



Designing the structural capital model for knowledge-based Companies

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Abstract

The appropriate organizational structural capital is one of the most important issues to emerge innovation in knowledge-based companies. The purpose of this paper is to design and implement a structural capital model in knowledge-based companies. The research is developed based on qualitative and quantitative research methods. Firstly, the paper has used the Grounded Theory method to develop the structural capital model based on the 10 experts' interview data. The experts are related to the organizational structural capital subject. Secondly, the model is applied to a knowledge-based company. Therefore, the researcher-made questionnaire is used to assess the status of structural capital in the knowledge-based company. So, the reliability was estimated at 0.94%. This paper presents a model for measuring structural capital in knowledge-based companies. The nature of knowledge-based companies has made it necessary to utilize these organizations' measuring to examine the status of infrastructure, processes, and all elements of structural capital.

Keywords: intellectual capital; structural capital; knowledge management; grounded theory.

Paper Type: Original Research

1. Introduction

Today, considering the dynamic and complex conditions facing organizations, intellectual capital is becoming an important and vital resource and asset for organizations. Previously, it was believed that the most important assets of an organization are physical assets such as machinery, equipment and buildings, but this belief is not suitable for the current economy, which is called the knowledge-based economy (Bontis, 2002). In the knowledge-based economy, the source of productivity and creating business value is the organization's intangible assets. In this connection, the term knowledge-based capital/asset is often used by economists or intangible assets used in accounting literature, as well as the title of intellectual capital used in management literature (Soetanto and Liem, 2019). Intellectual capital is the most important source for sustainable competitive advantages of organizations, and nowadays one of the important responsibilities of managers is the better management of intellectual capital (Malik et al., 2020). In fact, intellectual capital literature provides a comprehensive perspective on its value creation for strategic management. Edvinson and Sullivan (1996) define intellectual capital as: knowledge that can be converted into value (Ozdemir, 2017), (Mshdavi, 2011). According to Stewart (2001), intellectual capital is a set of knowledge, information, intellectual assets, experience, competition and organizational learning that can be used to create wealth (Bontis, 2000). The recent amazing software and hardware developments have accelerated human society moves toward a knowledge-based society. Unlike the industrial economy, in which the most important production factors are tangible/physical properties, whose utilization reduces their values, the most important properties and production factors in a knowledge-based economy are intangible properties (such as knowledge and intellectual capital), whose utilization does not reduce their values, but increases their values (Zahedi et al, 2019). Just as it is necessary to examine the physical health of a physician in a hospital, it is also necessary to examine the intellectual capital of an employee in a knowledge-based company. Researchers have proven that knowledge-based organizations and companies with strong R&D units have higher office value than other industries. Organizational structure is the structure of power and responsibility formed in the management process. The structure of power and responsibility can describe the organization's policy, leadership, control, and intelligence structure. Organizational structure has a significant relationship with organizational creativity and innovation. Organizational capital (structural capital) is defined as the sum of assets that enables the creation of the organization. The company's mission, vision, core values, and the strategies and operating systems and internal processes of a company can be considered as such assets. Structural capital is one of the basic principles for the creation of

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learning organizations. Even if the employees of an organization have the sufficient and high abilities and capabilities, if the organizational structure is made up of weak rules and systems, these capabilities and talents of employees cannot be used to create value and good organizational performance. It should be noted, however, that if an organization invests heavily in technology but employees are unable to use it, it will not be useful and effective (Bontis, 1998; Ozkan et al., 2017). Studies show that the competitive advantage and superior performance of an organization are related to the acquisition, maintenance and use of strategic assets (tangible and intangible), which create a competitive advantage and achieve strong financial performance. In recent years, intellectual capital has been recognized as a key resource for performance and value creation. In the modern economy, intellectual capital is a major source of economic development, and other traditional factors of production have secondary importance. Under such circumstances, intellectual capital has become a key factor in promoting organizational performance. On the other hand, organizations operate in successful knowledge-based economies that can invest in opportunities from intangible assets. (Bahrami, 2012) Competitive advantages are unstable and transient, and innovation is the key function of organizations in this age and the constant change in organizational structure is needed to facilitate the use of advantages and innovations. One of the most important barriers to change and innovation is the lack of appropriate processes in the organization or good structural capital in the organization. Because, basically, innovation comes with doubts. Knowledge-based companies need to foster creativity in order to have a say in the competitive arena, and without the creativity and innovation of knowledge-based companies, they cannot be defended. Without a proper understanding of existing structural capital, it is impossible to move forward and improve what is necessary for the life of knowledge-based companies, so a model for structural capital is needed. Investigating the related researches confirms the importance and role of structural capital in knowledge-based companies. This is especially true given the economic, cultural and social conditions of countries in order to solve future problems and bottlenecks that affected by the status of structural capital in organizations in one country. Similarly, organizations in general and knowledge-based institutions, in particular, need a model for measuring structural capital in order to improve inter-organizational processes and infrastructures and procedures. Pedro et al. (2019) suggests that future research on this issue deserve to be expanded from other countries and in conjunction with the support of experts in managing and running those same institutions (Pedro, Leitão, & Alves, 2019). Also, Muh et al. (2019) have stated for future works to expand the scope of the model and used to sample more for getting a better result and can prove the application of Intellectual Capital in all types of businesses and industries in relation to the Business Performance or the other dependent variables (Muh & ETTY, 2019). Knowledge-based companies agree that they need a specific model for managing, controlling the learning process, and measuring results. The main goal of this research is that although good steps have been taken to deal with intangible capital in recent years, the research, research and interviews conducted with managers, researchers and experienced and knowledgeable employees in management, knowledge management and structural capital It is based on documentary research. It is stated that in knowledge-based companies, comprehensive and numerous researches have not been done in this field, and the lack of a developed model for measuring structural capital management in the native platform of knowledge-based companies is always the main issue. . . In order to explain the need to pay attention to structural capital and its management, it is necessary to mention that structural capital is always considered as the most valuable asset of companies. The knowledge-based approach of new and up-to-date companies, on the one hand, and the development of new products and services according to environmental conditions, on the other hand, has drawn more attention to the need to identify and manage structural capital. Managers, therefore, the existence of native measurement models of structural capital is necessary for its better management in line with the basic knowledge of companies. This article seeks to find an answer to the main dimensions of structural capital in knowledge-based companies, how to connect the key dimensions of structural capital to design a measurement model, and the characteristics related to the key dimensions of structural capital in knowledge-based companies. . Correct management of structural capital is one of the main challenges of today's companies. Since the output of knowledge-based companies is largely intangible, information institutions can play a major role in highlighting knowledge management. Today, most of the funds of knowledge-based companies are provided by government and public institutions, so the transparency of the performance of such institutions has become a public demand, and the importance of measuring and reporting structural capital in them is increasing day by day. . Return. Since most of the activities of knowledge-based institutions are qualitative (such as research and development activities), there are still no comprehensive international standards that can quantify and report such activities. However, in recent years, a number of world-renowned knowledge-based institutions have spontaneously and entirely voluntarily designed new management tools that can help them manage knowledge assets. This research has chosen the background theory to build the theory. Grounded theory is a good approach to poorly understood phenomena. The method of data collection is interview and the main method of analysis is the use of coding analytical methods (Vaziri Guderzi and Mohadi Sobhani, 2013). This research, using the grounded theory method as a qualitative research method, has developed the structural capital model based on the interview data of relevant experts. Interview data were analyzed based on basic theoretical principles. Therefore, the structural capital model is developed based on the basic theory and expert interview data. Also, in this research, the model has been used in a knowledge-based company. Therefore, questionnaire distribution is used as a quantitative research method. Finally, the results of research methods and structural capital model are proposed in the article. In

fact, the main goal of this research is to find an answer to the question, what is the optimal structural capital model in knowledge-based companies? It has been done.

2. Literature review

2.1. Components of intellectual capital

Before we can identify, frame and manage the structural capital, we need to understand its meaning. The concept of intellectual capital has always been vague, and various definitions have been used to interpret it. In the early 2000s, the first scientific journal entitled "Intellectual Capital" was published. The European Union published its first Intellectual Capital Report and published the book *Intangible Wealth* at the Brookings Institution. In those years, the Austrian Centers of Intellectual Capital Reporting was published and the book of *Management, Measurement, and Reporting of Intangible Assets* was published, along with a large volume of books and articles on Intellectual Capital Management. Many projects have been defined and implemented to manage and measure intellectual capital in various organizations and are currently being pursued. Intellectual capital can be defined as the sum of what is produced by the three main elements of the organization (human capital, structural capital, and customer capital) (Roos, 2017) related to the knowledge and technology to provide more value for the company in the form of competitive advantage of the organization (Muh & ETTY, 2019). Also, the intellectual capital related to knowledge-based risk management in organizations (Piri et al, 2020). Bontis (Bontis, 1998) defines intellectual capital as a set of intangible assets (resources, capabilities, and competitiveness) derived from organizational performance and value creation. Intellectual capital is an asset that measures an organization's ability to generate wealth. It has no physical or objective nature and is an intangible asset acquired through the use of HR-related assets, organizational performance, and relationships outside the organization. All of these attributes create value because they are completely internal and cannot be traded. (Rose, 2005) Along with physical capital and financial capital, intellectual capital is one of the three vital sources of organizations. Intellectual capital includes all intangible assets that (a) are attributable to an organization and (b) interfere with the organization's value proposition (Marr, 2008). Generally speaking, intellectual capital refers to all intangible assets of an organization that produces value for the organization. Intellectual capital has a variety of dimensions and content, but there are various categories for it, but in general, it should be said that most of the classifications referred to the three human, structural and communication capital, which due to the thematic focus of the paper only on structural capital will be reviewed. Also, intellectual capital takes three basic forms: human capital, structural capital, and customer capital (Otcenášková & Bureš, 2018). Zahedi and Papoli (Zahedi&Papoli, 2018) have shown the conceptual structure in figure1.

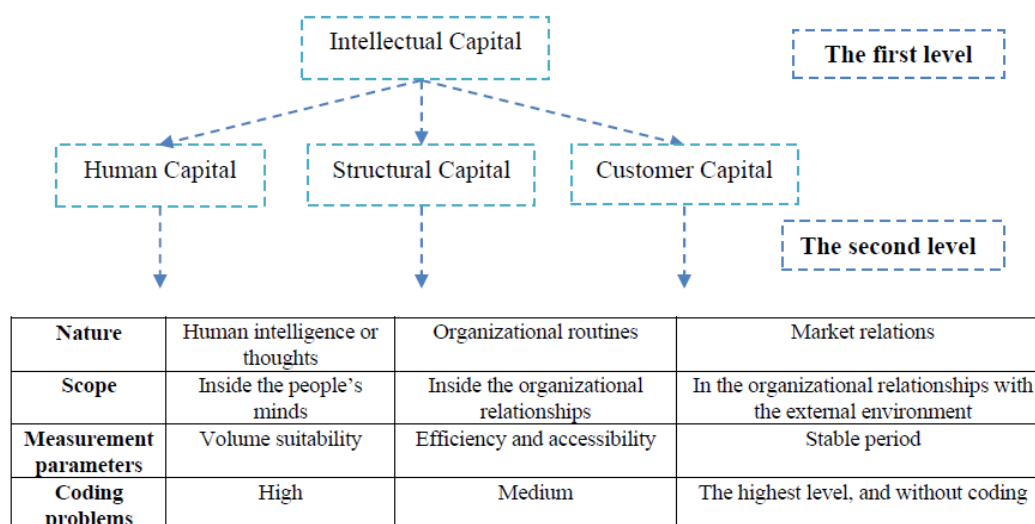


Figure1. the conceptual structure of intellectual capital (Zahedi and Papoli, 2018)

2.2. Structural capital

Bontis believes that researchers' interest of researchers to structural capital has increased in recent years because of organizations' desire to compete in the market. Organizational capital is defined as the sum of assets that enables the organization's creativity. The company's mission, vision, core values, and the strategies and operating systems and internal processes of a company can be considered as such assets. The structural capital encapsulates all explicit knowledge interrelated with the internal processes of promotion, communication and the management of scientific and technical knowledge in the organization, which spans both the organizational (operating environment derived from the interactions between research, management and the organization of processes,

organizational routines, corporate culture and values, internal procedures, within the scope of quality and information systems, among others), and the technological (technological resources available in the university, such as bibliographic and documentary resources, archives, technical developments, patents, licenses, software, databases, among others) facets (Pedro et al., 2019). Organizational capital is one of the underlying principles for creating learning organizations. Even if the employees of an organization have sufficient and high abilities and capabilities, if the organizational structure is made up of weak rules and systems, these capabilities and talents of employees cannot be used to create value and good organizational performance. It should be noted, however, that if an organization invests heavily in technology but employees are unable to use it, it will not be useful and effective (Bontis, 1998). According to Chen et al. (2004), structural capital refers to the current system, structure and procedures of business in an organization. More clearly, structural capital can be classified as organizational culture, organizational learning, operational process, and information system. Generally, in all definitions of structural capital in non-physical assets there are three key features: 1) The potential for economic profit, 2) Lack of physical nature, 3) Can be traded or maintained by the organization. If Structural Capital includes the organizational culture, business history, and the core part of managing them, Structural Capital can also be recognized as a source of knowledge that its aim is to guide the company to its vision, mission, values, and goals. In this process, the innovation that developed by structural capital is the key element that transforms these capabilities and skills into integrated networks, external organizational capabilities, brands and brands, processes and other intangible and sustainable resources. Thus, structured capital is created by people and belongs to the organization, but can be purchased from elsewhere. Strong structural capital within an organization includes a supportive culture that allows people to try new things and learn from mistakes. (Bontis, 1998) Structural capital includes organizational politics and culture. If these policies are favorable for a culture of environment-friendly and knowledgeable, human capital and communication can be developed and more profit extracted. By using a variety of information technology people are able to connect with other people or groups and share their knowledge (Kermally, 2002). Thus, structural capital is an intangible resource owned by the organization and its purpose is to facilitate the exchange of knowledge conditional on a culture that organizations can survive and grow in the current market conditions. In an organization, Structural Capital is the knowledge that serves to clear, organize and internalize the information. In short, structural capital plays a significant role in utilizing human capital to ensure effective tracking and organizational goals for profit in this case.

2.3. The role of structural capital in knowledge-based companies

In today's evolving world, the underpinnings of industrial economies shift from resource-centric to intellectual capital-driven, and therefore the factor of knowledge is becoming increasingly important. In these circumstances, a new form of organization is needed: organizations that are known as knowledge-based systems, or so-called knowledge-based companies are vital to economic development in a country. In fact, these companies are the engine of growth and development (Gorman, 2006; Khan et al., 2017). Vaz et al. (2019) classify structural capital in three divisions: organizational capital, capital of innovation and capital processes (Vaz, Selig, & Viegas, 2019). Mahdavi et al. (2014), also based on their operational experience in the management of Isfahan Technology Park, have defined the knowledge-based companies as private-sector institutions that are formed to transform knowledge into wealth. The most important asset of these companies is intellectual property, and R&D at these institutions is not a one-time, one-off job but is a permanent and dynamic process. In other research, the characteristics of knowledge-based companies are summarized as follows: The ratio of specialist to total employees in these companies is high, the technological changes in these companies are greater than those of traditional industries, with more research and development and more growth and development and their growth and development are more dependent on technology development. In addition, their competitive advantage is mainly in technology innovation, and eventually, these companies are rapidly conquering new markets. (Allahyari Fard, 2011). Stankio et al. (2017) by considering the impact of intellectual capital on the creation and enhancement of organizational performance as well as the effects of the continuous process of knowledge transformation, the move from the classical military organization to the military organization of knowledge-based organizations is considered essential. At the same time, in the new type of military organization, the intellectual capital must be redefined and the "engine" of the operation and development of the organization to be considered in a highly unstable security environment. A number of decisions have been proposed to accomplish; Training and specializing in human capital, Implementation, and development of own information and technology databases, implement an effective and appropriate knowledge management system and increasing the research and development costs in the field of the national defense. Also because of the specific culture of military organizations, the creation, innovation, transfer and re-use of information and knowledge must be more strongly supported, and by making these decisions the military organization can make better use of intellectual capital to carry out its missions. Organizations need the right combination of all aspects of intellectual capital to achieve higher performance. Intellectual capital by combining, deploying, interacting, integrating and creating inter-dimensional interactions, as well as managing the flow of knowledge between them can provide the best value for the organization. In fact, the viability and sustainability of an organization's performance will be determined by how real capital will be created between the physical and the intellectual capital of the organization to satisfy shareholders. (Mousavi et al., 2013). Rahim et al. (2011) conducted the Structural Capital and its effects on organizational performance in a Malaysian telecommunications

company with a sample of 1174 corporate executive's managers of the company. The results showed that, as Bontis et al. (2000), Wang and Chang (2005), Zernler et al. (2008) and Chu et al. (2011), structural capital has a positive impact on organizational performance and it can be generally concluded that each of its dimensions supports from organizational performance. This makes it clear that structural capital mechanisms such as organization structure, operational processes and instructions, databases, documents, information systems, and networks can have a beneficial effect on organizational performance. In another study conducted in Indonesia has been shown that structural capital efficiency has a positive effect on the firm's operating cash flow, implying that structural capital is a major driver of corporate performance in the consumer goods sector. This study identified structural capital efficiency as one of the most important variables affecting future firm performance. (Razafindrambinina & Anggreni, 2008). In a study by Yilmaz and Kams (2016), the effects of structural capital as a subset of intellectual capital were analyzed qualitatively and quantitatively, and it was found that structural capital had a significant positive effect on the qualitative and quantitative performance of firms. Factors that they examined included (a) organizational culture, (b) corporate and brand image, (c) information technologies, (d) intangible assets, (e) process, and managerial philosophy. The most important way to increase structural capital is also the processes developed from organizational experience that are useful for companies, industry, and stakeholders.

2.4. Grounded theory

In Grounded Theory methodology, data should be arranged in chronological order (based on time of interviews or sequence of events). Sorting may be done by other variables as well. However, sorting data should be able to see the sequence of events and even the chain logic of their relationship with each other.

The coding process is used to analyze the data collected in the grounded theory. Data analysis in this process is not separate from collection and sampling. At every step, analyzing previous data is a way to decide which data to look for or what to look for. During the coding process, the data is analyzed and conceptualized and finally, put together in a new way. (Flick, 2008) Strauss and Corbin have divided the coding process into three stages of open, axial, and selective coding.

1. Open coding: The process of crushing, comparing, conceptualizing, and categorizing data is called open coding. (Strauss & Corbin, 61: 2006) Many concepts emerge during the process of conceptualization. We will usually have a long list ahead of us. It is better to summarize similar concepts and formulate the following. Open coding also reveals the properties and dimensions of a category. Properties define the nature of a category. Dimensions also classify an entity along a spectrum. (Strauss and Corbin, 2006: 63).

2. Axial Coding: A set of concepts, categories, properties, and subcategories is the output of the open coding step. The relationship between each category and its subcategories (not the relationship between the categories) occurs at the axial coding stage. (Zakai, 2008).

3. Selective Coding: The open and axial coding process leads to the emergence of a set of categories that has a specific relationship pattern between each category and its subcategories. Now it is time to relate the categories and present a specific theoretical system. Linking categories together is called selective coding. (Strauss and Corbin, 2006: 118).

3. Structural capital model

3.1. Structural capital model development using grounded theory

The common way of collecting data in Grounded Theory is the data obtained through formal interviews with open-ended questions. In this study, semi-structured interviews were used as data collection methods. Sixteen intellectuals were selected to participate in the research and prioritized based on their experience and expertise. Interviewed with questions such as Describe structural capital? What are the components of structural capital? Explain the components of structural capital? What is the Importance of Structural Capital in Knowledge-Based Companies? What components of structural capital are important in knowledge-based companies? And the next questions were asked based on the participants' reactions to discovering the deep and specific aspects of the indicators and components of structural capital. For example, explain more? What do you mean by the component mentioned? How? Why? Interviews ranged from 45 to 30 minutes. Three methods of open, axial, and selective coding have been used with continuous comparison method. In the first phase of the analysis, it focused on identifying and extracting basic concepts from the interviews. Accordingly, after conducting each interview, the researcher extracted and coded the concepts contained in the interview text repeatedly. In sum were conducted 10 interviews, were extracted 312 concepts. Table 2 shows an example of the extracted basic concepts. After reviewing and reconciling them and eliminating duplicate concepts, 77 final concepts were identified. In Table 3, examples of finalized concepts are visible after analyzing interviews and eliminating duplicates in the open coding step. (Note that the codes next to the concepts include a Latin letter and a number. The Latin letter (in alphabetical order) indicates the interviewee, and the number next to this letter indicates the concept number extracted from that particular

interview.) Also, the concept number. The initial extracted from each interview as described in Table 1 is the number of concepts extracted from each participant's interview.

Table 1. Number of concepts extracted from interviews

Contributor	Number of concepts
People A	39
People B	31
People C	36
People D	23
People E	56
People F	30
People G	31
People H	24
People I	19
People J	21

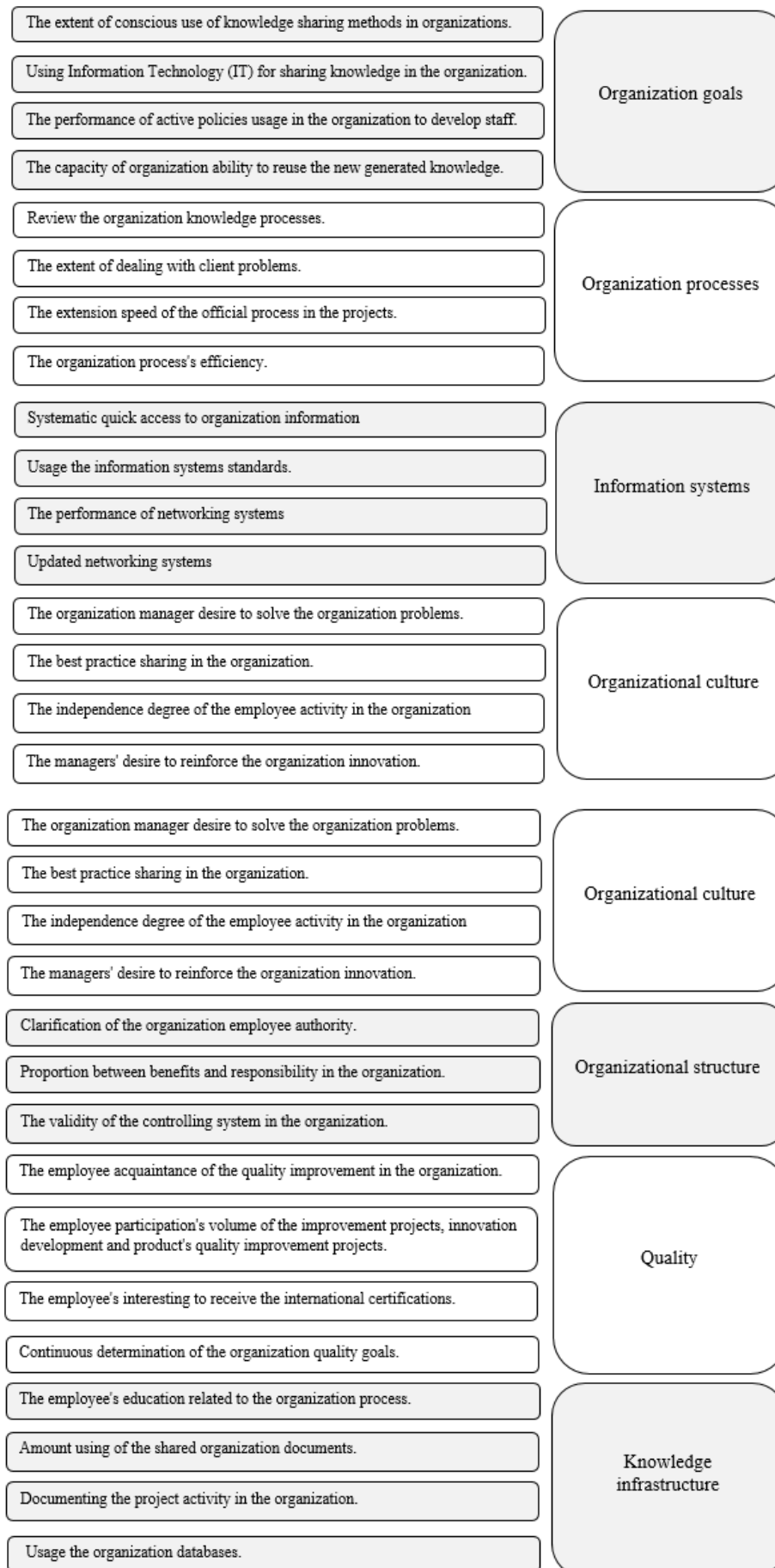
Table 2. an example of the 10 concepts extracted from the interview 1

Code	The first concept
A01	Suitable training program for staff
A02	Development of existing knowledge in the organization
A03	Using new information-sharing systems
A04	Studying the processes of the organization
A05	Support from new solutions
A06	Performance of existing processes in the organization
A07	Addressing clients' problems
A08	Support from relationships between employees
A09	Focusing on innovation
A10	The tendency to international standards

Table 3. an example of the first 10 concepts after reviewing and removing duplicates

Code	The first concept
A10	The tendency to international standards
A13	Importance to product quality level
A20	Supporting innovation
A21	Rewarding to new solutions
A23	Paying attention to investing in innovative projects
B01	The extended use of knowledge dissemination methods in organizations
B05	Percentage of success of tasks assigned to employees
B08	The degree of familiarity staffs with organizational improvement methods
B17	Documenting activities carried out in organization projects
B19	Staff education related to work areas

In the next step, it was attempted to create more general categories called categories by deeply considering the identified concepts and identifying their similarities and differentiating them, and to incorporate the concepts of both type and line into these broader categories. The outcome of this process was the identification of nine main categories that, together with the related concepts, are visible in Figure 2 with the Structural Capital Model of the identified categories of associated companies and related concepts. And since there is no hypothesis about the nature of the research, the contents of this section answer the research questions.



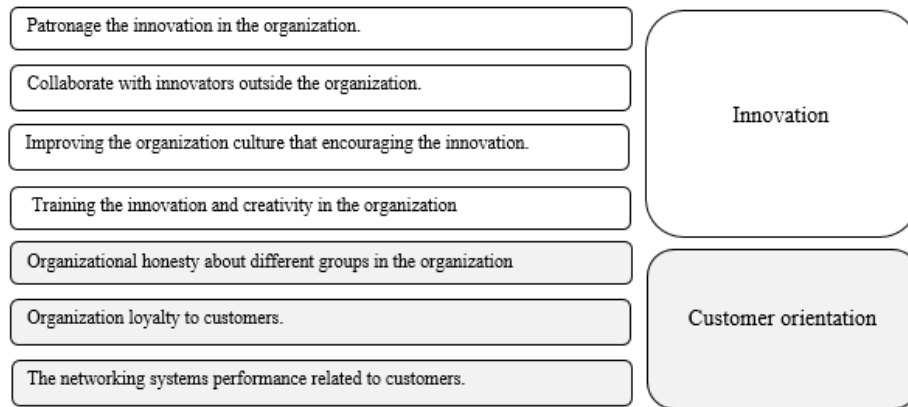


Figure 2. Structural Capital Model for Knowledge Base Companies

Interviewees included 10 experts, 9 men, and 1 woman, with information on 1 strategy, 1 knowledge management, 6 intellectual capitals and 2 entrepreneurship and innovation with activity experience and 1 people less than 10 years, 3 people between 10 to 15 years and 6 more than 15 years all had doctoral degrees. The structural capital model is developed based on the following study and the Grounded Theory:

1. Organizational Goals: Active policies in the organization to develop the knowledge of the new employees
2. Processes: Review of knowledge processes at the organization
3. Information Systems: Tendency to the International Information Systems Standards
4. Organizational culture: The volume of staff participation in the improvement projects of the educational quality
5. Organizational Structure: Clarify the employees' authority
6. Quality: Developing quality goals consistently
7. Knowledge Infrastructure: The amount of usage of the shared document
8. Innovation: Collaborate with the other innovator outside the organization
9. Customer Orientation: organization loyalty to customers

3.2. The model validity

According to Strabert and Carpenter (2005), the purpose of evaluating the validity, accuracy, and robustness of qualitative research is to ensure that the study accurately reflects the experiences of the research participants. There may be some doubts about the validity of the findings and the information obtained from the data analysis by the researcher, which is considered a challenge for qualitative research. Accordingly, Flick (2008) quoted Guba and Lincoln (1985) as considering five basic concepts: confidence, believability, reliability, transferability, and authenticity as the criteria for evaluating qualitative research. These factors may be compared with what is often referred to as validity and reliability in quantitative research. As explained below, the research has developed the model based on the five principles.

- The first step was to have the extracted categories of the interview, after each interview, sent to the participant, to review, confirm or otherwise modify what was inferred and adjusted based on their conversations. This has prevented from categories that might be the miss interpret and analyze false of the researcher.

- In the present study, the researcher's long-term collaboration with experts (about 6 months) allowed him to spend enough time building mutual understanding with the participants and dedicating time to collecting data that was effective in enhancing the credibility of the data. This study has also utilized multiple information sources, such as experts from knowledge-based companies, experts in intellectual capital auditing, and academics with experience in the field.

- After the qualitative content analysis of the collected data, the interviews were conducted once after the implementation of each interview and after 6 weeks of the first analysis, this work was repeated to check the consistency of the two analyzes. The results showed that, to a large extent, the two analyzes performed on an interview over this time interval overlapped.

- One of the responsibilities of the researcher in the qualitative study is to accurately describe the research process so that it can be used in other situations and the present research, the researcher has collected all the steps and thus the ability to follow step by step methods and decisions as well as evaluation. The ability to transfer data and results to other positions and groups has been provided to other researchers.

3.3. The model application in a knowledge-based company

After completing the interviews and obtaining the Structural Capital Model using the Grounded Theory, a questionnaire based on the output of the Structured Capital Knowledge Center was designed to assess the status of the Structured Capital and then approved by experts and informed by experts. Familiar with the fundamentals of management and intellectual capital as well as knowledge-based organizations. According to the Human Resources Center, the number was 370, and according to Morgan's formula, 144 were distributed to a knowledge-based company. 137 acceptable questionnaires were collected. It should be noted that to ensure the validity of the questionnaire, the qualitative method has been used, i.e., the opinions of experts and experts, and their corrections and changes have been applied after discussion in the questionnaire. And since each question is based on interviews with experts, it can be said that the questionnaire has validity and the reliability of the questionnaire is confirmed by Cronbach's alpha of 0.94 and component reliability coefficient. Trust decreases so all components are important and cannot be ignored.

Table 4. Reliability coefficient of research components

Component	Average if the item is deleted	Variance if the item is deleted	Cronbach if the item is deleted
organizational goals	47.5345	60.382	0.934
Organizational Structure	47.3105	61.263	0.935
Organizational Culture	46.8274	65.011	0.939
information system	47.3209	66.190	0.931
Quality	47.210	63.015	0.935
processes	47.5020	60.433	0.933
Knowledge infrastructure	47.1826	64.060	0.937
Innovation	47.3306	61.630	0.934
Customer Orientation	47.5202	60.252	0.938

Participants in the questionnaire were the members of a knowledge-based company that had 16 under 30, 38 under 40, 58 under 50 and 25 over 50 years of age, with 53 bachelors, 49 masters, and 35 Ph.D. with a work experience of 29 years younger than 10, 61 were younger than 15 and 47 were more than 15 years. Kolmogorov-Smirnov test was performed on the data and its results are shown in Table 2. With a significance level greater than 0.05 we conclude that all variables are normal and the parametric test should be used.

Table 5. Kolmogorov-Smirnov test

Research variables	The result of the hypothesis	significance level	Z-statistic
organizational goals	It's normal	0.269	1.101
processes	It's normal	0.261	1.072
Organizational Structure	It's normal	0.775	0.661
Organizational Culture	It's normal	0.254	1.015
Knowledge infrastructure	It's normal	0.272	0.998
Innovation	It's normal	0.587	0.774
information systems	It's normal	0.430	0.885
Quality	It's normal	0.270	1.091
Customer Orientation	It's normal	0.422	0.924

One sample t-test was performed to examine the status of the components in the company and the results are shown in Table 3. Based on the outputs of inferential statistics as well as the significance level and upper and lower limit of each component, it can be stated that the customer-oriented component does not have the minimum requirements and the other components in the company have the necessary conditions.

Table 6. Inferential statistics of structural capital components

Component	Test value = 3					
	t	Degrees of freedom	The significance level	Average difference	95% Confidence Interval of the Difference	
					Down line	High line
organizational goals	-1.199	136	0.233	-0.10584	-.2804	0.0687
Organizational Structure	-0.189	136	0.850	-0.01460	-.1673	0.1381
Organizational Culture	10.686	136	0.000	0.55036	.4485	0.6522
information systems	5.888	136	0.000	0.38929	.2585	0.5201
Quality	2.654	136	0.009	0.18005	0.0459	0.3142
processes	-0.531	136	0.596	-0.04380	-0.2070	0.1194
Knowledge infrastructure	3.427	136	0.001	0.22993	0.0972	0.3626
Innovation	0.000	136	1.000	0.00000	-0.1535	.1535
Customer Orientation	1.926	136	0.056	0.14599	-0.0039	0.2959

3.4. Proposing recommendation to the knowledge-based company

This paper presents a model for measuring structural capital in knowledge-based companies. The nature of knowledge-based companies has made it necessary to utilize these organizations' measuring to examine the status of infrastructure, processes, and structural capital. The structural capital of a knowledge-based firm under study based on inferential statistics is acceptable in all components except customer orientation. To improve the customer orientation component, 3 issues has recommended: 1) Improving the performance of customer relationship systems, 2) Improving the company loyalty to its obligations and fulfill the promises it makes to its customers, 3) Strengthen the corporate public relations and increase the transparency of performance for all corporate groups. It should be considered that participation in other components is acceptable, but ideally significant and should not neglect the improvement of other components.

Based on the research results, suggestions are made for the creation and better evaluation of structural capital as below:

- Based on the results of the research, it was found that one of the most important factors in creating structural capital is the strengthening of organization infrastructure capital. Factors such as corporate culture technology, routines, and business processes in the company should also be considered to enhance the organization's infrastructure capital.
- Corporate executives can step by increasing the number of systems, creating a supportive and facilitating culture of collaboration, as well as by investing in developing databases, reducing bureaucracy, supporting new ideas to strengthen infrastructure capital, and ultimately creating structural capital.
- Authorities should strive to improve business processes by outlining and moving the organization on a pre-planned path.
- Relationship with outside research firms, implementing organizational and external projects can also be effective in enhancing research and development capital and creating structural capital.
- Knowledge infrastructure capital, as one of the most important aspects of structural capital, should be given much attention. Knowledge management processes such as identifying and revising knowledge processes on the organization, knowledge sharing, knowledge creation and production, and the use of information technology in the field of knowledge dissemination are one of the most influential factors in creating structural capital that company executives should take particular care of them.

4. Conclusion

In today's competitive environment, where knowledge is considered a vital asset for an organization, organizations must strive to achieve leadership in the development and survival of this competition. Intellectual capital management has always been the core of knowledge management in organizations in the field of the knowledge economy. Intellectual capital management needs to be measured first. It should also be noted that if a company has weak systems and procedures, the intellectual capital will not be fully realized at its potential. Even if the employees of a company are capable and capable enough, they cannot take advantage of them if the organization is poorly structured. Whereas a company with a strong structured capital will have a supportive culture that allows people to be creative, to fail and to learn. As a result, a knowledge-based company must develop its own structural capital. This paper presents a model for measuring structural capital in knowledge-based companies. Structural capital was one of the main components of intellectual but neglected capital that was developed using the Grounded Theory approach. The model has 9 components including organizational goals, processes, information systems, organizational structure, quality, organizational culture, knowledge infrastructure, innovation, and customer

orientation, and 34 indicators to measure these 9 components. It is recommended for future researchers to conduct research consistent with the present research for knowledge-based companies and the result together to identify similarities and differentiate the designed models. This approach can also be applied to other components of intellectual capital. It is hoped that this study will take a step towards the proper measurement and management of this strategic asset.

Managerial insights

The results of this research provide an integrated and comprehensive output, in the sense that the use of this method, due to its systematic and comprehensive nature, can provide dimensions of the subject that individual researches, due to the adopted approach and bias towards a certain issue will naturally be overlooked. The presented framework and model can be used to evaluate the state of intellectual capital or describe it in an organization. Of course, there is a need for future research activities that deal with the operationalization of the presented model. Also, some indicators can be accompanied by changes regarding public and private organizations. In the end, it should be noted that intellectual capital and its dimensions can also include other concepts and indicators that need to be investigated in more extensive research. In this connection, Sullivan (1998) believes that the discussion of intellectual capital and its management can be a disappointing experience and the reason for this opinion is the semantic dynamics of the concept of intellectual capital, its metaphorical interpretation and a wide range of meanings related to this concept in the fields he knows different organizations (Brishan and O. Rozna, 2013: 133). Research present can help managers of organizations in the field of measuring intellectual capital and identifying its strengths and weaknesses as well as for planning and improving it. In the continuation of this research, it is suggested to conduct research on the following topics:

- Examining and determining the introduced indicators of the mentioned model in the public and private sectors Iranian organizations according to experts in the field;
- Ranking of the introduced indicators of intellectual capital in three dimensions using techniques Different;
- Designing a questionnaire to evaluate intellectual capital using extracted codes as examples and indicators;
- Compilation and design of intellectual capital maturity assessment model based on the dimensions presented in this research.
- Introduction of intellectual capital improvement strategies in different dimensions of the model.
- Examining the impact of each dimension of intellectual capital on the intellectual capital of the entire organization

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