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Modeling the Effects of Intellectual Capital Components on the Economic Competitiveness, and Assessing its Consequences Using a Fuzzy Cognitive Map

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ABSTRACT

Despite its known importance, relatively few studies have focused on studying the effects of Intellectual Capital Components (ICC) on the economic competitiveness, determining related elements and relationships exists between them to assess its consequences. This study was designed to provide a comprehensive evaluation of the problem. After a literature review, fifteen related elements, obtained from the previous studies, were collected. A Fuzzy Cognitive Map (FCM) was used to determine the relations exists between the elements, where the opinions of fifteen experts were applied when making related decisions. Data were analyzed using statistical analysis. The results showed relations exist between all fifteen elements, where all of them were confirmed using FCM representation.

1. Introduction

Although it has been a symbol of power since the beginning of the industrial revolution, the physical and fiscal capital is currently facing upstaging [12]. Today, economists consider other factors that boost growth, development, and productivity, besides traditional manufacturing elements (including land, capital, and labor). Accumulation of physical capital is no longer considered as a criterion for economic growth and development, while sustainable economic growth can only be achieved relying on productivity and innovation and through effective management of tangible and invisible assets simultaneously [13]. In other words, firms have resources that are critical to achieving strong financial

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performance and competitive advantage. In the first group, there are tangible assets such as properties, machinery, and alternative physical technologies that can be traded easily on free markets. The second group includes invisible assets, all of them are valuable, scare, irreplaceable and strategic, with high potential for creating competitive advantage and superior financial performance [41]. The role and importance of physical assets are well documented, while invisible assets, especially intellectual capital, as strategic resources, are needed to be further explored, since the producing (manufacturing) and extending such resources is challenging and may create considerable value [28].

Extensive research has been conducted on the intellectual capital at organizations and confirming their importance. Bose showed that measuring performance at organizations using an intellectual capital approach improves the quality of user decisions, internal management, reporting to outside the organization, exchanging this capital within and outside the company, as well as accounting functionality [6]. Effective management of intellectual capital can create value to the business entity, and increase its competitive advantage. Ting and Lean [21] considered intellectual capital as the only source of competitive capacity in the business entity that could increase the enterprise's profit. The question arose is that which factors are affected by intellectual capital? Nematollahi [36] confirmed the effect that intellectual capital has on the relative efficiency of manufacturing cooperation. Ghasem Zadeh et al. [15] confirmed the role that intellectual capital and professional ethics plays on organizational learning capacity and knowledge sharing. According to the results of numerous studies, there is a positive relationship between intellectual capital and competitiveness (Rastogi [42], Vătămănescu et al. [54], Cherkesova et al. [8], and Zambon [57]). Though according to the literature review, intellectual capital has a significant impact on factors such as efficiency, effectiveness, organizational learning, knowledge sharing, and competitive ability, further research can provide different outcomes.

It should be considered that the results of each of these factors, which themselves are affected by intellectual capital, lead to other results and factors that can be investigated. Organizational competitiveness, for example, can have an impact on stock prices [40], organization assets [9], environmental performance [55], and accounting information [3]. Considering the number of factors affecting (are affected by) above-mentioned elements, there is a need to a perspective and thinking that can examine all these factors and their relationship simultaneously. The present study aims at investigating all the variables related to intellectual capital, especially the relationship exists between intellectual capital and competitive advantage in the organization, as well as evaluating related consequences.

The rest of this paper is structured as follows. The concept of intellectual capital and competitiveness are first discussed, and theoretical foundations and research backgrounds are then provided. The relationship between variables is determined using a Fuzzy Cognitive Map (FCM) and the initial model is presented. The relationship exists between the variables is obtained using data obtained from a researcher-made questionnaire and then is analyzed statistical tests. Finally, the model on the effects that intellectual capital components have on economic competitiveness, as well as assessing consequences is presented.

2. Theoretical Foundations and Research Background

2.1. Intellectual Capital

Many definitions have been proposed for the concept of intellectual capital. John Kenneth Galbraith, who first proposed the term "intellectual capital" in 1969, argues that "intellectual capital is beyond a pure thinking" and includes the degree of intellectual measures [5]. Edvinsson and Malone [14] defined the "intellectual capital" as a gap exists between the book value and the company's market value. Kaplan et al. [25] argued that intellectual capital consists of invisible assets including human capital (e.g. skills and knowledge), information assets (e.g. databases, information systems, and technology infrastructures), and organizational capital (e.g. culture, leadership style and ability to share knowledge). Although there is no definite agreement on the definition of intellectual capital, some consensus exists on the main components of intellectual capital, including "human capital", "structural capital" and "customer (relational) capital" [43].

Human capital is the first and most important component of intellectual capital in most classifications. Its importance is mainly since it can't easily be copied by other companies and therefore gives a sustainable advantage to the organization. Also, there is no specific scope for the benefits and exploitation resulted from human capital. Human capital has significant advantages, but organizations can't ensure its long-term durability [30]. Organizations are therefore looking for a different kind of intellectual capital with more durability and higher ownership than human capital. It can be a structural capital that includes technologies, data networks, publications, and processes. Edwardson considered structural capital as a resource applied to support productivity, reduce risk and increase restructuring capacity [19].

Customer or relationship capital is another component of intellectual capital with considerable importance in organizations. Accordingly, considerable resources are used by business establishments to create value for customers aiming to benefit from related advantages [34].

2.2. Economic Competitiveness

Economic competitiveness means the ability to achieve superiority in a competitive world, aiming to distinguish between an organization and others, from one or more point of view [20]. Economic competition brings competitive advantage, which includes a set of factors or capabilities and always provides the company with better performance [44]. Superiority is necessary for all areas covered by an organization, but in some financial organizations, having economic competitiveness gains more importance. Economic competitiveness can, therefore, be considered as the set of capabilities of an organization to have economic superiority to other organizations [56]. Different resources can be used in an organization to achieve economic competitiveness. More importantly, the lower accessibility of competitors to these resources, the greater the competitive advantage will be achieved [24]. Many researchers, therefore, consider intellectual capital as one of the most powerful sources for creating competitive advantage, where it is suggested to use competitive advantages of human, organization and cyberspace fields as well as the competitive advantage derived from customer or relationship capital, aiming to create economic competitiveness [7].

2.3. Fuzzy Cognitive Map (FCM)

In recent years, fuzzy logic has gained wide acceptance in the field of accounting and business. This acceptance is due to the ability to management in situations of ambiguity and lack of consistency that does not exist within other approaches to dual value logic. In dual value logic, the proposition is true or false. Also, accounting has ambiguous in many important respects [23].

There are different techniques and methods for making multiple fuzzy criteria that have different advantages and disadvantages over each other. A supply chain is a series of organizations involved in the production and delivery of a product or service. This chain starts with raw material suppliers and continues to the end customer. Supply chain management is one of the effective and efficient approaches that reduces production costs and waiting time. This attitude facilitates the provision of better customer service and ensures the opportunity for effective monitoring of transportation systems, inventory, and distribution networks. In this way, the organization can exceed the expectations and demands of customers [51].

2.4. Research Background

Extensive research has been conducted on intellectual capital in the organization, where, in most cases, intellectual capital includes human capital, structural capital, and customer or relationship capital [2]. In most researches, intellectual capital includes three aspects of human capital, structural capital and relationship capital, but the major differences are in the relationship exists between these three variables and others. The results of researches and the relationship between intellectual capital aspects and other variables are presented in *Table 1*.

Table 1. *Aspects of intellectual capital according to research background.*

Author(s)	**Related Concepts**
Fuzzy logic in accounting and auditing.	*[23]*
Investigating the impact of intellectual capital on equity returns.	*[29]*
Product market competition.	*[52]*
Intellectual capital and productivity.	*[39]*
Human resource productivity.	*[19]*
Efficacy.	*[43]*
Competitive advantage and organizational innovation.	*[32]*
Organizational entrepreneurship.	*[46]*
Financial Performance.	*[10]*
Developing innovative products.	*[16]*
The influence of intellectual capital on the effectiveness of productive.	*[36]*
Market value, Return On Total Assets (ROA), assets turnover, Return On Equity Capital (ROEC).	*[4]*
Quality of financial information.	*[11]*
The relationship between intellectual capital and the performance.	*[34]*
The position of intellectual capital in the performance.	*[49]*
Earnings per share, ROEC rate, annual return.	*[1]*
Current and future financial performance.	*[31]*
Competitive advantage.	*[18]*
Measuring the competitive power of products.	*[35]*

As the *Table 1* shows, intellectual capital affects product market competition, organization's productivity, human resource productivity, efficiency, competitive advantage, entrepreneurship,

financial performance, products development, Return On Equity Capital (ROEC), Return On Total Assets (ROA), market value, quality of financial information, company's performance, earnings per share, annual returns and financial performance.

On the other hand, extensive research has been conducted on economic competitiveness (*Table 1*). The results confirm the relationship between variables and economic competitiveness. Mojtahed zadeh et al. [34] examined the relationship between competitiveness and product market competition and confirmed this relationship. Soltani et al. [50] examined the role of human resources in creating competitive advantage and identified human resources as one of the main sources in creating a sustainable and unique competitive advantage. Riasi [43] conducted a comprehensive study on the competitive advantage and found that performance (especially when reducing costs) could lead to a competitive advantage for the organization. Haji Hoseini and Norozade Moghadam [22] studied the effect of innovation and market orientation on business performance and competitive advantage in industrial companies and confirmed the relationship exists between these factors. Khazai et al. [27] confirmed the relationship exists between strategic entrepreneurship and competitive advantage. Saeidi et al. [47] also confirmed the relationship exists between financial performance and competitive advantage.

Khalique et al. [26] showed that human capital has a significant importance in intellectual capital. Dzenopoljac et al. [13] found that intellectual capital affects the organization's overall performance. Kianto [28] described intellectual capital as the most important asset in knowledge management, which can create value in the organization. Nimtrakoon [36] examined the relationship between intellectual capital, the market value of a company and the financial performance of the organization.

According to previous researches, there is a positive association between intellectual capital and economic competitiveness; these two concepts are also indirectly related by other variables. It's not possible to neglect the effect of other variables on the relationship exists between intellectual capital and competitiveness; therefore, we aim at examining the direct, indirect, and internal relationships of all variables with each other, based on the results of previous researches and using research and statistical methods.

Marzband [33], in study entitled "Precise Services and Supply Chain Prioritization in Manufacturing Companies Using Cost Analysis Provided in a Fuzzy Environment" in order to identify and prioritize the factors affecting the supply chain in manufacturing companies, using indicators such as cost, timely delivery and procurement time to evaluate the supply chain efficiency was considered. And performance evaluation was performed at the manufacturer level. Therefore, to evaluate the performance of the supply chain using the AHP integration approach and the DEA method approach in the fuzzy environment, the suppliers and suppliers of the manufacturing company were evaluated and ranked in terms of performance. Results lead to a competitive advantage and are more effective and decisive in the performance indicators of the organization, including earning more.

3. Research Methodology

This was an applied, fundamental and causal research aiming to examine the relationship exists between the variables of intellectual capital and economic competitiveness as well as all related variables. The participants were 15 specialists, including university professors and financial company executives. The statistical population in the other part of the study was employees of financial companies who were

studied for the quantitative analysis of data. A total of 800 employees were employed, while according to the Morgan table, a sample of 260 people is enough.

The FCM representation was used to obtain the desired model. In general, the relationship between the variables is determined by using the FCM's outputs, but in order to achieve better and more accurate results, based on the FCM results, a researcher-made questionnaire was prepared and distributed among participation after its validity and reliability were evaluated. The one-sample t-test value was determined using statistical methods, aiming to determine the relationship exists between variables. The conceptual model of research is presented in *Fig. 1*.

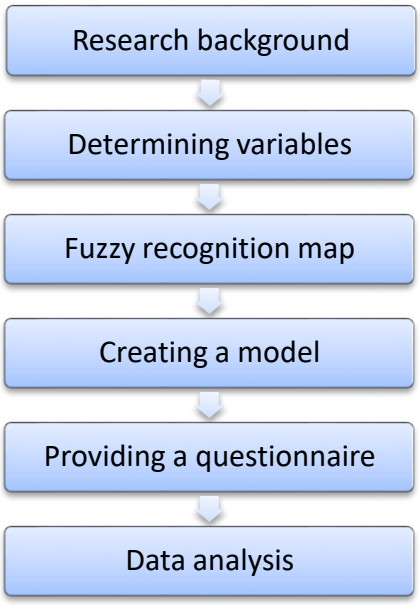

Fig. 1. *The conceptual model of the research.*

3.1. Research Background and Variables Determination

The research background was provided in intellectual capital, economic competitiveness and economic consequences. This section mainly focuses on identifying different aspects associated with the above-mentioned variables. Outputs of this section includes intellectual capital, economic competitiveness, product market competition, productivity, efficiency, organizational innovation, organizational entrepreneurship, financial performance, product development, market value, total assets, ROEC, quality of financial information, firm performance, earnings per share, ROA and annual returns.

3.2. Applied Algorithm

Research algorithm is based on a fuzzy approach called Fuzzy Cognitive Map (the abbreviation is FCM obtained from initial letters). FCMs have gained considerable research interest due to their ability in representing structured knowledge and model complex systems in various fields. This growing interest led to the need for enhancement and making more reliable models that can better represent real situations that leads to our used algorithm, FCM method [45].

Fuzzy cognitive maps are signed fuzzy digraphs. They may look at first blush like Hasse diagrams, but they are not. Spreadsheets or tables are used to map FCMs into matrices for further computation. FCM is a technique used for causal knowledge acquisition and representation, it supports causal knowledge reasoning process and belong to the neuro-fuzzy system that aim at solving decision making problems, modeling and simulate complex systems [6]. Learning algorithms have been proposed for training and updating FCMs weights mostly based on ideas coming from the field of Artificial Neural Networks. Adaptation and learning methodologies used to adapt the FCM model and adjust its weights. Schneider and Hase [48], suggested the Differential Hebbian Learning (DHL) to train FCM. There have been proposed algorithms based on the initial Hebbian algorithm; other algorithms come from the field of genetic algorithms, swarm intelligence and evolutionary computation. Learning algorithms are used to overcome the shortcomings that the traditional FCM present i.e. decreasing the human intervention by suggested automated FCM candidates or by activating only the most relevant concepts every execution time; or by making models more transparent and dynamic [45].

3.3. Fuzzy Cognitive Map and Determining a Model

FCM is a modeling methodology for complex decision-making systems that can describe a system's behavior based on its concepts. Each concept represents identity, a status, a variable, or a feature of the system. FCMs have applications in simulation, modeling of organizational strategies, supporting the formulation of strategic plans and analysis of failure situations, specifications, and requirements of urban design support systems, managing relations in the services provided by the airline companies and promoting the network's operation. A cognitive map is a diagram designed to express a person's cause and effect view of a particular field, as well as to analyze the effects of some items such as policies or business decisions in connection with the realization of specific goals [45].

The methodology developed by Rodriguez-Repiso et al. [45] uses four matrices including the initial matrix of success, the pseudo-successive fuzzy matrix, the matrix of the successful relationship power, and the final matrix of success for creating FCMs. The process of creating an FCM consists of five steps. In the first step, the initial matrix of success is formed. This contains an $n \times m$ matrix, where n is the number of key factors of success (also called the concepts or variables) and m is the number of people interviewed for data acquisition. Each element of the matrix reflects the importance that the individual "*j*" considers for a particular concept "*I*" on a particular scale; this can be different in different projects and even for different factors of a success in a project, because these results in the future will become a fuzzy set, with values between zero and one also between one. The fuzzy matrix of success is created in the next step, where numerical vectors *Vi* are transferred to fuzzy sets in which each element of the fuzzy set indicates the membership of each element *Oij* of vector *Vi* with the vector *Vi* itself. Numerical vectors with values between zero and one are converted into fuzzy sets.

The maximum value is determined in *Vi* and $Xi = 1$ is considered for it. Then the maximum value is determined in *Vi* and $Xi = 0$ is considered for it. The ratio of all elements of the vector *Vi* is determined from 0 to 1.

$$X_i(O_{ij}) = \frac{O_{ij} - \min(O_{ip})}{\mathrm{Max}\,(O_{ip}) - \min(O_{ip})}.$$

In the third step, the relationship matrix of the success power is created, which is an $n \times n$ matrix. Matrix rows and columns are key factors of success, and each element in the matrix indicates the relationship

between factors *I* and *j*. S_{ij} can also gain values from -1 to +1. Each key factor of success is represented as a numerical vector Si, which contains the element n for any concept demonstrated on the map. There are three possible relationships between the two concepts of S_{ij}.

$S_{ij} > 0$ represents a direct (positive) causality between the concepts of i and j, where the increase in the value of the concept of *i* increases the value of the concept of *j*.

$S_{ij} < 0$ represents the inverse (negative) causality between the concepts of *i* and *j*, where the increase in the value of the concept of *i* leads to the decrease of the value of the concept of *j*.

$S_{ij} = 0$ shows that there is no relation between the concepts of *i* and *j*.

Before the next step, the duality of the relationships must be determined. The numerical vectors IMS and FZMS are converted to fuzzy sets. Given the *V1* and *V2* (vectors associated with factors 1 and 2) and *X1* (*Vj*) and *X2* (*Vj*) (degrees of membership j in vectors *V1* and *V2*), these vectors only have an increasing relationship (i.e. a direct relationship between concepts 1 and 2; $S_{ij} > 0$). If *X1* (Vj) is similar to *X2* (*Vj*) for all or most of the elements related to both vectors, and when vectors V1 and V2 exclusively have a decreasing relation with concepts 1 and 2, and if *X1* (*Vj*) is similar to (*1-X2 (Vj*)) for all or most of the elements related with both vectors, then *Sij<0*.

The proximity between the two vectors *V1* and *V2* must be determined in order to determine the relationship level. Calculating similarity between these two vectors indicates the power of the relationship between concepts 1 and 2 in relation to these two vectors, represented by the element *S12*, which is presented in the Strength of Relationship Matrix (SRMS). The proximity of the relationship between two distance-based vectors is based on the concept of the distance between vectors. The mathematical procedure for calculating the similarity between these two vectors is the approach presented by Schneider and Hase [48].

Different computational methods are needed for vectors having a direct relationship and vectors having an inverse relationship. If the vectors *V1* and *V2* are directly related, then the closest relationship between them for each j is achieved when *X1 (Vj) = X2 (Vj)*.

If *dj* is the distance between the elements *j* of vectors *V1* and *V2* (as follows):

$$d_j = \left|X_1(v_j) - X_2(v_j)\right|.$$

And if AD is the mean distance between vectors *V1* and *V2* (as follows),

$$AD = \frac{\sum|d_j|}{m}.$$

The proximity or similarity *S* between the two vectors is shown in this equation:

S = 1- AD, S = 1 represents the complete similarity and *S = 0* indicates the maximum non-similarity.

If vectors *V1* and *V2* have an inverse relation, then the method for calculating the similarity between them is similar to that of the previous one, while in this case, the equation for calculating the distance between the corresponding elements is a reverse relation with vectors *V1* and *V2*.

$$D_j = \left|X_1(V_j) - (1 - x_2(V_j)\right|.$$

The remaining equations are similar to calculate the mean distance between the two vectors *AD* and their similarity *S*.

In this case, *S = 1* represents a complete reverse similarity, and *S = 0* indicates a complete inverse non-similarity between the two vectors.

The final success index is the next step. After completing the SRMS matrix, part of its data can be misleading. All key factors of success presented in the matrix are not related, and there is not always a causal relationship between them. An expert opinion is needed to analyze the data and transform SRMS into the final matrix of success, which only includes those numerical fuzzy elements that represent the causal relationships among the key factors of success. When analyzing data in an SRMS matrix, two vectors can be related intersecting. Vectors can represent close mathematical relations, however, logically, two indicators/concepts can be completely non-related. These unconventional relationships can be easily identified by experts.

The graphic representation of the FCM is the last step. The graphical representation of the final matrix of success as an FCM, draws out a targeted FCM for illustrating key factors of success. In the final display, each flash of factors *i* and *j* have a marked weight. This value represents the power of the positive or inverse relationship of causality between the two factors and the value contained in the final matrix of the success in row *i* and column *j* [38].

In the present study and according to the proposed method, 15 variables studied including product market competition, productivity, efficiency, organizational innovation, organizational entrepreneurship, financial performance, product development, market value, total assets, ROEC, quality of financial information, company's performance, earnings per share, ROA, and annual returns as intermediary variables between the two main variables "intellectual capital" and "competitiveness". In fact, the aim of using an FCM is to determine the relationship between these variables and the two main variables of the research. Note that intellectual capital and competitiveness are based on research hypotheses, while the other 15 variables are selected based on the research background. Fifteen specialists rated all 17 variables, where the importance of the existence of the variable in the intellectual capital-economic competitiveness relationship was determined from 0 to 100. The scoring results are presented in *Table 2*, where the columns represent the score of each specialist to each variable, while the rows represent the 17 variables, as follows:

1 = Intellectual capital; 2 = Economic competitiveness; 3 = Product competitiveness; 4 = Productivity; 5 = Efficiency; 6 = Organizational innovation; 7 = Organizational entrepreneurship; 8 = Financial performance; 9 = Product development; 10 = Market value; 11 = Total assets; 12 = ROEC; 13 = Quality of financial information; 14 = Company's performance; 15 = Earnings per share; 16 = ROEC rate; and 17 = Annual returns.

Table 2. *Primary matrix.*

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
60	80	80	90	70	80	90	80	90	90	40	60	80	50	95	1
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2
60	40	70	60	60	80	80	60	80	50	80	60	80	60	80	3
70	50	80	80	80	60	40	80	60	80	60	70	60	80	30	4
80	80	90	60	60	70	60	60	70	60	70	80	70	60	60	5
90	80	40	70	80	80	80	70	80	80	80	90	80	70	70	6
40	60	50	80	60	90	80	80	90	60	90	60	90	80	40	7
100	90	100	90	90	90	100	90	100	90	90	90	100	90	100	8
50	80	80	90	70	40	60	90	40	80	50	80	80	90	50	9
80	60	60	40	80	50	80	40	80	60	80	60	60	40	80	10
60	70	80	90	90	80	10	50	60	70	40	70	80	30	60	11
80	80	60	40	40	80	80	80	70	80	80	80	60	60	80	12
60	60	70	80	50	60	60	60	80	90	60	80	70	70	60	13
70	70	80	60	80	80	70	80	90	80	70	60	80	40	70	14
80	80	90	70	90	60	80	60	40	40	80	70	90	50	80	15
90	90	40	80	40	70	80	70	50	70	90	80	40	80	90	16
40	40	80	90	80	80	60	80	80	80	40	90	90	60	40	17

In *Table 2*, the number 95 (expert 1; variable 1) means that expert 1 believes that intellectual capital has directly 95% effect on economic competitiveness.

The fuzzy matrix is then obtained. The lower limit of 20 and the upper limit of 90 are considered for responses, aiming to avoid responses from divergence, where all answers with a score equal to or lower than 20 are considered 0, while all answers equal or more than 90 are considered 1. In the next step, the power matrix of relations is obtained that illustrate the relationship of all 17 factors to each other. A focus group was created with 6 members to form the final matrix. The members of the group included university professors and specialists of economic competitiveness. According to their opinions, non-significant associations between factors were excluded and the casual orientation of relationships was determined. The results are presented in *Table 3*; the FCM diagram is shown in *Fig. 2*. According to the results, factors "ROEC" and "ROEC rate" have the same meaning and concept and therefore the factor "ROEC" was excluded. Also, the factors "financial performance" and "company's performance" were similar, due to the financial nature of the organization and so the factor "company's performance" was excluded. Other non-logical relationships were also excluded, according to experts.

Table 3. *Matrix fuzzy cognitive map.*

	1	2	3	4	5	6	7	8	9	10	11	13	15	16	17
1		4.64		5.68	5.73	5.21	5.42	4.44							
2			6.19	6.32				2.36	5.97	7.06	7.54	6.55	5.83		
3															
4					4.91										
5															
6									6.48						
7									6.09						
8												6.55	5.83		
9										8.28	5.11		5.51	7.51	4.54
10															6.88
11															
13															
15														5.63	
16															8.68
17															

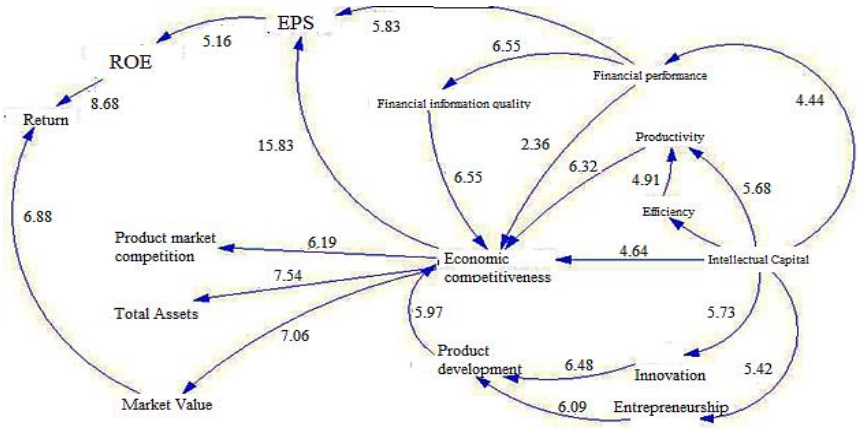

Fig. 2. *A fuzzy cognitive map for intellectual capital, economic competitiveness and related variables.*

The model shows the relationship between intellectual capital and economic competitiveness variables and its value. Accordingly, intellectual capital affects economic competitiveness, innovation, entrepreneurship, efficiency, productivity, and financial performance. Economic competitiveness is also related to productivity, financial performance, quality of financial information, earnings per share, product market competition, total assets, market value, and product development. On the other hand, there is an indirect relationship between ROEC rate and annual returns with intellectual capital and economic competitiveness, where economic competition first influences market value and earnings per share, and then these two variables affect annual returns and ROEC, respectively. The model also shows the effect that ROEC rate has on annual returns.

3.4. Providing Questionnaire and Data Analysis

Statistical tests were used for quantitative data analysis. Toward this end, a 21-items researcher-made questionnaire was designed based on the final model, where each item represents the relationship between the variables of the model and is designed based on the five-point Likert scale, ranging from very high to very low. For example, "intellectual capital affects the economic competitiveness" indicates the relationship between these two variables. The face and content validity of the questionnaire was evaluated using opinions from 6 experts in intellectual capital, economic competitiveness, and financial management, as well as by Cronbach's alpha (0.933). After approval, the questionnaires were distributed among 280 participants, of which 265 were completed that is, in fact, more than the minimum number (i.e. 260) required.

Sixty-five and thirty-five percent of respondents were male and female, respectively, most of them with a master's degree. Forty-eight percent were aged 36 and 45 years. In the next step, mean and the one-sample t-test were used for analyzing data obtained from questions. The fixed value in the one-sample t-test was 3 in the Likert scale. The results of each item are presented in *Table 4*.

Table 4. *Mean and one-sample t-test results for each item.*

No.	Question	Mean	t-value	Significance
1	*Intellectual capital affects economic competitiveness.*	*3.99*	*9.827*	*0.000*
2	*Intellectual capital affects efficiency.*	*3.83*	*7.365*	*0.000*
3	*Intellectual capital affects productivity.*	*3.83*	*7.799*	*0.000*
4	*Intellectual capital affects innovation.*	*3.85*	*8.017*	*0.000*
5	*Intellectual capital affects entrepreneurship.*	*3.92*	*8.897*	*0.000*
6	*Intellectual capital affects financial performance.*	*3.95*	*9.272*	*0.000*
7	*Efficiency affects productivity.*	*3.96*	*9.699*	*0.000*
8	*Productivity affects economic competitiveness.*	*3.62*	*5.314*	*0.000*
9	*Innovation affects product development.*	*4.06*	*11.095*	*0.000*
10	*Entrepreneurship affects product development.*	*3.96*	*9.528*	*0.000*
11	*Product development affects economic competitiveness.*	*4.08*	*11.493*	*0.000*
12	*Financial performance affects economic competitiveness.*	*3.64*	*5.574*	*0.000*
13	*Financial performance affects quality of financial information.*	*3.34*	*5.600*	*0.000*
14	*Quality of financial information affects economic competitiveness.*	*3.98*	*9.897*	*0.000*
15	*Financial performance affects earnings per share.*	*4.00*	*9.874*	*0.000*
16	*Economic competitiveness affects earnings per share.*	*3.76*	*6.980*	*0.000*
17	*Economic competitiveness affects product market competition.*	*3.77*	*7.259*	*0.000*
18	*Economic competitiveness affects total assets.*	*3.78*	*7.296*	*0.000*
19	*Economic competitiveness affects market value.*	*3.75*	*6.901*	*0.000*
20	*Market value affects annual return.*	*3.88*	*8.462*	*0.000*
21	*Earnings per share affects ROEC rate.*	*3.80*	*7.348*	*0.000*
22	*ROEC rate affects annual return.*	*3.81*	*7.356*	*0.000*

According to *Table 4*, if the mean is higher than 3 and the significance value is less than 0.05, then it can be stated that the observed t is acceptable and, as a result, there is a single-variable relationship. Accordingly, it can be claimed that all relationships in the model are confirmed. On the other hand, based on the results, the highest mean obtained for the "the effect of product development on economic competitiveness", where it can be stated that product development has a significant effect on the economic competitiveness. Also, the mean value of the relationship between innovation and product development and the relationship between financial performance and earnings per share was higher than 4, and so these relationships are also significant. The lowest mean was obtained for the effect of financial performance on the quality of financial information, where this relationship is confirmed considering observed statistics, and, on the other hand, the effect that financial performance has on the quality of financial information is at the least level, given the lower mean value obtained than the other variables.

4. Conclusion and Suggestion

As the results confirm, there is a direct and nonlinear relationship between intellectual capital and economic competitiveness that is influenced by other factors. Creating economic competitiveness firstly leads to the establishment of some other variables and then affects them directly or indirectly. Intellectual capital affects economic competitiveness; it then affects total assets, product market competition, market value, and earnings per share. There is a correlation between the findings of this research and the results of researches conducted by Rastogi [42], Vătămănescu et al. [54], Cherkesova et al. [8] and Zambon [57], in terms of product market competition. Intellectual capital can also affect productivity, efficiency, financial performance, innovation, and entrepreneurship, where all these variables affect economic competitiveness. Nematollahi [37] emphasized the relationship between intellectual capital and efficiency. All of these eventually affect the annual ROEC. Taghavi and Alifarri [52], and Kiyamehr and Asgharzadeh [29] considered the direct relationship between intellectual capital

and ROEC. Yahyazadehfar et al. [54] confirmed the effect of intellectual capital on financial performance directly or indirectly; there is a correlation between these findings and the results of this research. Based on the FCM results, the highest and lowest impact was observed in the "relationship between economic competitiveness and earnings per share" and "the effect of financial performance on economic competitiveness", respectively. With one-sample t-test, the highest mean was observed for 11th items and the relationship between product development and economic competitiveness, while the lowest mean was observed for the item "financial performance affects the quality of financial information." According to employees' opinions, it can be claimed that the mean values of the relationship between "financial performance and earnings per share", "product development and economic competitiveness," as well as "innovation and product development" are higher 4, resulting in stronger effectiveness. In general, the effect that intellectual capital has on economic competitiveness can be confirmed, but the relation between these two variables is not simple and affected by other variables and the economic consequences. Also, according to experts, and considering the FCM results, the effect of intellectual capital on economic competitiveness, and the effect of other variables on annual returns are confirmed. Therefore, annual returns can be the most important and final economic consequence. The highest effectiveness was observed for intellectual capital, while the greatest effect is on economic competitiveness.

Scenarios can be presented based on the proposed model. For example, in a probable scenario, increased intellectual capital will lead to increased economic competitiveness, high economic competitiveness will lead to higher market value, and ultimately high market value will lead to an increase in annual returns. When using the results of this study, some considerations should be considered. The results obtained in this study are based on the results of research conducted in Iran. As a result, interpreting the results of this study should be based on observed variables. On the other hand, experts included managers and professors in financial management, while other experts have different opinions. Therefore, studying different scenarios by other researchers is recommended. It is also suggested the model be expanded using approaches such as system dynamics and using software such as Vensim PLE.

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