Original Research

Interpretive Structural Modeling (ISM) of Intellectual Capital Components

Mohammad Saleh Owlia*. Kosar Roshani · Mohammad Hossein Abooei

Received: 11 October 2020 / Accepted: 28 December 2020 / Published online: 29 December 2020

* Corresponding Author, owliams@yazd.ac.ir
Department of Industrial Engineering, Yazd University, Yazd, Iran

Abstract
In recent years, many organizations have made attempts to identify, measure, and manage their intellectual capital (IC). The efficiency of IC largely depends on identifying its main components and their relationships. So far, however, no study has been conducted to clarify the interactions among those components or to develop a model for laying out a hierarchy of IC components. There is, indeed, an urgent need to analyze the behavior of IC components so that the corresponding policies may be successfully implemented. This paper aims to identify the relationships among the IC components with a focus on the banking industry. A literature review was used to identify the 16 most important IC components. The Interpretive Structural Modeling technique was practiced to determine the interrelationships among these components, based on the data gathered from the Export Development Bank of Iran. The interconnections between the components were clarified. Furthermore, MICMAC analysis and classifying them into four categories including autonomous, driver, dependent, and linkage components regarding their driving and dependence power is a new effort in the field of IC. A hierarchical structure was proposed through prioritizing, sequencing, and leveling of the components. The adoption of such an ISM-based model of IC components in the banking industry would provide insights for managers, decision makers and policy makers for a better understanding of these components and to focus on the major components while managing their IC in their organizations.

Keywords: Intellectual capital; Banking industry; Interpretive Structural Modeling; MICMAC analysis

1. INTRODUCTION

Nowadays, in perfectly competitive markets, intellectual capital (IC) is taken into account as a key issue to gain and maintain a competitive advantage [1]. In this regard, IC refers to knowledge, work experience, organizational technology, customer relationships, and professional abilities that establish a competitive advantage in markets [2]. From the perspective of Ordonez De Pablos [3], intellectual capital can correspondingly get involved in value creation for organizations through improving the foundations for growth, flexibility, and innovation.

Therefore, organizations are expected to understand their own intellectual capitals and make out their roles in the domain of organizational success. Such organizations can benefit from them to make the most important decisions, adopt oppropriate policies, and allocate their resources so as to achieve a sustainable competitive advantage [2].

In the wake of the challenges brought about by globalization, internationalization, and liberalization, banking industry has undergone scores of changes [4]. As it is noted, since banks need to improve their profitability, there is currently an emphasis on resource efficiency, capital performance, and earnings growth. Also, information and communication technology is being used in many ways to reduce costs, increase efficiency, and accelerate innovations [4]. According to Kubo and Saka [5], banking industry can be regarded as an ideal area for research on intellectual capital because reliable published data are available, the nature of business in banking industry is highly intellectual,

and the personnel in this industry are more homogeneous in terms of intellectual abilities than those in other industries.

Furthermore, intellectual capital is known as a broad concept with various dimensions and components. Most studies in this respect have confirmed the impact of the main dimensions of intellectual capital on organizational financial performance. Nonetheless, a more detailed understanding of intellectual capital components is needed to effectively manage this valuable asset and use its advantages, especially in knowledge-based organizations such as banks. In other words, each of the three main dimensions of human capital, structural capital, and relational capital is composed of components whose accurate identification and proper management can be of help for an organization to accomplish its goals.

The present article aims to identify the relationships among intellectual capital components through interpretive structural modeling (ISM) and by classifying those components according to their driving and dependence power. The ISM, a technique introduced and developed by Warfield in 1974, is considered as an interactive methodology used to identify the relationships among certain components of a system, particularly economic and social ones. The technique utilizes mathematics, computer, and professionals' involvement in the design of large and complex systems.

Section 2 of this article provides a brief overview of the definitions, tenets and domains of intellectual capital as reported in the literature. In Section 3, the relevant literature is explored to identify intellectual components. Section 4 presents the details of ISM applications to model intellectual capital components in banks. The classification of IC components in banks and the development of a structural diagram for them make up Sections 5 and 6 respectively. Section 7 is dedicated to the discussion of the results. Finally, a summary of the research, the achievements and implications of the study, the research limitations, and recommendations for future research are offered in Section 8.

2. Literature Review

Knowledge-related assets as the primary drivers for a sustainable competitive advantage are often acknowledged as intellectual capitals [2]. These types of capitals consist of assets created through intellectual activities [6] and have an impact on value creation and organizational performance [7-9]. According to Edvinsson and Malone [10], knowledge, experience, technology, customer relationships, and supplier relationships are examples of intellectual capitals in an organization. Itami and Roehl [11] considered intellectual capitals as forms of intangible assets in a company including items such as intellectual rights, firm experience, firm reputation, customer relationships, and organizational culture. These items would be valuable in terms of organizational competitive power. Furthermore, Stewart and Ruckdeschel [12] pointed to intellectual items such as knowledge, information, intellectual assets, and experience that would be of use for value creation.

Most researchers believe that there are three levels of intellectual capitals including individual level (human capital), organizational level (structural capital), and group level (relational capital) [13].

Human capital is considered as the main component of intellectual capital [4] representing the storage of individual knowledge among the personnel in an organization [13, 14]. This capital is not owned by the organization; it can be excluded as individuals withdraw. It is also mainly tacit and is rooted in the talent of the personnel [2]. Its value depends on its potentials for participation in achieving competitive advantages for an organization [15].

The structural capital refers to knowledge at the level of organization. It can be created through institutionalizing individual and collective knowledge available in a company and via learning processes [13]. The input of such processes comes from human resources, indicating the interaction of two types of intellectual capital [13]. Based on the consensus among the majority of scholars, structural capital can be defined as "the knowledge that remains in the company when employees go home"[2, 3, 13]. This kind of capital forms a part of the assets of an organization [16] and can be created as an intellectual content owned by that organization. Therefore, such a capital belonging to the organization can be shared and reported [2].

The relational capital is the available tacit knowledge possessed by an organization to have relations with its environment [13]. Some researchers have labeled such a capital as customer capital, but most scholars have pointed to the value of organizational relations with all individuals and organizations [2] including shareholders, customers, suppliers, partners, and others involved. In simple words, relational capital is what occurs between internal and external stakeholders [17], and this relation is a necessary condition for construction, maintenance, and renovation of resources, structures, and processes over time. It has been noted that external relations can help companies gain access to important and complementary resources [4].

Intellectual capitals in banks have been evaluated and measured in several studies designed with different methods and goals. Content analysis of the annual activity reports of banks using data mining is considered as one of these methods. Researchers typically make use of a given tool to check the position of intellectual capital and its importance for banks and to review intellectual capital disclosure measures [18-20]. Additionally, in some investigations, Multiple Regression Analysis has been used to examine the determinants of intellectual capital performance [21] and to determine intellectual capital efficiency in banks [22].

Value Added Intellectual Coefficient (VAIC) method based on the data in annual reports has been used in several studies to determine intellectual capital efficiency. For example, Pulic [23] evaluated and analyzed the efficiency of intellectual capitals in European companies by VAIC. This method has been also used by a group of researchers such as

Bakar and Yusop[24], Goh[25], Al-Musali and Ismail[26], and Joshi[27]. Mamath [28] and Mavridis[29] focus on the value-based performance of intellectual capital and its measurement via VAIC method in banks. Furthermore, researchers have employed this method in order to investigate the relationship between intellectual capital and the financial performance of banks [26, 30-32].

VAIC is an acceptable tool for measuring intellectual capital, but it is applied to the macro-level of organizations and from a financial perspective. In spite of many advantages cited for this method, there are certain aspects in intellectual capital components that cannot be explored by this method. Hence, some researchers such as Cabrita and Vaz [4] and Aminbeidokhti and Darvishkhadem [33] have examined intellectual capital components and their impacts on organizational performance via questionnaires. Moreover, Mention and Bontis[34] have made use of the Structural Equation Modeling (SEM) to investigate the impact of intellectual capital and its components on business performance.

In order to properly manage intellectual capital in an organization, it is necessary to know its components accurately. This entails the identification of its components as well as their interrelationships. As a matter of fact, the findings of a great bulk of research in this field can be of benefit for policy making at a macro level to enhance the performance efficiency of this valuable capital.

3. Identification Of Intellectual Capital Components

Through a review of the literature and from expert opinions, we identified various intellectual components in the banking industry. Since the literature is not sufficiently rich in IC components in the banking industry context, we had to refer to the literature on other organizations and industries as well. Thus, 66 models in the field of human capital, 56 models in the area of relational capital and 55 models in the structural capital dimension were investigated.

In this way, value drivers were extracted and identified and then refined in several steps. To do the refinement, duplicated value drivers were removed, conceptually equivalent value drivers were merged, indicators used to measure intellectual capital were deleted, and the final list was prepared. In the next step, using the expert opinions, the knowledge of intellectual capital components was synthesized in order to classify the components and gain a better understanding of the dimensions of intellectual capital [35]. Totally, 16 intellectual components were identified in three main dimensions in banks. The human capital consists of five main components including employee knowledge, employee skill, employee attributes, employee intellectual agility and employee attitude. Five main components constitute the structural capital, including management policies, corporate culture, processes and systems, technology infrastructure, and intellectual property. Finally, the relational capital is structured with six major components including customers, suppliers, stakeholders, environmental and community issues, diffusion and networking, alliances, licensing and agreements. The definitions of these components are as follows:

1- **Employee knowledge**: In an organizational context, it is the combination of what is known to exist in the intelligence and in the competence of people. It is composed of education, work-related knowledge, training, learning, and management knowledge.
2- **Employee skill:** It is an ability acquired through deliberate, systematic, and sustained efforts to smoothly and adaptively carry out complex activities or job functions involving IT skills, professional skills, general skills, relational skills, and management skills.
3- **Employee attributes:** They are the characteristics that lead to certain behaviors and can be strong predictors of how someone will respond in a given situation. It is established by the third-order constructs of personality trait, managerial attributes, intelligence, and employee health.
4- **Intellectual agility:** One of the most complicated components in human capital is intellectual agility which indicates the ability to transfer knowledge from one context to another, the ability to see common factors in two distinct pieces of information and link them together, and the ability to improve both knowledge and company output through innovation and adaptation. It refers to innovation, imitation, and adaptation
5- **Employee attitude:** It refers to the motivation of employees to work and their satisfaction with the work. It is regarded as a prerequisite for employees to give full play to their competence and move to action. Skill and knowledge coupled with a positive attitude, which is translated into a positive behavior, create value for the organization. Employee attitude comprises such third-order constructs as values, motivation of the employee, employee attitudes, cultural relevance, satisfaction of the employee, employee behavior, loyalty, and commitment.
6- **Management policies:** They are a set of guiding principles used to set a direction in an organization. They can be a course of action to guide and influence decisions. They should be used as a guide to decision making under a given set of circumstances within the framework of objectives, goals and management philosophies as determined by senior managers. They are composed of social policies, financial policies, legal policies, human management policies, environmental policies, R&D policies, and organizational structure.
7- **Technology infrastructure:** It is defined broadly as a set of components that make the foundation of an information technology service. It comprises typical physical components, including computer and

networking hardware and facilities as well as various software and network components. This covers the whole information technology, but not the associated people, processes, and documentation. A favorable information system enables a company to quicken the flow of the inner information, heighten the operational efficiency, and hasten to learn within the company. This component encompasses computer network systems, information systems, computer software, and computer hardware.

8- **Processes and systems:** System, procedures, and processes are practiced or used by companies to configure the organizational operations dedicated to internal or external clients. They show the organizational efficiency and should be designed as a series of steps to follow.

Practicing them serves as a consistent and repetitive approach to accomplish an end result. This component is established by several third-order constructs including production process and systems, management process and systems, knowledge process and systems, and R&D process and systems.

9- **Corporate culture:** One of the most complicated components in structural capital is corporate culture which serves as the pattern or arrangement of behaviors adopted by a corporation, group or team as the accepted way of solving problems or establishing visions and values to improve the efficiency and effectiveness of collaboration, creativity, communication, trust and sharing throughout an enterprise for economic gain.

10- **Intellectual property:** Intellectual property is the volume of knowledge legally protected or naturally available in the organization. It is related to the internal development of innovations. The main constructs that form this component are patents, registered trademarks, licenses and internet domains.

11- **Customer:** This kind of capital is the knowledge embedded in the marketing channels and customer relationships that an organization develops through the course of conducting business. It leads to the economic value that results from the association (loyalty, satisfaction, longevity) that an enterprise has built with consumers of its goods and services. This component is comprised of 10 main constructsincluding handling customers, relationships with customer, customer loyalty, customer satisfaction, customer database, customer base, market orientation, marketing, reputation, and brand image.

12- **Suppliers:** A supplier is an entity that supplies goods and services to another organization. This entity is part of the supply chain of a business, and economic value results from the association (financial, strategic, authority, power) an enterprise has established with its suppliers in pursuit of advantageous outcomes.

To reach this goal, supplier's capabilities to meet the needs of the organization are critical. Along with supplier capabilities, the existence of a database of suppliers in the organization and relationships with suppliers are the most frequent third-order constructs of this component.

13- **Stakeholders:** A stakeholder is a party that has an interest in a company and can either affect or be affected by the organization actions, objectives and policies. The primary stakeholders in a typical corporation are its investors, employees, customers, suppliers, consultant and professional associations, allies, board members, citizens, government agencies, and unions. Therefore, the community has responsibilities toward it and is interested in its success. Not all stakeholders are equal.

Some have a much greater influence on the success of the business than others, or are more influenced by the decisions and policies of the organization than others, like employees, customers and suppliers. Hence, to focus more on these stakeholders, these three groups are not included in this component.

Human capital has many components defined in items 1 to 5. Customers and suppliers were also discussed in components 11 and 12.

14- **Alliances, licensing and agreements:** These are a kind of business partnering between two or more players to share assets, resources, knowledge, expertise or any core competence of benefit for all the parties involved. This kind of partnering helps the parties by covering the weaknesses and enhancing their businesses while remaining as independent organizations. It is established by a few third-order constructs including alliances, licensing, contracts, and agreements.

15- **Environmental and community issues:** It is the institution’s commitment to social and environmental improvement. It is an intangible asset which protects the environment and takes care of the society. Being socially responsible results in an improved image. Firms give information about the impact of their work on the environment and on the society at large.

16- **Diffusion and networking:** They refer to the act or process of interacting with other businesses, intermediaries, wholesalers, retailers, distributors, and even the Internet to deliver goods and services to the intended consumers and to cash payments from the end consumer. Meanwhile, information is exchanged among individuals, groups, or institutions to develop mutually beneficial relationships. This component is composed of networking capability, distribution channel, and on-line distribution.

A brief summary of various intellectual capital components as reported in the literature is presented in Table I.

TABLE I.
LIST OF RESEARCH WORKS ON IC COMPONENTS AS REPORTED IN THE LITERATURE

Human Capital	
1- Employee knowledge	[20], [36], [37], [39], [40], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52]
2- Employee skill	[9], [38], [53], [39], [40], [42], [43], [54], [49], [20], [55], [51], [52]
3- Employee attributes	[36], [9], [37], [41], [42], [38], [44], [43], [46], [45], [48], [20], [55], [50], [52]
4- Intellectual agility	[53], [48], [43], [55], [44], [45], [42], [36]
5- Employee attitude	[37], [38], [39], [40], [53], [42], [43], [45], [46], [47], [48], [49], [56], [20], [57], [55], [50], [51], [52]
Structural capital	
6- Management policies	[39], [58], [59], [43], [60], [45], [61], [50], [51]
7- Corporate culture	[36], [62], [39], [63], [59], [43], [58], [60], [47], [56], [20], [64], [55], [50], [18], [52], [65]
8- Processes and systems	[36], [62], [63], [39], [59], [58], [47], [61], [56], [64], [50], [55], [51], [52], [18], [65]
9- Technology infrastructure	[36], [62], [39], [59], [58], [61], [56], [64], [20], [55], [50], [52], [18], [65]
10- Intellectual property	[36], [62], [58],, [47], [56], [57], [55], [65]
Relational capital	
11- Customers	[36], [37], [63], [38], [39], [40], [44], [58], [49], [47], [61], [56], [20], [64], [55], [50], [66], [51], [52], [67], [68], [65]
12- Suppliers	[38], [49], [56], [50], [55], [68], [67], [65]
13-Stakeholders	[69], [58], [49], [61], [56], [64], [55], [50], [51], [68], [67], [65]
14- Alliances, licensing and agreements	[36], [69], [63], [44],, [49], [56], [64], [20], [55], [67], [68],
15-Environmental and community issues	[69], [38], [49], [50], [68], [67]
16- Diffusion and networking	[36], [37], [63], , [44], [49], [56], [64], [20], [55], [51], [67], [68]

4. ISM METHODOLOGY AND MODEL DEVELOPMENT

ISM is known as a process for the transition of vague intellectual models into structured systems, which can help people better understand their beliefs and take in what they do not know [70]. The ISM method can also enable individuals and groups to identify and map the direct or indirect relations among large numbers of items in a complex decision-making position. In this case, it actually serves as a means of disciplining and directing the complexity of relations among variables. In addition to ordering and directing the relations among the items of a system, the method helps to analyze and evaluate the impact of an item on other items. Thereby, the relational complexity among the items is coped with, and the variables are ultimately classified on the basis of their driving-dependence power. The various steps involved in the ISM method are shown in Figure 1.

ISM has been employed in several contexts. Khan and Rahman [71] used ISM in brand experience anatomy in retailing and modeled its variables by this method. Kanungo and Bhatnagar [72] applied this methodology to present a framework for assessing and synthesizing information system (IS) quality. Thakkar *et al*. [73] developed a balanced scorecard (BSC) through ISM and showed its appropriateness for development of performance measurement systems. In the research by Chang *et al*. [74], ISM is utilised to identify the interactive causal relationships of critical agility factors when launching a new product into mass production. Singh *et al*. [75] developed interrelationships among knowledge management variables using this methodology. The main aim of this study is to find the individual interactions of the components of intellectual capital in the banking industry. ISM can be appropriately employed as a tool under such an individual interaction state of affairs because the basis of the relationship between the components and the overall structure can be extracted from the system under consideration. Therefore, it can map the model of the intellectual capital in a bank. The various steps involved in the ISM methodology are as follows:

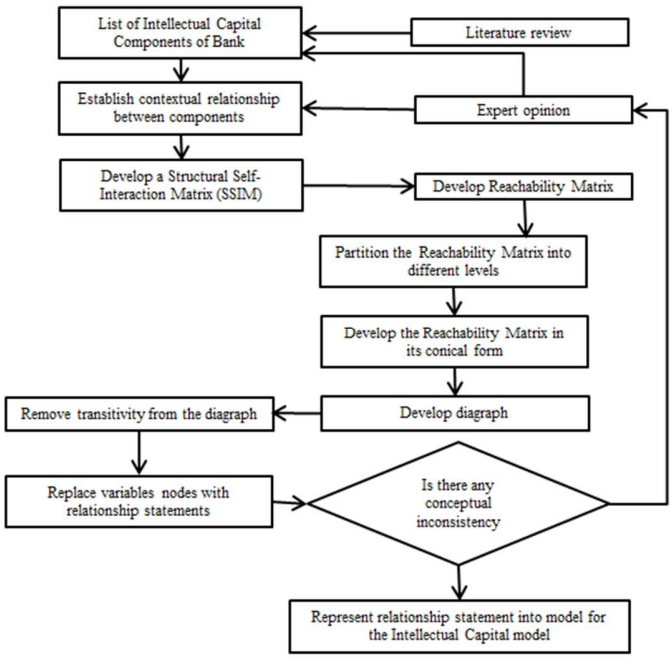

FIGURE 1
FLOW DIAGRAM FOR PREPARING ISM [76]

Step 1: Variables of the system under consideration are listed, which can be its components.
Step 2: From the variables identified in step 1, a contextual relationship is established among variables with respect to which pairs of variables would be examined.
Step 3: A Structural Self-Interaction Matrix (SSIM) is developed for variables, which indicates pairwise relationships among the variables of the system under consideration.
Step 4: A reachability matrix is developed from the SSIM, and the matrix is checked for transitivity. The transitivity of the contextual relation is a basic assumption made in ISM. It states that, if variable A is related to B and B is related to C, then A is necessarily related to C.
Step 5: The reachability matrix obtained in Step 4 is partitioned into different levels.
Step 6: Based on the relationships given above in the reachability matrix, a directed graph is drawn and the transitive links are removed.
Step 7: The resultant digraph is converted into an ISM, by replacing variable nodes with statements.
Step 8: The ISM model developed in Step 7 is reviewed to check against conceptual inconsistencies, and necessary modifications are made.

4.1. Structural Self-Interaction Matrix (SSIM)

A team of experts consisting of 13 senior managers of the Export Development Bank of Iran, all having master's and postgraduate degrees and also familiar with the concept of intellectual capital, was consulted to identify the nature of contextual relationships among the IC components identified in Section 3. These experts had several years of work experience in banking and related areas of management, human resources and performance. ISM methodology suggests the use of expert opinions alone (based on management techniques such as brainstorming and nominal group technique) to develop contextual relationships.

To analyze the components and develop an SSIM, paired comparisons were performed and the following four symbols were used to denote the direction of the relationships among the components (i and j):

V: attribute i will help to enhance attribute j;
A: attribute i will help be enhanced by attribute j;
X: attribute i and j will help to enhance each other;
O: attribute i and j are unrelated.

Given the dimensions of the problem, 120 comparisons were made in this way and the SSIM was developed based on the contextual relationships (Table II).

The following would explain the use of symbols V, A, X, and O in the SSIM (Table II):

(i) Component 1 helps increase component 8. This means that, as efforts are made to raise employee. knowledge, the effectiveness of processes and systems improves. Thus, the relationship between components 1 and 8 is denoted by "V" in the SSIM (Table II).

(ii) Component 2 can be enhanced by component 9, i.e. progress of component 9, namely technology infrastructure, improves the employee skill (component 2). Thus, the relationship between these components is denoted by "A" in the SSIM (Table II).

(iii) Components 1 and 6 help achieve each other. Component 1, namely employee knowledge, and component 6, namely management policies, help achieve each other. Thus, the relationship between these components is denoted by "X" in the SSIM (Table II).

TABLE II.
STRUCTURAL SELF-INTERACTION MATRIX (SSIM)

C. No	Components	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1	Employee knowledge	V	O	O	O	O	X	O	O	V	V	X	V	X	X	V
2	Employee skill	V	V	O	V	O	V	O	A	V	A	A	V	X	X	
3	Employee attributes	V	O	V	O	O	V	O	O	O	V	V	V	X		
4	Employee intellectual agility	V	V	O	V	O	V	O	O	V	V	V	V			
5	Employee attitude	V	V	X	X	O	X	V	O	O	X	X				
6	Management policies	V	V	X	X	X	X	V	X	X	X					
7	Corporate culture	V	V	V	V	V	V	V	O	X						
8	Processes and systems	V	V	V	V	V	V	O	X							
9	Technology infrastructure	O	V	O	O	V	V	O								
10	Intellectual property	V	O	V	V	O	O									
11	Customers	O	X	X	O	A										
12	Suppliers	O	O	O	X											
13	Stakeholders	A	O	O												
14	Environmental and community issues	V	V													
15	Diffusion and networking	V														
16	Alliances, licensing and agreements															

(iv) No relationship exists between intellectual property (component 10) and suppliers (component 12) and, hence, the relationship between these components is denoted by "O" in the SSIM (Table II).

4.2. Reachability matrix

In the second step of ISM, the SSIM was converted into a binary matrix, called the initial reachability matrix, which is a square matrix whose entries can be considered 1 once the item i with length 1 can have access to elements j; otherwise, the entries are 0.

The substitution of 1s and 0s were as per the following rules:

- If the (i, j) entry in the SSIM is V, the (i, j) entry in the reachability matrix becomes 1, and the (j,i) entry becomes 0.
- If the (i, j) entry in the SSIM is A, the (i, j) entry in the reachability matrix becomes 0, and the (j,i) entry becomes 1.
- If the (i, j) entry in the SSIM is X, the (i, j) entry in the reachability matrix becomes 1, and the (j,i) entry also becomes 1.
- If the (i, j) entry in the SSIM is O, the (i, j) entry in the reachability matrix becomes 0, and the (j,i) entry also becomes 0.
- If i = j, the (i, j) entry in the reachability matrix becomes 1.

Based on the rules above, the initial reachability matrix for the components emerged as shown in Table III. After the initial reachability matrix was obtained, the final reachability matrix could be acquired by inserting transitivity into the variable relations. This is a square matrix whose entries are considered 1 otherwise 0, wherein the item *i* with any length has access to the element *j*.

The common approach to achieve this matrix is to allow raising the initial reachability matrix repeatedly as long as none of its entries changes. Equation (1) illustrates this method.

$$(B+I)^{n-1} < (B+I)^n = (B+I)^{n+1} = M \quad (1)$$

Warfield [77] emphasized that the development of the initial reachability matrix and its conversion into the final one would be likely to encounter a serious threat, i.e. inconsistency to completing the SSIM.

TABLE III.
INITIAL REACHABILITY MATRIX

C. No	Components	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Employee knowledge	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	1
2	Employee skill	0	1	1	1	1	0	0	1	0	0	1	0	1	0	1	1
3	Employee attributes	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	1
4	Employee intellectual agility	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	1
5	Employee attitude	0	0	0	0	1	1	1	0	0	1	1	0	1	1	1	1
6	Management policies	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1
7	Corporate culture	0	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1
8	Processes and systems	0	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1
9	Technology infrastructure	0	1	0	0	0	1	0	1	1	0	1	1	0	0	1	0
10	Intellectual property	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1
11	Customers	1	0	0	0	1	1	0	0	0	0	1	0	0	1	1	0
12	Suppliers	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0
13	Stakeholders	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0
14	Environmental and community issues	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1
15	Diffusion and networking	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
16	Alliances, licensing and agreements	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

According to him, if there is such inconsistency, a universal matrix all of whose entries are assumed 1 will be created when converting the initial reachability matrix into the final one. It, thus, does not allow the ranking and the complementary analysis of the ISMs. In order to avoid this inconsistency, only relations of length 1 should be used to complete the SSIM even though recognizing relations only with length 1 can be difficult for experts. Therefore, as Warfield [77] suggested, the final reachability matrix needs to be created from the very beginning (i.e. after obtaining the SSIM). Since many entries in reachability matrices can be derived on the basis of inferences, this method is assumed shorter and more reliable. In this method, two groups of sub-matrices are completed to achieve a reachability matrix. In this respect, the sub-system matrix is developed based on the method described by Warfield (ibid), and the intersection matrices are then calculated according to the method explained in [78]. What results from this method is a fully consistent reachability matrix which can be further analyzed.

The final reachability matrix in the present study was obtained by using the method described above. In other words, the SSIM data were first converted into 0 and 1. Then, sub-system matrices were developed based on the resulting matrix. After that, intersection matrices were created on the basis of this matrix. Finally, a reachability matrix was obtained from the aggregation of these two matrices according to Table IV.

By this matrix, interrelationships of the components are known, and are drown in the figure 2. As can be seen This diagram is complex and difficult to infer. The remaining steps of the ISM method, help to obtain a hierarchical and transparent model of the IC components.

4.3. Level partitioning

After the final reachability matrix is obtained, it should be divided into different levels. The partitioning of the system into different levels can help to clarify the role of individual components as well as their mutual interactions and facilitate their analysis process. In other words, using the level partitioning method and divisions into systems and sub-systems can reduce the existing complexity of large systems and improve their analysis. At this stage, reachability and antecedent sets are obtained for each variable through the final reachability matrix. A reachability set consists of the components of the system derived from the relevant variable. To do the derivation, the row of this variable must be checked. Number 1 in this row indicates the driving power of the variable, and its location can show the antecedent variables and the directional lines exiting from it. The antecedent set of a variable comprises the system components that can lead to that variable. For this to occur, the column of the variable must be examined. Number 1 in this column shows the dependence power of the variable, its location, its antecedent variables, and the directional lines entering into it.

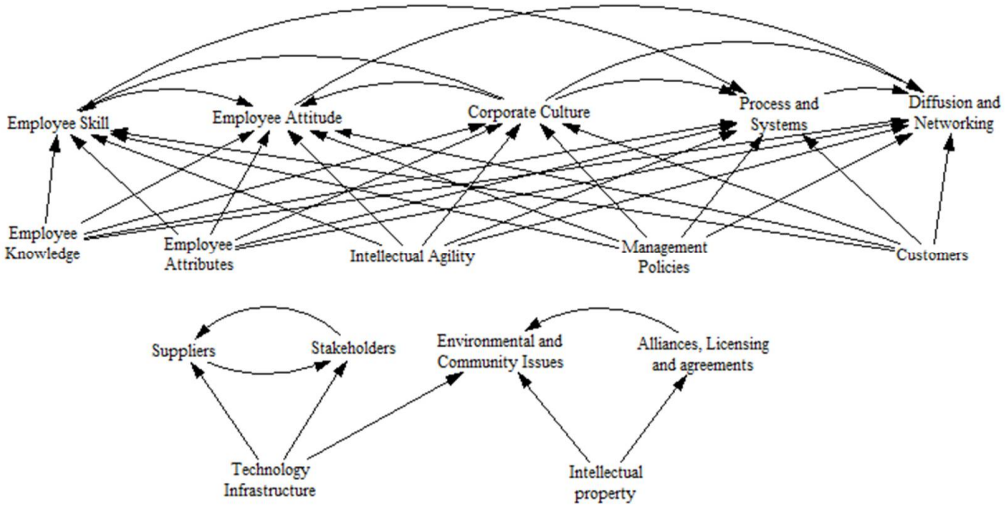

FIGURE 2.
INTERRELATIONSHIPS OF IC COMPONENTS

For example, the reachability set for component 7, namely corporate culture, consists of the component itself and the other variables which it may help to achieve. As Table IV shows, components 2, 5, 8 and 16 make its reachability set. Moreover, its antecedent set consists of the component itself and the other components which it may help to achieve. As the column related to component 7 in Table IV shows, components 2, 5, 8 and 16 consist of the antecedent set of component 7. After determining the reachability and antecedent sets, the intersection sets can be determined for each variable. For example, for component 7, the intersection set is limited to the component itself. Accordingly, the variables whose reachability and intersection sets are the same can be placed at the highest levels of the ISM hierarchy.

TABLE IV.
FINAL REACHABILITY MATRIX

C. No	Components	16	8	5	2	7	11	6	3	4	1	13	12	15	14	10	9	Driving power
16	Alliances, licensing and agreements	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8	Processes and systems	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
5	Employee attitude	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	Employee skill	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
7	Corporate culture	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	5
11	Customers	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
6	Management policies	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
3	Employee attributes	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
4	Employee intellectual agility	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
1	Employee knowledge	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
13	Stakeholders	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
12	Suppliers	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
15	Diffusion and networking	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
14	Environmental and community issues	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
10	Intellectual property	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
9	Technology infrastructure	1	1	1	1	0	0	0	0	0	0	1	1	1	0	0	1	8
Dependence power		11	9	9	8	6	5	5	5	5	5	3	3	4	2	1	1	

TABLE V.
LEVELS OF IC COMPONENTS

Component	Reachability sets	Antecedent sets	Intersection	Level
Employee knowledge (1)	1,2,3,4,5,6,7,8,11,16	1,3,4,6,11	1,3,4,6,11	V
Employee skill (2)	2,5,8,16	1,2,3,4,6,7,9,11	2	III
Employee attributes (3)	1,2,3,4,5,6,7,8,11,16	1,3,4,6,11	1,3,4,6,11	V
Employee intellectual agility (4)	1,2,3,4,5,6,7,8,11,16	1,3,4,6,11	1,3,4,6,11	V
Employee attitude (5)	5, 6	1,2,3,4,5,6,7,9,11	5	II
Management policies (6)	1,2,3,4,5,6,7,8,11,16	1,3,4,6,11	1,3,4,6,11	V
Corporate culture (7)	2,5,7,8,16	1,3,4,6,7,11	7	IV
Processes and systems (8)	8,16	1,2,3,4,6,7,8,9,11	8	II
Technology infrastructure (9)	2,5,8,9,12,13,15,16	9	9	IV
Intellectual property (10)	10,14,15	10	10	III
Customers (11)	1,2,3,4,5,6,7,8,11,16	1,3,4,6,11	1,3,4,6,11	V
Suppliers (12)	12,13	9,12,13	12,13	I
Stakeholders (13)	12,13	9,12,14	12,13	I
Environmental and... (14)	14,15	10,14	14	II
Diffusion and networking (15)	15	9,10,14,15	15	I
Alliances, licensing and… (16)	16	1,2,3,4,5,6,7,8,9,11,16	16	I

To find the next levels of the system components, the highest level components can be separated out from the other components in the related table, and the operation associated with determining the components of the next level can be performed in the same way as to specify the components of the highest level. This operation is continued until the system components at all the levels are determined. After this stage, a basic model can be mapped considering the variables' levels and the final reachability matrix. The final model can be achieved by eliminating transitivity from the initial model.

In this study, these procedures were performed on the final reachability matrix. As shown in Table V, components 12, 13, 15, and 16 have the same set of reachability and intersection sets and are placed at the first level of the ISM. Thus, they were positioned at the top of the ISM model. After these components were removed, the stages continued until the level partitioning of all the components was done, as illustrated in Table V.

5. CLASSIFICATION OF INTELLECTUAL CAPITAL COMPONENTS: MICMAC ANALYSIS

After a reachability matrix is obtained, driving-dependence power can be calculated for each component. In the corresponding table, the total quantity in a row is the driving power of a component, and the sum of the values in a column equals the dependence power of a component. To analyze driving-dependence power in the ISM (MICMAC diagram), the variables are classified into four groups as follows:

I) Autonomous variables, which have a weak driver power and weak dependence. These components are relatively disconnected from the system; there are only a few links that may be strong.

(II) Dependent variables that have a weak driver power, but strong dependence.

(III) Linkage variables that have a strong driving power and strong dependence. These components are unstable in that any action on these components will have an effect on the others and on their own feedbacks.

(IV) Independent variables which have a strong driving power but weak dependence.

As it can be seen in Table IV, component 10 has a driver power of 3 and a dependence power of 1. Therefore, in Figure 2, it is positioned in a place corresponding to the driver power of 3 and the dependency of 1.

In this way, all the intellectual capital components of the bank were classified into four groups of autonomous, dependent, linkage, and independent variables with reference to their driving-dependence power. The driving-dependence power values of the intellectual capital components of the bank are presented in Figure 2. As it can be seen, the variables of intellectual property, suppliers, stakeholders, environmental and community issues, as well as diffusion and networking have been placed in the autonomous area, representing weak driving-dependence power. In other words, the six intellectual capital components of the bank were somewhat isolated from the other components, and they had poor relations. The other variables such as employee attitudes and perceptions,

processes, systems, as well as alliances, licensing and agreements also had a low driving power while they were highly dependent on the other variables. The independent area only included the variable of technology infrastructure with a high driving power but very low dependence on the other components. In other words, the impact of this component on the other ones was very high in terms of achieving returns on equity and earnings. In the end, the components in the linkage area were found to be endowed with a high driving-dependence power. These components were unstable, and they could easily affect the other intellectual capital components. They also had a feedback effect on themselves. As shown in the diagram of the intellectual capital components, the variables of employee knowledge, employee skills, employee attributes, employee intellectual agility, management policies, customers, and corporate culture are placed in this area.

6. Formation Of The ISM Diagram And Model

Based on the level partitioning at the fourth stage of the ISM (Table V) and considering the final reachability matrix relations (Table IV), a structural diagram was drawn for the intellectual capital components of the bank, as shown in Figure 3. The variables appearing at the lower levels of this diagram were those that were also located in the linkage and driving areas according to the MICMAC diagram. The dependent variables and, to some extent, the autonomous variables were at the top of this diagram, showing their low impact on the other components.

As observed in Figure 3, employee knowledge, employee attributes, employee intellectual agility, management policies and customers are very significant components of intellectual capital as they lie at the base of the ISM hierarchy. The four components of the relational capital dimension (i.e. 12, 13, 15 and 16) have appeared at the top of the hierarchy. It shows that this dimension is the most dependent one among the intellectual capital dimensions of the Export Development Bank of Iran. The diagram shows intellectual property, suppliers, stakeholders, environmental and community issues as well as diffusion and networking are somewhat isolated from the other components. This confirms the result of the MICMAC analysis in Figure 2. Employee skill is influenced by technology infrastructure and corporate culture, leading to better employee attitude and process and systems.

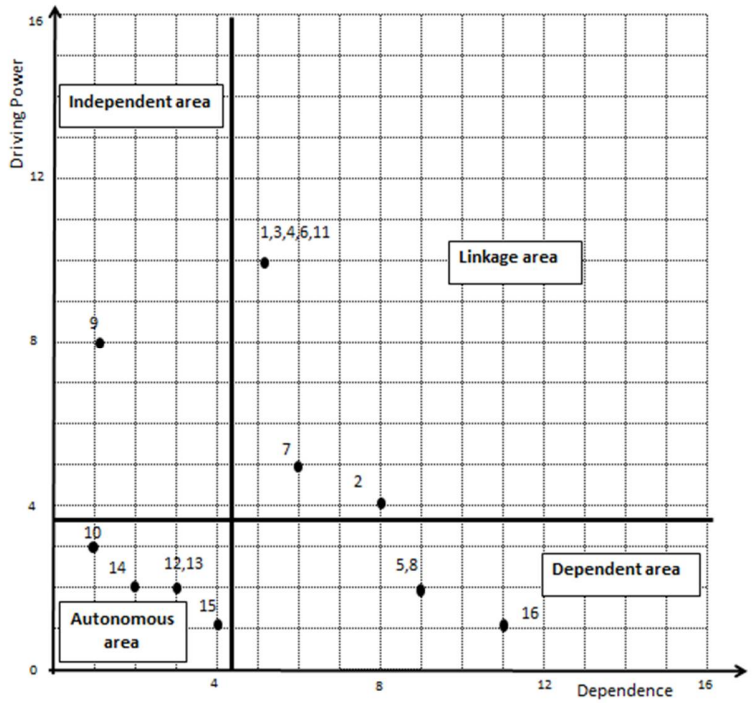

FIGURE 3.
DIAGRAM FOR THE DRIVING AND DEPENDENCE POWER OF THE COMPONENTS

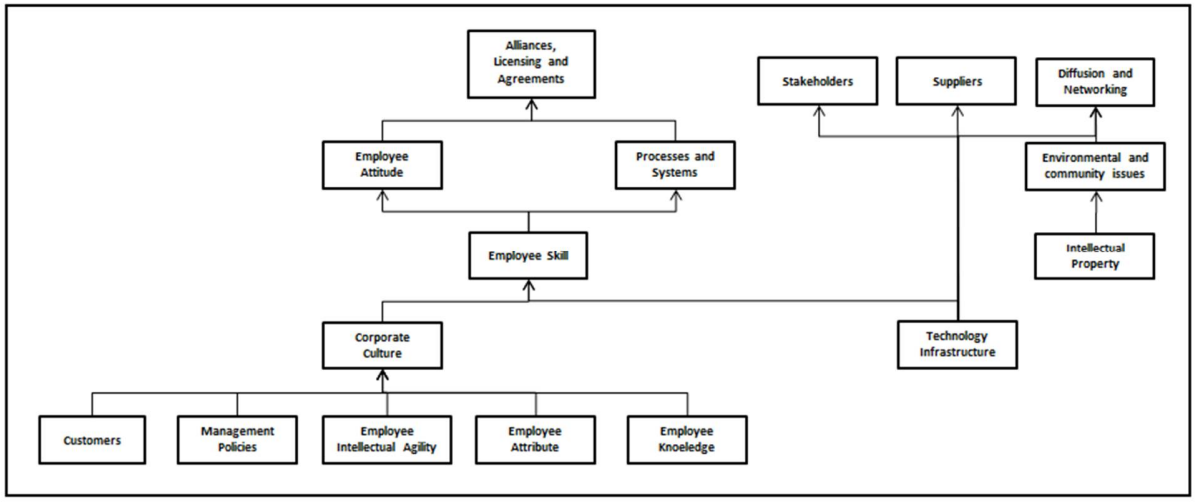

FIGURE 4.
ISM-BASED MODEL OF THE INTELLECTUAL CAPITAL COMPONENTS OF THE BANK

7. RESULTS AND DISCUSSION

The importance of intellectual capital stems from the fact that the modern economy with its specific characteristics, such as e-commerce, globalization, intense competition, the rapid growth of new technologies, and rapid changes in customer demand, postulates special requirements for organizations. In such a situation, companies need to develop perfectly transparent strategies that give them a competitive advantage. Also, organizations have to understand how much capability they need to achieve and maintain competitive advantages [41]. Abilities derive from knowledge; therefore, organizations seeking to improve their ability must manage their knowledge assets and capitals. However, the matter is that not all sources of knowledge are of the same importance or impact [79]. Therefore, identifying the sources of intellectual capitals, the relationships among them, and managing them is one of the most important requirements for achieving a sustainable competitive advantage.

The results of this research help to identify the components of the intellectual capital in the banking industry, the relationships among them, and their influences. Regarding the relationships among intellectual capital components, certain results were obtained. First of all, The position of various components of human capital and their relationship with those of structural capital in the ISM model (Figure 3) showed the impact of human capital on structural capital. This is in agreement with the results reached by Shih et al. [47] who analyzed the correlation between the human capital and structural capital of the banking industry and found that human capital in this industry exerts positive and direct influence on structural capital. Secondly, the ISM model (Figure 3) developed in this study points to the direct impact of process and systems on alliances, licensing and agreements as well as technology infrastructure on suppliers, stakeholders and diffusion and networking and the impact of intellectual property on environmental and community issues . The relationships among the different constructs that make up the structural capital and relational capital can be confirmed with the study done by Martinez-Torres [80]. He developed and validated a procedure to identify and measure the intellectual capital in a knowledge-based organization. His study showed that structural capital is the component of the greatest importance, and the structural capital assets are used in contacts with people outside the organization (i.e. relational capital). Thirdly, it was found that suppliers and stakeholder are influenced by technological infrastructure, as shown in Figure 3. This is similar to the finding of Rindermann *et al.* [81] who proposed a definition for "relationship with suppliers". In their definition, technological support is a variable that influences suppliers and stakeholders. Regarding the position of intellectual capital components in the hierarchical structure, their driving and dependence power, and their category in the MICMAC diagram, certain results were obtained. First, as Figure 3 shows, three components of human capital, namely employee intellectual agility, employee knowledge, and employee attribute, lie at the bottom level while two of its components, namely employee skill and employee attitude, lie at the middle level of the ISM model. This indicates the influential role of human capital in the bank success. In a similar case, Perez and Ordonez de pablos [79] state that employee knowledge, skill, and abilities constitute one of the most significant and renewable resources which a company can take advantages of. Secondly, the present study paid special attention to the specific features and the effective role of suppliers in the success of organizations. However, the results show that they are exactly in the same position as the stakeholders in

Figure 2 and Figure 3. St-Pierre and Audet [61] cite Bontis [8], Grasenick[82], Green and Ryan [83] and Canibano[84] for their definition of relational capital. As they have proposed, "relational capital includes all the resources involved in the relationships between the firm and its stakeholders (customers, investors, suppliers, etc.) and all knowledge embedded in these external relationships" (p. 204). In this definition, suppliers are considered as a group of stakeholders. Therefore, the identical position of suppliers and stakeholders is validated.

The third result is based on what is understood from Figure 2. According to the figure, the component of alliances, licensing and agreements is the most dependent one among 16 IC components. The MICMAC analysis, too, categorized this component as a dependent one. It lies at the top level of the IC model in the bank, which indicates that it is influenced by the other components. In this regard, Mat Husin *et al*. [64] have gained similar results. They state that the initiatives of a company are developed to form an alliance with external parties in a search for resources that they are lacking (e.g. assets, knowledge, expertise or any core competence). In this situation, the alliance will create intellectual asset partners as a competitive advantage. Hence, it depends on the strength and weakness of the other components of the tangible or intangible assets of the organization.

The component of management policies is the subject of the next result. This component lies at the bottom level of the ISM model (Figure 3) and is one of the most driving components in Figure 2. The consequential function of management policies is confirmed by Moon and Kym [58] who underline the importance of management policies in administrating the various components and subcomponents of intellectual capital. They argue that management policies are a set of guiding principles used to set a direction in an organization. With respect to human capital, organizations should enact programs and policies to enhance employee capabilities, employee satisfaction, and retention. For structural capital, managers must build and sustain a strong positive organizational culture, invest in effective and efficient work processes, enact strong information systems and safeguard intellectual properties. Finally, to build and sustain relational capital, organizations must nurture customer relationships, partnerships with other stakeholders of the organization, and ties with the community in which they are embedded (ibid). As described in Section3, management policies are composed of organizational structure and a few types of policies. One of its components is human management policies or human resource policies. They are, indeed, the continuous guidelines on the approach an organization intends to adopt in managing its people. They present specific guidelines to HR managers on various matters concerning employment and state the intent of the organization in different aspects of human resource management such as recruitment, promotion, compensation, training, and selections. Therefore, human capital is greatly influenced by those policies. This is evident from the close relevance of this component to employee knowledge, employee attribute and employee intellectual agility, all of which are in the linkage area of the MICMAC diagram. These variables are both driving and dependent and are affected by their own actions.

Finally, with regard to Figure 2, corporate culture is both driving and dependent. It is affected by many components and affects many components too. These properties make it unstable and difficult to address. The mediating role of culture has been considered in Moon and Kym's [58] study. They suggest that culture is reflected in an organization's market orientation, strategy direction, human resources policies and practices, internal networks, and information sharing. So, an organization must expend extra attention, monitoring, and effort to address this component successfully.

8. Conclusion

In this research, an attempt was made to identify and analyze the major components of intellectual capital in a bank using the ISM model and the MICMAC analysis. Sixteen components of IC were identified, and the interpretive structural modeling (ISM) methodology was used to find the contextual relationships among them. Employee knowledge, employee attributes, employee intellectual agility, management policies, technology infrastructures and customers proved to be at the bottom of the structural model. It means that they are the most powerful components, and upgrading these components can enhance a maximum number of the other components. Except technology infrastructures, the other components were identified as linkage components which are unstable and any action done on them can influence them as well as the other components. The component of alliances, licensing and agreements was found to lie at the top of the structural model and identified as a dependent variable. Employee attitude and processes and systems were also identified as dependent variables. The enhancement of these components depends more on the upgrading of the other components. The other five components, including intellectual property, suppliers, stakeholders, environmental and community issues and diffusion and networking are autonomous.

The structural model suggests how the components of intellectual capital in a bank are interrelated. ISM modeling provides an understanding as how the various components interact with one another. This is an issue of importance because policy makers often focus on just a few components that they thinks are significant without considering the effects of other components. Enacting or adopting a policy may upgrade one or more key components that enhance the bank performance, but, at the same time, it may downgrade the other components rather than upgrade them. The ISM model developed in this paper enables policy makers in banks to understand and take into account the parameters

that are of effect on their tackling with IC problems. It is to be stressed that the findings on the influential components of IC, as discussed in this research, can be reliably used for managing intellectual capital effectively and efficiently as well as making strategic and tactical decisions This is because the model was extracted through a review of a large bulk of literature and on the basis of expert opinions. Of course, with slight modifications, the model may be applied to organizations other than banks as well.

Components with higher driving power are of more strategic orientation, while those categorized as dependent are oriented more toward performance and result. Thus, the best results can be achieved by continually improving the independent components.

In spite of the above-mentioned results, this study had its own limitations. First of all, the research was conducted based on the data collected from the banking industry with a focus on the Export Development Bank of Iran. The implementation of its findings in other industries, therefore, needs resetting of contextual relationships based on the corresponding data.

Secondly, the relationship model for the identified IC components was not statistically validated. Any future research in this case may benefit from Structural Equation Modeling (SEM), which is capable of testing the validity of such hypothetical models..

In general, ISM may claim an ability to describe a causal hierarchical structure for the factors involved in a problem, but it definitely cannot provide quantitative information for management decisions or demonstrate the statistical significance of the components. Accordingly, it is suggested for future studies to combine this method with the analytic network process (ANP) so as to achieve a complete model in terms of dimensions, intellectual capital components, and weight and importance of each component.

References

[1]. Cricelli, L. and M. Grimaldi, 2008,A dynamic view of knowledge and information: a stock and flow based methodology. *International Journal of Management and Decision Making*. 9(6), 686-698.

[2]. Sydler, R., S. Haefliger, and R. Pruksa, 2014,Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal*. 32(2), 244-259.

[3]. Ordonez de Pablos, P., 2002,Evidence of intellectual capital measurement from Asia, Europe and the Middle East. *Journal of intellectual capital*. 3(3), 287-302.

[4]. Cabrita, M.d.R. and J.L. Vaz, 2006,Intellectual Capital and Value Creation: Evidence from the Portuguese Banking Industry. *The Electronic Journal of Knowledge Management*. 4(1), 11-20.

[5]. Kubo, I. and A. Saka, 2002,An inquiry into the motivations of knowledge workers in the Japanese financial industry. *Journal of Knowledge Management*. 6(3), 262-271.

[6]. Wiig, K.M., 1997,Integrating intellectual capital and knowledge management. *Long range planning*. 30(3), 399-405.

[7]. Roos, G. and J. Roos, 1997,Measuring your company's intellectual performance. *Long range planning*. 30(3), 325-426.

[8]. Bontis, N., 1998,Intellectual capital: an exploratory study that develops measures and models. *Management decision*. 36(2), 63-76.

[9]. Bontis, N., W.C.C. Keow, and S. Richardson, 2000,Intellectual capital and business performance in Malaysian industries. *Journal of intellectual capital*. 1(1), 85-100.

[10]. Edvinsson, L. and M.S. Malone, *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*. 1997: New York: Harper Collins buiness.

[11]. Itami, H. and T.W. Roehl, *Mobilizing invisible assets*. 1991: Harvard University Press.

[12]. Stewart, T. and C. Ruckdeschel, *Intellectual capital: The new wealth of organizations*. 1998: Wiley Online Library.

[13]. Ordonez de Pablos, P., 2004,Measuring and reporting structural capital: lessons from European learning firms. *Journal of intellectual capital*. 5(4), 629-647.

[14]. Bontis, N., M.M. Crossan, and J. Hulland, 2002,Managing an organizational learning system by aligning stocks and flows. *Journal of management studies*. 39(4), 437-469.

[15]. Ordonez de Pablos, P. and M.D. Lytras, 2008,Competencies and human resource management: implications for organizational competitive advantage. *Journal of Knowledge Management*. 12(6), 48-55.

[16]. Boisot, M., 2002,*The creation and sharing of knowledge. The strategic management of intellectual capital and organizational knowledge*, 65-77.

[17]. Roos, J., et al., *Intellectual Capital: Navigating in the New Business Landscape, Macmillan*. 1997: Houndsmills, Basingtoke.

[18]. Yildiz, S., C. Meydan, and M. Guner, *Measurement of Intellectual Capital Components through Activity Reports of Companies, in Procedia-Social and Behavioral Sciences*. 2014. p. 614-621.

[19]. Khan, H.-U.-Z. and M. Ali, 2010,An empirical investigation and users' perceptions on intellectual capital reporting in banks: Evidence from Bangladesh. *Journal of Human Resource Costing & Accounting*. 14(1), 48-69.

[20]. Ahmed Haji, A. and S. Mubaraq, 2012,The trends of intellectual capital disclosures: evidence from the Nigerian banking sector. Journal of Human Resource Costing & Accounting. 16(3), 184-209.

[21]. El-Bannany, M., 2012,Global financial crisis and the intellectual capital performance of UAE banks. Journal of Human Resource Costing & Accounting. 16(1), 20-36.

[22]. El-Bannany, M., 2008,A study of determinants of intellectual capital performance in banks: the UK case. Journal of intellectual capital. 9(3), 487-498.

[23]. Pulic, A., 2004,Intellectual capital-does it create or destroy value? Measuring business excellence. 8(1), 62-68.

[24]. Bakar, N.A. and H. Yusop. Intellectual capital efficiency: Study on Malaysian banking sectors. in Proceedings of Asia-Pacific Business Research Conference. 2011.

[25]. Goh, P.C., 2005,Intellectual capital performance of commercial banks in Malaysia. Journal of intellectual capital. 6(3), 385-396.

[26]. Al-Musali, M.A.K. and K.N.I.K. Ismail, 2012,Intellectual capital performance and board characteristics of GCC banks. GSTF Business Review (GBR). 2(1), 219-226.

[27]. Joshi, M., D. Cahill, and J. Sidhu, 2010,Intellectual capital performance in the banking sector: An assessment of Australian owned banks. Journal of Human Resource Costing & Accounting. 14(2), 151-170.

[28]. Kamath, G.B., 2007,The intellectual capital performance of the Indian banking sector. Journal of intellectual capital. 8(1), 96-123.

[29]. Mavridis, D.G., 2004,The intellectual capital performance of the Japanese banking sector. Journal of intellectual capital. 5(1), 92-115.

[30]. Mondal, A. and S.K. Ghosh, 2012,Intellectual capital and financial performance of Indian banks. Journal of intellectual capital. 13(4), 515-530.

[31]. Al-Musali, M.A.K. and K.N.I.K. Ismail, 2014,Intellectual capital and its effect on financial performance of banks: Evidence from Saudi Arabia. Procedia-Social and Behavioral Sciences. 164, 201-207.
[32]. Yalama, A. and M. Coskun, 2007,Intellectual capital performance of quoted banks on the Istanbul stock exchange market. Journal of intellectual capital. 8(2), 256-271.
[33]. Aminbeidokhti, A. and S. Darvishkhadem, 2012,A study of effects of intellectual capital on organizational performance: A case study of Keshavarzi bank branches in Semnan province of Iran. Management Science Letters. 2(3), 971-978.
[34]. Mention, A.-L. and N. Bontis, 2013,Intellectual capital and performance within the banking sector of Luxembourg and Belgium. Journal of intellectual capital. 14(2), 286-309.
[35]. Roshani, K., A Model For Measuring Intellectual Capital In Banks, in Industrial Engineering department. 2018, Yazd University: Yazd.
[36]. Petty, R. and J. Guthrie, 2000,Intellectual capital literature review: measurement, reporting and management. Journal of intellectual capital. 1(2), 155-176.
[37]. Ordonez de Pablos, P., 2003,Intellectual capital reporting in Spain: a comparative view. Journal of intellectual capital. 4(1), 61-81.
[38]. Bozbura, F.T., 2004,Measurement and application of intellectual capital in Turkey. The Learning Organization. 11(4/5), 357-367.
[39]. Chen, J., Z. Zhu, and H.Y. Xie, 2004,Measuring intellectual capital: a new model and empirical study. Journal of intellectual capital. 5(1), 195-212.
[40]. Han, D. and I. Han, 2004,Prioritization and selection of intellectual capital measurement indicators using analytic hierarchy process for the mobile telecommunications industry. Expert Systems with applications. 26(4), 519-527.
[41]. Marr, B., G. Schiuma, and A. Neely, 2004,Intellectual capital-defining key performance indicators for organizational knowledge assets. Business Process Management Journal. 10(5), 551-569.
[42]. McGregor, J., D. Tweed, and R. Pech, 2004,Human capital in the new economy: devil's bargain? Journal of Intellectual Capital. 5(1), 153-164.
[43]. Bueno Campos, E., M.P. Salmador, and C. Merino, 2006,Towards a model of intellectual capital in public administrations. International Journal of Learning and Intellectual Capital. 3(3), 214-232.
[44]. Guthrie, J., R. Petty, and F. Ricceri, 2006,The voluntary reporting of intellectual capital: comparing evidence from Hong Kong and Australia. Journal of intellectual capital. 7(2), 254-271.
[45]. Lytras, M.D., L. Edvinsson, and P. Ordonez de Pablos, The intellectual capital statements: evolution and how to get started, in Knowledge Management Strategies: A Handbook of Applied Technologies. 2008, IGI Global. p. 63-90.
[46]. Ax, C. and J. Marton, 2008,Human capital disclosures and management practices. Journal of Intellectual Capital. 9(3), 433-455.
[47]. Shih, K.-H., C.-J. Chang, and B. Lin, 2010,Assessing knowledge creation and intellectual capital in banking industry. Journal of intellectual capital. 11(1), 74-89.
[48]. Beattie, V. and S.J. Smith, 2010,Human capital, value creation and disclosure. Journal of Human Resource Costing & Accounting. 14(4), 262-285.
[49]. Campbell, D. and M.R. Abdul Rahman, 2010,A longitudinal examination of intellectual capital reporting in Marks & Spencer annual reports, 1978-2008. The British Accounting Review. 42(1), 56-70.
[50]. Tsui, E., et al., 2013,Knowledge-based extraction of intellectual capital-related information from unstructured data. Expert Systems with applications. 41(4), 1315-1325.
[51]. Anatolievna Molodchik, M., E. Anatolievna Shakina, and A. Barajas, 2014,Metrics for the elements of intellectual capital in an economy driven by knowledge. Journal of Intellectual Capital. 15(2), 206-226.
[52]. Liu, X., et al., 2014,Analysis of intellectual capital disclosure in cross-cultural E-tourism enterprises. Journal of Intellectual Capital. 15(2), 249-263.
[53]. Baxter, R. and S. Matear, 2004,Measuring intangible value in business-to-business buyerâ€“seller relationships: An intellectual capital perspective. Industrial Marketing Management. 33(6), 491-500.
[54]. Bozbura, F.T., A. Beskese, and C. Kahraman, 2007,Prioritization of human capital measurement indicators using fuzzy AHP. Expert Systems with applications. 32(4), 1100-1112.
[55]. Grimaldi, M., L. Cricelli, and F. Rogo, 2013,A theoretical framework for assessing managing and indexing the intellectual capital. Journal of Intellectual Capital. 14(4), 501-521.
[56]. Grajkowska, A., 2011,Valuing intellectual capital of innovative start-ups. Journal of Intellectual Capital. 12(2), 179-201.
[57]. Yi, C.-G., 2012,Intellectual capital indicators for the Korean public research institute. International Journal of Intelligent Enterprise. 1(3-4), 199-214.
[58]. Moon, Y.J. and H.G. Kym, 2006,A model for the value of intellectual capital. Canadian Journal of Administrative Sciences. 23(3), 253-269.
[59]. Adams, R., J. Bessant, and R. Phelps, 2006,Innovation management measurement: A review. International journal of management reviews. 8(1), 21-47.
[60]. Bozbura, F.T. and A. Beskese, 2007,Prioritization of organizational capital measurement indicators using fuzzy AHP. International Journal of Approximate Reasoning. 44(2), 124-147.
[61]. St-Pierre, J. and J. Audet, 2011,Intangible assets and performance: Analysis on manufacturing SMEs. Journal of Intellectual Capital. 12(2), 202-223.
[62]. Bozzolan, S., F. Favotto, and F. Ricceri, 2003,Italian annual intellectual capital disclosure: an empirical analysis. Journal of intellectual capital. 4(4), 543-558.
[63]. Seetharaman, A., K. Lock Teng Low, and A.S. Saravanan, 2004,Comparative justification on intellectual capital. Journal of Intellectual Capital. 5(4), 522-539.
[64]. Mat Husin, N., K. Hooper, and K. Olesen, 2012,Analysis of intellectual capital disclosure-An illustrative example. Journal of Intellectual Capital. 13(2), 196-220.
[65]. Lentjusenkova, O. and I. Lapina, 2016,The transformation of the organization's intellectual capital: from resource to capital. Journal of Intellectual Capital. 17(4), 610-631.
[66]. Gogan, M.-L., 2014,An innovative model for measuring intellectual capital. Procedia-Social and Behavioral Sciences. 124, 194-199.
[67]. Bianchi Martini, S., et al., 2016,Relational capital disclosure, corporate reporting and company performance: Evidence from Europe. Journal of Intellectual Capital. 17(2), 186-217.
[68]. Hosseini, M. and M.S. Owlia, 2016,Designing a model for measuring and analyzing the relational capital using factor analysis: Case study, Ansar bank. Journal of Intellectual Capital. 17(4), 734-757.
[69]. Cohen Kalafut, P. and J. Low, 2001,The value creation index: quantifying intangible value. Strategy & Leadership. 29(5), 9-15.
[70]. Attri, R., N. Dev, and V. Sharma, 2013,Interpretive structural modelling (ISM) approach: an overview. Research Journal of Management Sciences 2(2), 3-8.
[71]. Khan, I. and Z. Rahman, 2015,Brand experience anatomy in retailing: An interpretive structural modeling approach. Journal of Retailing and Consumer Services. 24, 60-69.
[72]. Kanungo, S. and V.V. Bhatnagar, 2002,Beyond generic models for information system quality: the use of interpretive structural modeling (ISM). Systems Research and Behavioral Science. 19(6), 531-549.
[73]. Thakkar, J., et al., 2007,Development of a balanced scorecard: An integrated approach of Interpretive Structural Modeling (ISM) and Analytic Network Process (ANP). International Journal of Productivity and Performance Management. 56(1), 25-59.
[74]. Chang, A.-Y., K.-J. Hu, and Y.-L. Hong, 2013,An ISM-ANP approach to identifying key agile factors in launching a new product into mass production. International Journal of Production Research. 51(2), 582-597.

[75]. Singh, M.D., et al., 2003,An interpretive structural modeling of knowledge management in engineering industries. Journal of Advances in Management Research. 1(1), 28-40.
[76]. Kannan, G., S. Pokharel, and P.S. Kumar, 2009,A hybrid approach using ISM and fuzzy TOPSIS for the selection of reverse logistics provider. Resources, conservation and recycling. 54(1), 28-36.
[77]. Warfield, J.N., Developing subsystem matrices in structural modeling, in IEEE Transactions on Systems, Man, and Cybernetics. 1974. p. 74-80.
[78]. Warfield, J.N., 1974,Developing interconnection matrices in structural modeling. Systems, Man and Cybernetics, IEEE Transactions on. SMC-4(1), 81-87.
[79]. Perez, J.R. and P. Ordonez de Pablos, 2003,Knowledge management and organizational competitiveness: A framework for human capital analysis. Journal of Knowledge Management. 7(3), 82-91.
[80]. Martinez-Torres, M.R., 2006,A procedure to design a structural and measurement model of intellectual capital: an exploratory study. Information & Management. 43(5), 617-626.
[81]. Rindermann, H., O. Kodila-Tedika, and G. Christainsen, 2015,Cognitive capital, good governance, and the wealth of nations. Intelligence. 51, 98-108.
[82]. Grasenick, K. and J. Low, 2004,Shaken, not stirred: defining and connecting indicators for the measurement and valuation of intangibles. Journal of Intellectual Capital. 5(2), 268-281.
[83]. Green, A. and J.J.C.H. Ryan, 2005,A framework of intangible valuation areas (FIVA) Aligning business strategy and intangible assets. Journal of Intellectual Capital. 6(1), 43-52.
[84]. Canibano, L., M. Garcia-Ayuso, and P. Sanchez, 2000,Accounting for intangibles: a literature review. Journal of Accounting literature. 19, 102-130.