field of intellectual capital and the IC components, we selected the relevant IC components which were used by Calabrese et al. (2013) for ICT services industry as adequate components to be considered while examining the Telecommunication Company of Khuzestan province. IC components covered two dimensions of human capital (including competency, morale, and intellectual agility measures), and structural capital (including measures of relationships, organization, renovation and development). Table 2 shows the components, measures and indices related to IC along with their symbols.

Table 2: components of Intellectual Capital

	symbol	dimension	symbol	Measure	symbol	Index
IC components	B1	human capital	C4	intellectual agility	D1	effect of efficiency of procedures and processes
			C5	morale	D2	innovation in process and product
			C6	competency	D3	customer satisfaction
	B2	structural capital	C1	renovation and development	D4	investment in R&D
			C2	relationships	D5	work environment
			C3	organization	D6	personnel's incentives
					D7	education

Therefore, the AHP decision tree was created following the identification of relevant IC components. Figure 3 shows that decision tree.

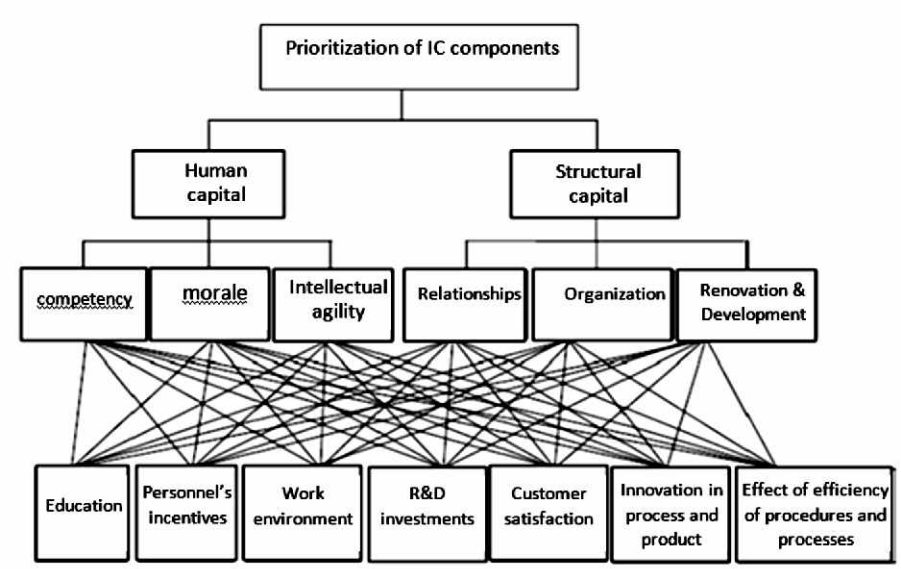

Figure 3: The components of IC – AHP decision tree

To make the pairwise comparisons possible, a questionnaire was designed and distributed to 10 senior managers of Khuzestan Telecommunication Company which were deemed to have the required authority to respond. The managers were asked to compare IC components in pairs using the scale provided in Table 1. As mentioned before, the weights of IC components and their priorities were determined using Fuzzy AHP method along with the approach that was proposed by Chang (1996). First, the pairwise comparisons were made by the managers and were in the form of linguistic phrases had to be transformed into fuzzy numbers. The scale provided by Wang et al. (2009) (Table 2) was implemented to do this task. Note that all the calculations regarding data analysis has been done using MS EXCEL software implementing the capability of the program to work with macros. For example, pairwise comparisons by one of the managers regarding human capitals are presented in Table 3. As we can see, the obtained CR value is lower than 0.1 which suggests that matrix is consistent.

Table 3: Pairwise comparisons for human capital criteria

CR=0‹022		C4			C5			C6		
C4	Linguistic		1			0,167			4	
	Fuzzy	1	1	1	0,25	0,167	0,125	6	4	2
C5	Linguistic		6			1			1	
	Fuzzy	8	6	4	1	1	1	1	1	1
C6	Linguistic		0,25			1			1	
	Fuzzy	0,5	0,25	0,167	1	1	1	1	1	1

Furthermore, following transformation of all pairwise comparisons provided by the managers into fuzzy numbers and making sure the judgments are consistent; the arithmetic mean of the judgments was calculated in order to sum up all of responds provided by managers. The weights for measures of human capital were calculated through Fuzzy AHP process. Table 4 shows the results.

Table 4: Weights for measures of human capital

	Human Capital		
Symbol	C4	C5	C6
Measure	Intellectual Agility	Morale	Competency
Weight	0,229	0,502	0,269
Priority	3	1	2

As could be observed, managers believe that morale or emotional state of personnel is more important as a measure of human capitals than the other two measures. Similarly, the relevant weights were calculated for measure indices associated with structural capital. The results are shown in Table 5 below.

Table 5: Weights for measures of structural capital

	Structural Capital		
Symbol	C1	C2	C3
Measure	Renovation & Development	Relationships	Organization
Weight	0,300	0,338	0,362
Priority	3	2	1

In case of structural capital, the importance priorities are "organization", "relationships" and "Renovation & Development" respectively as suggested by managers through the judgments they had made.

Table 6: Weights for measures of human capital

	Intellectual Capital (IC)	
Symbol	B1	B2
Measure	Human Capital	Structural Capital
Weight	0,819	0,181
Priority	1	2

As the Table 6 shows, among two dimensions of IC, much more importance is associated to the human capital in comparison to structural capital.

Table 7: Weights of indices for structural capitals

	Structural Capital						
Symbol	D1	D2	D3	D4	D5	D6	D7
Measure	Effect of efficiency of procedures and processes	Innovation in process and product	Customer satisfaction	R&D investments	Work environment	Personnel's incentives	Education
Weight	0,262	0,206	0,069	0,171	0,156	0,050	0,086
Priority	1	2	6	3	4	7	5

Table 8: Weights of indices for Human capitals

	Human Capital						
Symbol	D1	D2	D3	D4	D5	D6	D7
Measure	Effect of efficiency of procedures and processes	Innovation in process and product	Customer satisfaction	R&D investments	Work environment	Personnel's incentives	Education
Weight	0,207	0,197	0,0794	0,175	0,157	0,0791	0,105
Priority	1	2	6	3	4	7	5

The weights for indices regarding the structural capital are calculated as the products of weights associated with structural capital and general weights of indices (calculated using Chang's method). A similar procedure was followed when calculating the weights for human capitals. Information in Tables 7 and 8 suggest that "effect of efficiency of procedures and processes", and "Innovation in process and product" are the most important measures in regard to both human capital and structural capital aspects. Furthermore, the sequences of measures for both human and structural capitals are similar.

Table 9: Final priorities of indices

	Intellectual Capital (IC)						
Symbol	D1	D2	D3	D4	D5	D6	D7
Measure	Effect of efficiency of procedures and processes	Innovation in process and product	Customer satisfaction	R&D investments	Work environment	Personnel's incentives	Education
Weight	0,251	0,204	0,071	0,172	0,156	0,056	0,090
Priority	1	2	6	3	4	7	5

The final priorities of indices of IC are shown in Table 9. According to this data, the most important indices are "effects of efficiency of procedures and processes" and "innovation in process and product" respectively, followed by "customer satisfaction", "R&D investment" and "work environment" in the next priorities.

Conclusion

The present study was designated in order to determine the priorities of 7 constituent measures, namely "effect of efficiency in procedures and processes", "innovation in process and product", "customer satisfaction", "investment in R&D", "work environment", "personnel incentives" and "education" in different aspects of intellectual capital using the Fuzzy AHP approach. First, main indices associated with each aspect of human capital were compared to each other as pairs. According to the managers' judgments, the index of personnel's morale was at the highest level of importance, based on the degree of importance (DI) of 0.502 assign to it, when compared to two other indices of competency with DI equal to 0.269, and intellectual agility with DI equal to 0.229, respectively. Moreover, regarding to indices pertaining to structural capital, the index of "organization" received the DI of 0.362 which places it at a higher importance level when compared to "relationships" with DI of 0.338 and "renovation and development" with DI equal to 0.30, respectively. Also a comparison was carried out between two different dimensions of IC which are "human capital" and "structural capital". The results suggested that human capital is deemed to be more important with DI of 0.819 in relation with structural to which a DI of 0.181 was assign through the judgments by managers. Then, a set of pairwise comparisons were performed between 7 components of "effect of efficiency in procedures and processes", "innovation in process and product", "customer satisfaction", "investment in R&D", "work environment", "personnel incentives" and "education" in regard to general component of intellectual capital in IC. Results obtained from those comparisons suggested that "effect of efficiency of procedures and processes" was considered more important (DI equal to 0.251) than other components in managers' point of view. Following that, "innovation in process and product", "R&D investments", "work environment", "education", "customer satisfaction", and "personnel's incentives" are respectively at the second to seventh ranks of importance. Those results are different to those from Calabrese et al., (2013) to some extent. Those differences might be caused by the type of strategies which the companies follow as well as diverse viewpoints of managers. Overall ranking performed by the managers of Telecommunication Company through the present study suggests that human capital and the aspect of human resources are highly important to achieve the organizational goals since the human resources would allow other resources to be effective. Among the indices pertaining to human capital, devoting more attention to personnel's morale in comparison to two other indices, namely "intellectual agility" and "competency", might result in highest levels of efficiency within the organization. This observation needs to be considered when arranging the practical priorities of managers.

In light of the priorities which are determined according to the judgments of managers in Telecommunication Company, human capital is considered to be more important than the structural capital. That suggests that managers need to pay special attention to human capital and its associated indices when designing work plans and strategies of the organization. That is because human capital as an intangible asset propels the progress of the organization and differentiates it from other firms in the arena of competition. This type of assets could be transformed as a competitive advantage which does not erode and leads to success for the organization while making it to survive in long terms. What resulted from the managers' own judgments is that paying more attention to personnel's morale and incentives in light of human capital should be strongly considered while more relatively more attention is needed to be given to other indices as well.

Among seven components under examination in this study, a higher level of importance was assigned to "effect of efficiency of procedures and processes". Therefore company managers should arrange the procedures and processes in the way that provide the organization with required level of effectiveness and efficiency. This important goal could be achieved through standardization of process and procedures. Another component which needs to receive a special attention from the Telecommunication Company is to innovate in process and products. That company can gain higher social acceptance rates through innovations in its process and products. In other words, innovation can be incited by progresses in technology and improving and/or reinforcing resources and capabilities of the organization, which in turn leads to differentiation from the competitors.

Companies need to continuously develop their designs and extend theirproducts and services. Ceaseless changes in technology, presence of competitors and varying priorities of customers have rendered the developments in designs, products and services inevitable. Considering the investment in Research and Development (R&D) and maintaining a R&D department could lead to differentiate the company from competitors. R&D is a factor which is absolutely necessary for every company and greatly contributes to survival of the businesses.

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