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Intellectual Capital Maturity Assessment Based on Ambidextrous Learning Themes: Evidence from Iranian Oil and Gas Knowledge-based Companies

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ABSTRACT

Due to environmental turmoil, many companies today have no choice but to link organizational learning levels with their intellectual capital because the potential consequences of such strategies enable companies to achieve a level of intellectual capital maturity by stimulating motivational levels in the context of environmental change, to pave the way for sustainability in companies' competitive processes. This study aims to analyze the most effective basis for assessing intellectual capital maturity based on the themes of the ambidextrous learning link. In terms of purpose, this research is part of developmental research. Because of the lack of a basis for assessing the intellectual capital maturity under ambidextrous learning in previous research, based on meta-synthesis in the first step, an attempt was made to identify components as the analytical basis of the research and propositions as reference variables. Then, in order to explain the identified components and propositions, in a small part, intuitive fuzzy sets (IFSs) were used to determine the most effective basis for evaluating intellectual capital maturity based on the themes of the ambidextrous learning link. This study's target population consisted of two parts: qualitative and quantitative. In the qualitative section, with the help of 16 management specialists and experts, an attempt was made at the university level to identify research components and propositions in the form of score forms. In the small section, 50 managers, officials, and experts at various levels of knowledge-based companies participated. The results showed that the proposition of strategic tendencies in learning was considered the most influential theme of the ambidextrous learning link in

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the studied companies, strengthening the sustainability of knowledge creation as an influential component in intellectual capital maturity. This result shows that strategic tendencies enable the company, through the sustainability and effectiveness of identifying environmental capacities, to acquire knowledge based on environmental changes and, by combining them, to strengthen productivity and institutionalize the capacity to absorb and create knowledge as a value.

1. Introduction

Maturity in management and administration is an essential part of the development process in all areas of an organization, such as human resources, finance, and production. The focus and formulation of dynamic strategies can strengthen the competition's effective capacity (Subramanian and De Vrande, 2019). Intellectual capital maturity is considered an area of human resource enrichment that provides the ground for increasing innovation and presenting pure ideas to solve the problem (Al-Fatah Kaeaeneh, 2021). Twenty-first-century organizations need to accelerate their innovation cycles, and the awareness of how to effectively manage intellectual capital (IC) has become an urgent need for business success. Success in organizational functions must be valued in developing intellectual capital to strengthen processes, products, and services (Gracioli, 2005). The evolution of new technologies and the growth of service activities have had a profound effect on the structure of industrial economies so that with the increase in intangible asset costs since 1980, companies have attached great importance to information value and recognition of intellectual capital development capacities (Coser, 2012; Hsu and Fang, 2009). Therefore, shifting the approach from the mere importance of intellectual capital as an intangible asset to developing potential and mature intellectual capacities is a process that has received more serious attention over the past decade. According to Nadeem et al. (2021), in a globalized environment based on innovation and the demand for knowledge-based products and services is increasing, the main competitive advantage of organizations does not necessarily indicate having intellectual capital, and the need to focus on intellectual capital maturity as a human resources strategy can help increase and develop companies' competitive capacities and capabilities. However, many organizations face limitations in developing such capabilities because the highly binding, formal, and complex structures have caused the level of adaptation of human resources to be affected. Therefore, the maturity of intellectual capital as an effective mechanism in knowledge-enhancing functions is facing many problems. In other words, if human resources are considered intangible assets and intellectual capital based on the use of their potential capabilities and abilities in order to reach maturity, one can expect, in achieving its goals and strategies, the company can perform better in a competitive environment (Hamidi et al., 2018) because it has been able to create a good fit between organizational strategies and human resource perceptions based on the development of ambidextrous learning. Ambidextrous learning is a theoretical approach to developing human resource capabilities that have placed organizational learning functions between the two spectrums of exploration and utilization. Popadiuk (2012) defines exploration as the diversity of environmental characteristics and utility, which refers to the intrinsic characteristics of the internal environment in organizational learning. In other words, exploration includes the pursuit of learning, higher than the usual knowledge domains of the organization, while the benefit includes the exploitation and deepening of the existing knowledge stores of the organization (Seyed Naghavi et al., 2016). Therefore, by placing intellectual capital at a desirable level between the two spectrums of exploration and profit, we can expect a level of intellectual capital maturity based on developing organizational capabilities and capacities. The maturity of intellectual capital covers knowledge, thinking, awareness, and individual decisions, enabling a company to achieve lasting success (Matos, 2013).

Global statistics show that, on average, 64% of the wealth of developed countries is intellectual capital, 16% is physical resources, and 20% is natural resources. According to the same statistic, 55% of the 64% of intellectual capital depends on the maturity of individual abilities to achieve stability in competition. In Iran, meanwhile, only 34% of wealth is intellectual capital, 37% is physical resources, and another 29% is natural resources. There is a direct relationship between the development of intellectual capital and the development of countries. According to the United Nations Intellectual Development Report in 2013, Iran's

intellectual capital development index reached 0.702, ranked 70th among countries (Resource Development Program, 2016). Considering the potential of intellectual capital shows the extent to which managerial and strategic functions have been incapable of developing and using the capabilities of intellectual capital. Moreover, paying attention to this critical part can be considered leverage in the knowledge-based companies market. Based on the explanations provided, the importance of this research can be described from the following two perspectives.

First of all, this research is one of the few that deals with intellectual capital maturity assessment based on ambidextrous learning. Expanding the combination of qualitative and quantitative analysis and focusing on intuitive fuzzy sets (IFSs) analysis is considered additional research from other researchers. Although previous research works, such as Muñoz-Pascual and Galende (2020), Asif (2020), and Kang and Snell (2008) examined respectively "Ambidextrous Knowledge and Learning Capability", "Strategic Leadership and Ambidextrous Learning", and "Intellectual Capital Architectures and Ambidextrous Learning", no research has examined "Intellectual Capital Maturity Assessment Based on Ambidextrous Learning". Therefore, conducting this research can help the development of theoretical literature to fill the gap in the development of human resource productivity to improve the level of practical functions of the organization in terms of problem-solving.

Second, the results of this study can help managers of organizations to increase the level of individual commitment based on the development of their perceptual and psychological strategies regarding the importance of human resource effectiveness within organizational structures. Thus, it can help strengthen ambidextrous learning mechanisms because human resources are the most crucial capital asset of any organization that tries to perform its best duties if it trusts the organization. Therefore, although it has been studied and reviewed from different angles, an ambidextrous view of organizational learning has not been considered one of the necessary and insufficient conditions for developing the effectiveness of organizational capabilities. Since the issue of evaluating intellectual capital maturity has not been studied in the form of propositions of ambidextrous learning link, this study intends to evaluate intellectual capital maturity by linking the themes of propositions of development of reciprocal learning. This paper is structured as follows. The second part of the paper presents the literature review because understanding the concepts related to the research topic can help in theoretical coherence and more integrated understanding. The third section presents a methodology for understanding the nature and population of the statistical target of the research. The fourth section presents the research findings in two qualitative and quantitative. Finally, a discussion and conclusion can be presented in the fifth section.

2. Literature review

2.1. Intellectual capital mature

The concept of intellectual capital is an abstract concept that refers to a company's intangible assets. It is often difficult and complex to measure due to the internal characteristics of individuals as an essential part of intangible assets (Ghasemi et al., 2020). On the other hand, due to the dynamic nature of intellectual capital, which is highly dependent on economic values, social, cultural, and even political, it is difficult to determine its effectiveness level (Hormiga et al., 2013). In most intellectual capital models, as shown in Figure 1, intellectual capital can be combined with human capital, considered structural and social.

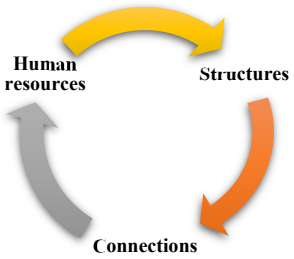

Figure 1: The criteria for the intellectual capital

Intellectual capital in the above three dimensions can be defined as a group of knowledge assets and part of the organization's characteristics. It can increase the level of value-added for critical stakeholders of the organization, significantly improving the organization's competitive position (Ghasemi et al., 2020). In particular, intellectual capital can be a source of accumulation of personal knowledge and skills, expertly and empirically defined, that can help increase productivity and collective functions. However, knowing the elements of intellectual capital alone may not necessarily be helpful because it is necessary to measure the effectiveness of intellectual capital and its management to formulate models of intellectual capital to create correlations between its criteria (Shang and Lin, 2018). Some models of intellectual capital are presented in Table 1.

Table 1: Some models of intellectual capital

Model basis	Dimensions	Reference
Evaluation of intellectual capital information in the form of analytical reports	Human Capital; Foreign and domestic capital	Chen et al. (2004)
Financial estimation in strengthening intellectual capital	Human Capital, Customer capital, Structural capital	Rodov and Leliaert (2002)
Knowledge asset map	Structural resources and stakeholder resources	Marr and Schiuma (2001)
Reporting the intellectual capital of Irish companies	Internal structures, External structures (customer/communication), and individual competence	Bernnan (2001)
ECM Company	Value extraction, customer capital, structural capital, value creation, human capital	Liebowitz et al. (2000)
* Note: Due to the multiplicity of intellectual capital models and the similarity of their dimensions, an attempt was made to focus on models with different dimensions.		

Although intellectual capital is evaluated through different models and in different forms, all these models and forms have the same process. These processes include identifying the various components of intellectual capital and using specific classifications, which finally makes it possible to identify the minor indicators of each sector. For example, Matos (2013) presented the intellectual capital model in a four-dimensional model to increase its effectiveness and measure it.

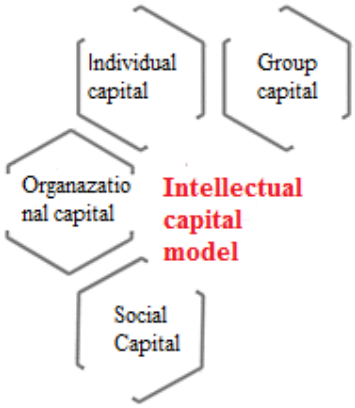

Figure 2: The intellectual capital model

Matos (2013) believed that the combination of all four individual capitals is organizational and social and causes the organization's quality to increase in various functional dimensions from within the structure to the social environment. Nevertheless, despite the multiplicity of intellectual capital models, less research has examined the model of intellectual capital maturity. A model with all the characteristics of different

intellectual capital models simultaneously significantly affects both measurement and productivity. According to Rabechini (2003), the maturity of intellectual capital is a dynamic goal and flexibility of the criteria of intellectual capital because the main elements of the three content components of any organization include strategy, technology, and management, which, depending on the market, provide the process of flexibility and change in the organization. Fleury and Fleury (2000) emphasized that the maturity of intellectual capital did not matter. However, it shows the competence to identify and pursue the necessary and sufficient level of understanding and expertise by acquiring knowledge (knowing what), developing skills (knowing how), and aligning attitudes with business goals (knowing why). Kerzner (2001) believed that the maturity of intellectual capital led to the development of systems and processes in the organization, which are not reproducible and strengthen the competitive and dynamic capabilities of organizations. The concept of intellectual capital maturity is the possibility of identifying gaps related to the stages of the development process. Information gives knowledge and how to combine them to create real growth opportunities (theoretically, by filling in the gaps). The concept of intellectual capital maturity is intuitive and based on institutionalized values of organizational functions that create a mutual understanding and strengthen organizational norms (Prado, 2010). It is emphasized in the approach of intellectual capital maturity that *mature* organizations respond dynamically and effectively to quality goals, deadlines, and potential opportunities, while *immature* companies cannot seize external opportunities while having consistent and unchallenged procedures (Schmietendorf and Scholz, 2001; Poppendieck, 2004; Jorgensen et al., 2007; Niederhauser, 2010; Liker and Morgan, 2011; Leon and Ferris, 2011; Hopmann et al., 2011). In other words, *mature* companies usually perform better than those with a lower level of maturity in a given process because they have better knowledge and systematized their processes.

In general, the difference between the functions of intellectual capital maturity and immaturity in intellectual capital can be measured in indicators such as cost, time, speed, compliance with quality standards, and customer satisfaction (Moraes, 2004). Vaz et al. (2018) presented the maturity of intellectual capital in a model based on the case study method using Proknow-C analysis. This method, which was a four-step method, first identified related research based on databases and then identified the most influential models of intellectual capital that had the most reference to them based on the classification of thematic literature. Vaz et al. (2018), Paulk Models (1993), Pasquali (1999), Ubrina (2009), Bardin (2011), and Coser (2012) were theoretically analyzed. Then, based on the differences in the scales in maturity, intellectual capital was examined for each model. This method, to determine the dimensions of the model of intellectual capital maturity, seeks to evaluate the level of the most desirable scale in measuring the maturity of intellectual capital. Finally, Vaz et al. (2018) determined the six most effective criteria for intellectual capital maturity by determining six levels of intellectual capital maturity and maturity scale points in Table 2.

Table 2: The levels of the intellectual maturity assessment scale

Maturity level	Signs of maturity	Maturity scale points
Unavailable	Black	0
Initial process	Red	1–18
Planned process	Orange	19–36
Created process	Yellow	37–74
Managed process	Blue	75–110
Optimized process	Green	111–147

Using the levels of maturity and according to the level of a needs assessment of companies, management can make strategies based on them and define coherent goals and indicators to create the highest effect for the company. Therefore, Vaz et al. (2018) defined the criteria for measuring the levels of intellectual capital maturity. Finally, Figure 3 determines the essential principles of intellectual capital maturity based on the above six levels.

Table 3: The definitions of intellectual capital maturity levels

The level of maturity of intellectual capital	Definitions
Nonexistent: level zero (Black)	The company does not admit that there is a problem to be addressed. The complete absence of any process.
Level 1: Initial process (Red)	The company is at a preliminary stage (or not at all) at what is being analyzed. Example: lack of understanding of intellectual capital and intangible assets
Level 2: Planned Process (Orange)	The company is aware of the need for it in the management of intangible assets of the company, but its form is informal and without standardization. Example: there is an understanding of the need for intellectual capital management.
Level 3: Created (Yellow)	There are formal documents and procedures for carrying out intellectual capital activities, but there is no systematic monitoring of its progress, and management indicators or tools are used. Example: documented intangible assets that guide the company's actions.
Level 4: Managed (Blue)	Indicates a situation in which intangible assets are formally controlled and managed. Example: intellectual capital is examined periodically using performance indicators.
Level 5: Optimized (Green)	The final stage is the maturity of the company, and the results of intangible assets are managed by performance metrics, which include optimization goals. Example: Performance indicators constantly monitor intellectual capital for suitability for need.

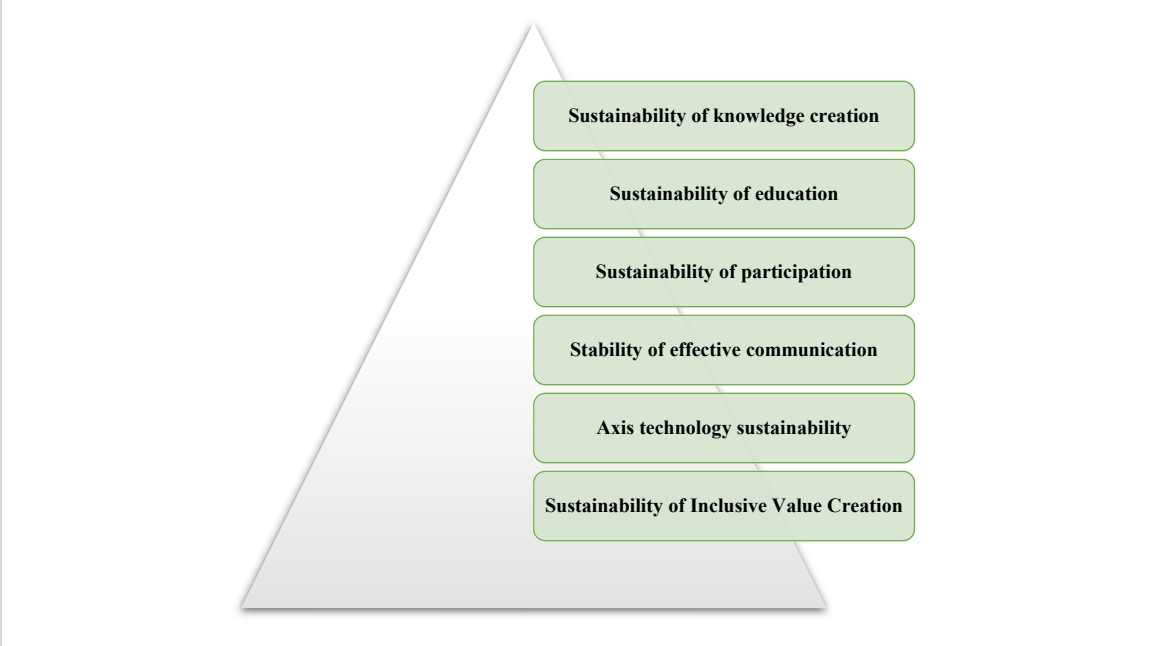

Figure 3: The model of intellectual capital maturity

2.2. Development of ambidextrous learning

As a knowledge-based concept, ambidextrous learning seeks to enhance high levels of efficiency and innovation to enhance companies' competitive advantages through risk control and increased returns. Ambidextrous learning encompasses competitive capacities for the simultaneous pursuit of exploration, that is, learner efforts and profit, i.e., learner outcomes. Ambidextrous can therefore be seen as the capacity to implement strategies that support the creation and maintenance of success over time (Prieto-Pastor and Martin-Perez, 2015). Monodextrous companies specialize in exploratory or for-profit learning. However, monodextrous companies are always at risk of being associated with these two types of learning; they may fall into the trap of success (when exploitation becomes more critical than exploration) or failure (when exploration becomes more critical than exploitation).

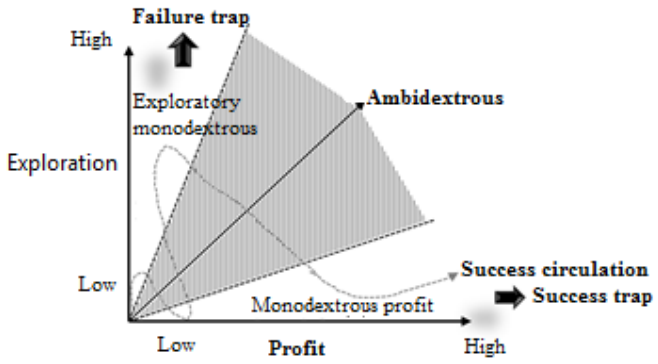

Figure 4: The pattern of reciprocity versus monodextrous and the temporary cycle of learning (Prieto-Pastor and Martin-Perez, 2011)

On the other hand, as shown in Figure 1, some companies use a consistent, step-by-step approach. For example, they are temporarily placed between exploration and for-profit activities. Such strategies are punctuated equilibrium, temporal cycling, or temporal specializations/separation (Venugopal et al., 2019). Companies that pursue such strategies are not ambidextrous because they do not simultaneously have different learning modes. The scope of companies' performance from the perspective of ambidextrous learning can be considered a link mechanism based on the integration of the same views and values and managerial rewards, ensuring the success of learning ambidextrous.

Table 4: Functional learning ambidextrous (Pohan, 2008)

Exploration units	For-profit units	The link between learning reciprocity
Innovation, growth	Cost, profit	Strategic orientation
Compatibility, success through innovation	Efficiency, increasing	Innovation
Entrepreneurship	Operational	Competencies
Compatible, organic	Formal, mechanical	Structure
Risk acceptance, speed, flexibility, and testing	Efficiency, low risk, quality, and customers	Culture

Exploration and utilization can be briefly described based on the link between learning and reciprocity.

A) Benefit at the learning level: The concept of profitability, according to March (1991), on issues such as choice, manufacturing, and performance implies employment and implementation. When an organization strives for profit, it tends to be more confident and faster, closer and more transparent in its activities. Profit suggests less effort for large-scale, above-mean, and long-term innovations, which can lead to the deterioration of organizational knowledge. The benefit is also related to knowledge for continuous improvement, modification, refinement, and development of changes in current products, processes, and services (O 'Reilly and Tushman, 2008). More explicit knowledge is provided, and continuous ideas, routines, standards, and duplicates are becoming more prominent. Competencies and skills increase the potential for reward for employees and the organization. Thus, there is reason to believe that interactions will increase, especially in the organization (Vanhaverbeke et al., 2009). Therefore, the task of utilization strategies in the existing learning curve is to make the best and most use of the existing expected flows, core competencies, and capabilities. The best example of net profit is producing large-scale, low-cost products, commonly known as a one-cycle learning process (Cohen and Levinthal, 1990).

B) March (1991) connects exploration with new capabilities, which include research, change, risk-taking, experimentation, games, flexibility, discovery, and innovation. Even without significant short-term gains, organizations focused on exploration must invest more in basic testing and research. They present many distinctive ideas, skills, and competencies under

development (Ahuja and Katila, 2004). This approach focuses on innovation, tacit knowledge, research for knowledge, new achievements, innovation, fundamental change, and the creation of innovative products, processes, and services. Exploration is associated with developing new products and, as a learning process, provides the basis for increasing competitive advantage (Anand et al., 2009).

2.3. Maturity of intellectual capital under the development of mutual learning

Researchers in various sciences have identified a close relationship between the organization's tendency to learn and the organization's knowledge storage (Cohen and Levinthal, 1990; Helfat, 2007). The maturity of intellectual capital refers to the set of all reserves of knowledge that the organization uses as a competitive advantage (Gurlek, 2020). Reaching maturity in intellectual capital causes the storage of specific knowledge through individuals and establishes relationships, and the organization distributes it back and forth. Intellectual capital maturity indicates an organization's ideal position in exploiting its hidden potential to leverage to increase organizational productivity. The concept of intellectual capital maturity is a way to assess the state of completeness, completeness, or readiness or the degree of completeness or completeness of the growth or development of the components of intellectual capital (Salmani et al., 2019). Therefore, in ambidextrous learning, each component of intellectual capital has a unique role in the accumulation process; they share and create new knowledge. First, human capital, or knowledge, skills, and abilities of individuals, with the effect they have on the ability of employees to acquire new knowledge, are crucial components of organizational learning. Argyris and Schon (1998) stated that no organizational learning could occur without individual learning and that individual learning is a necessary but insufficient condition for organizational learning. Knowledge capital or knowledge within the employee relation networks is a channel for the exchange and synthesis of knowledge within the organization. Stata (1989) stated that organizational learning occurs through sharing thoughts, knowledge patterns, and insights among employees. From this perspective, organizations benefit from sharing and combining employees' knowledge through social relationships. Organizational capital represents the knowledge gained from processes, systems, and structures (Oehmichen et al., 2017).

Given that individuals and organizational and communication systems are superficial intangible assets of the organization, companies with intellectual capital maturity, knowledge, behavior, and mind maps maintain norms and values over time and use them as a competitive advantage. The maturity of intellectual capital is the tendency to create patterns of behavior and cognitive systems that lead to knowledge acquisition and provides a fundamental mechanism for creating and combining other knowledge outside the organization (Grant, 2006). Therefore, considering the unique cooperation of human, social, and organizational capital in the form of intellectual capital maturity to create organizational learning is logical, proving the relationship between exploration and profit, which shows the dependence of the specific composition or structure of intellectual capital maturity.

3. Research background

Asif (2020) conducted a study entitled "Strategic Leadership and Ambidextrous Learning: Investigating the Role of Dynamic Capabilities and Intellectual Capital". The research methodology was based on a systematic review of the literature concerning the above variables for developing propositions that did not have a coherent framework due to theoretical dispersion. Based on theoretical screening, a set of research propositions was codified as a theoretical framework to examine the relationship between research variables. The relationship between the research variables was based on path analysis and structural equations. The results showed that strategic leadership had a significant relationship with ambidextrous learning, i.e., learning at the profit level and learning at the level of exploration. It was also found that dynamic capabilities and intellectual capital positively strengthened the relationship between strategic leadership and ambidextrous learning. Gurlek (2020) conducted a study entitled "The Effects of High-Performance Work Systems (HPWS) on Intellectual Capital, Organizational Ambiguity, and Knowledge Acquisition Capacity: Evidence from the Hotel Industry". The study's target population was the senior managers of four- and five-star hotels in Istanbul and Antalya, Turkey, who participated based on a random sampling method of 475 people. Partial least squares were used to analyze and fit the model. The results showed that the effect of organizational ambiguity on knowledge acquisition capacities was positive and significant. It was also found that intellectual capital as a moderating variable strengthened the positive effect of organizational ambiguity on knowledge absorption

capacities. Khalil Nezhad et al. (2020) conducted a study entitled "The Effect of Knowledge Acquisition Capacity on Strategic Innovation by Considering the Moderating Role of Strategic Orientation". Following the positivist paradigm and survey method, a questionnaire consisting of 33 items was set up. The statistical population was in the first level of all companies and the second level of all their employees. The results showed that the capacity to absorb knowledge was related to strategic innovation, but this effect was insignificant for the two sub-hypotheses. It was also found that in companies with competing and customer-oriented strategic orientations, this effect was strengthened and weakened in cost-oriented companies. Hence, organizations that seek to strengthen strategic innovation, continually adapt their business model to change, and increase the capacity to absorb knowledge must base their strategies on the customer or competitor. Ghasemzadeh Alishahi et al. (2020) conducted a study entitled "The Role of Learning and the Atmosphere of Organizational Training in Job Performance: the Variable Share of Organizational Learning Capacity". The statistical population of this study was 600 employees of Tabriz Agricultural Jihad. The sample size was 234 using the Morgan table. Four standard questionnaires of organizational learning, educational atmosphere, job performance, and organizational learning capacity were used to collect data. The obtained data were analyzed using the correlation method and structural equation model. The results showed a direct and significant relationship between organizational learning and job performance, organizational training atmosphere with job performance, organizational learning with organizational learning capacity, and organizational learning capacity and job performance. Organizational learning and organizational training atmosphere indirectly affect job performance through organizational learning capacity. Therefore, the mediating effect of organizational learning capacity in this study is confirmed. Salmani et al. (2019) conducted a study entitled 'Development and Explanation of the Maturity Model of Intellectual Capital in Iranian Universities". The research method is qualitative and based on grounded theory, and data collection is done through semi-structured interviews. Data analysis was conducted by the Strauss and Corbin method and paradigm model, and sampling was performed by the theoretical sampling method using targeted techniques and snowballs, based on which 29 interviews with qualified experts were conducted. The results in the form of a model with 12 components and 5 domains showed that structural dimensions, implementation costs, top management of the organization, organizational climate, evaluation, organizational knowledge and experience, and internal resilience were the variables affecting the implementation process of the model and could facilitate or prevent its successful implementation. If the model is implemented, we can expect the development of a research and development network, an increase in the efficiency of the educational and research system, the development of the structure, and the commercialization of knowledge. Vaz et al. (2018) conducted a study entitled "The Proposed Model for Evaluating the Maturity of Intellectual Capital". This study was applied–qualitative in terms of research methodology because it tried to determine the dimensions of the intellectual capital maturity model through exploratory studies and Proknow-C theoretical method and then evaluate the identified components through the 0–100 questionnaire tool. The results showed the basis for evaluating a company regarding intellectual capital maturity and sustainable development in various dimensions of human capital. It is structural and communicative, and secondly, the most important basis for the maturity of intellectual capital is the functions of the organization's knowledge-enhancing field, which can promote effective functions in a competitive environment.

Therefore, according to the theoretical foundations, the research questions are presented in the following order:

1. What are the components of managers' intellectual maturity as a basis for intuitive fuzzy sets?
2. What are the ambidextrous learning link statements as a reference in intuitive fuzzy sets?
3. What is the most compelling intellectual capital maturity based on ambidextrous learning links in intuitive fuzzy sets?

4. Methodology

The present study is applied in terms of purpose because it aims to develop the knowledge of intuitive fuzzy sets to investigate the maturity of intellectual capital based on the themes of the two-way learning link. This research is considered part of developmental research in terms of results. In terms of data collection logic, this research is also mixed because, according to the nature of intuitive fuzzy sets, theoretical screening should be done through the qualitative part to determine the components and propositions of the research. In a small part, among the intuitive fuzzy sets, the analysis that has gained the most analytical validity can be used

to choose the best basis (intellectual capital maturity) based on the best reference proposition (ambidextrous learning). Finally, it should be noted that the research was from 2020 to 2021.

4.1. Statistical population of the research

In the qualitative part, this study, through the basis of homogeneous sampling, selected 16 specialists and experts in the field of management at the university level to determine the level of reliability (intellectual capital maturity) and research propositions (ambidextrous learning) based on Delphi analysis regarding the existence of a theoretical approach concerning the research topic. In the second phase, to perform the interpretive prioritization analysis, 50 managers, officials, and experts at different levels of knowledge-based companies were asked as the focus group members after evaluating and confirming the components and propositions identified in the qualitative section. They should respond to the developed matrix questionnaires. This section aims to develop the effectiveness of using the capital asset capacities (dynamic human resources) of knowledge-based companies to develop sustainable learning to gain a competitive advantage among companies. It should be noted that since an intuitive fuzzy set is an analysis based on matrix analysis and operation analysis, it should be done based on a specific criterion, such as experience or specialized knowledge by the participants, which is limited in terms of sample size and is in accordance with research works such as Xu et al. (2014) and Yu (2013). Based on the participation of the target statistical population, demographic statistics are presented as listed in Table 5.

Table 5: Target statistical population

Demographic characteristics			Qualitative		Quantitative	
No.	Variable	Demographic levels	Frequency	Frequency percentage	Frequency	Frequency percentage
1	Gender	Female	6	37.5%	18	36%
		Male	10	62.5%	32	64%
		Total	16	100%	50	100%
2	Work experience	Under 12 years	5	31.25%	8	16%
		12–14	7	43.75%	35	70%
		Over 14 years	4	25%	7	14%
		Total	16	100%	50	100%
3	Workplace	State universities	8	50%		
		Islamic Azad University	8	50%		
		Total	16	100%		
4	Age	40–45	10	62.5%	32	64%
		46–50	4	25%	12	24%
		Over 50 years	2	12.5%	6	12%
		Total	16	100%	50	100%

5. Research findings

In order to make the connection between the components of intellectual maturity and ambidextrous learning propositions based on theoretical foundations, we attempted to compile the research matrix checklists in the quantitative part by entering the components and propositions identified in the past research to enter the interpretive analysis phase. Therefore, in the first step, based on the theoretical basis presented in the second part of the research, i.e., the theoretical basis, the definitions of the research components are expressed so that after determining its reliability by Delphi analysis in the next step, interpretive analysis is performed. Accordingly, their theoretical definitions are first made using research components and propositions.

Table 5: Components of intellectual capital maturity

5.1. Components of intellectual capital maturity (V)

As described in the theoretical foundations of the research, based on the dimensions identified by the intellectual capital maturity model by Vaz et al. (2018), the following definitions are provided for each.

Components	Symbols	Definitions
Sustainability of knowledge creation	V1	Knowledge can be considered a fluid mixture of experiences, values, information, and systematic attitudes that provide a framework for evaluating and benefiting from new experiences and information. Sustainability of knowledge creation can be considered the process of continuous creation of new knowledge or replacement and improvement of existing knowledge by strengthening the level of organizational values, which, if continued, can lead to the creation of new and competitive knowledge that enhances organizational effectiveness (Leon and Ferris, 2011).
Sustainability of education	V2	Training as an essential part of human resource functions, when sustained, can help create organizational learning to solve problems and help increase the sharing of knowledge and practical skills among an organization's human resources. The maturity of intellectual capital is enhanced by increasing coherence in ongoing and sustainable education programs, as issues are addressed through empowering insight into human resources (Ubrina et al., 2009).
Sustainability of participation	V3	This level of sustainability refers to the increase in organizational correlations for participatory decision-making. The sustainability of participation in organizational decisions indicates the perceived value of human resources. While understanding the conditions and decision-making situations, they try to show their most effective presence as an essential person in the organization (Bardin, 2011).
Stability of effective communication	V4	This level of sustainability refers to the effectiveness of intra-organizational and interpersonal communication with external communication/customers. The sustainability of effective communication creates a kind of interactive identity between organizational processes and the external environment of the organization, which gives the company the ability to respond to changing expectations and potential emotions based on the flexibility it has created through mutual understanding of needs and preferences with internal resources. It will be able to respond best and fastest (Liker and Morgan, 2011).
Axis technology sustainability	V5	Technology-driven sustainability is a resource-based approach that focuses on resources and capabilities controlled by the firm as a source of competitive advantage. These resources can act as barriers to copying and imitating other assets. Therefore, from this perspective, they can be considered sustainable, which, while imitable and irreplaceable, creates a competitive advantage and achieve more value for stakeholders than other competitors for the company because of the value they create (Gogan and Darghichi, 2013).
Sustainability of inclusive value creation	V6	The sustainability of inclusive value creation is a basis in the normative functions of organizations that emphasizes the provision of a set of structural values that will lead to greater integration of organizational functions in a competitive environment. Strengthening symbols and slogans helps create shared insights of the organization in creating effective and inclusive values and causes organizational performance to be based on adherence to inclusive and pluralistic values (Chen et al., 2004).

5.2. Ambidextrous learning link statements (W)

As explained in the theoretical foundations of the research, based on the identified dimensions of the two-way learning link proposition by Pohan (2008), the following definitions are provided for each of them.

Table 6: Ambidextrous learning link statements (exploratory/for-profit)

Components	Symbols	Definitions
Strategic orientation	W1	Strategic tendencies are one of the guiding principles influencing the competitive functions and selection of strategies of a company's activities, which reflect the tendencies the strategies implemented by the company to create appropriate behaviors and lead to better performance and are based on the company's idea of doing business through a wide range of values and root beliefs (Nayebzadeh et al., 2018). Strategic orientation refers to how the company adapts to the external environment. Strategic orientation is also used to understand specific management, preparations, inclinations, motivations, and desires that guide strategic planning and development (Naeiji et al., 2018).
Innovation	W2	Innovation is defined as the development, approval, and application of specific, new services, ideas, and ways of doing things to improve and modify them. Learning in innovation can be defined as maintaining knowledge about previous activities and experiences, so systematic learning from past experiences is the foundation for effective management of new product improvement and development processes and innovation (Salmon, 2014).
Competencies	W3	Competence, in one definition, refers to the ability to work effectively and efficiently in a natural environment based on a predetermined standard. In other words, competency is the ability to do the job according to the standard of performance set by the world of work for each job. The term competency in learning describes a set of behaviors that reflect a single combination of knowledge, skills, abilities, and motivations and are related to performance in an organizational role (Nguyen, 2012).
Structure	W4	Structure in the concept of learning link refers to whether reciprocity is pursued in independent organizational units or within interdependent units. O'Reilly and Tasman (2008) argue that dual or dual-core organizational structures are considered to link exploration with learning benefits because the long-term success of organizational structures must strengthen the capacity for innovation. However, large, dual, or binary organizational structures are flexible regarding organizational processes and enhance organizational learning (Seyed Naghavi et al., 2016).
Culture	W5	Learning should be based on culture, not in any way; therefore, it can be stated that learning theories derive their basic concepts from the dominant culture and ideas in any organization and are embedded in their cultural and social context. The effectiveness of learning theories is possible only by examining them in the cultural–social context of the organization in which they are used (Weerts et al., 2018).

6. Delphi analysis

In this section, to determine the research components in the form of research variables, the identified components and propositions of research are presented as a 7-point Likert scale checklist. It is then distributed among 16 elites as panel members selected through a homogeneous sampling method to determine whether their views on aligning the nature of the research variables with the identified components and propositions are theoretically sufficient.

Table 7: The process of the first and second steps of Delphi analysis

Components/propositions	Assessment criteria	Symbols	The first round of Delphi		The second round of Delphi		Result
			Mean	Coefficient of agreement	Mean	Coefficient of agreement	
Components of intellectual capital maturity	Sustainability of knowledge creation	V1	5.20	0.60	5.30	0.65	Confirm
	Sustainability of education	V2	5.30	0.65	5.50	0.75	Confirm
	Sustainability of participation	V3	6	0.80	6.20	0.85	Confirm

Components/propositions	Assessment criteria	Symbols	The first round of Delphi		The second round of Delphi		Result
			Mean	Coefficient of agreement	Mean	Coefficient of agreement	
	Stability of effective communication	V4	5.20	0.60	5.30	0.65	Confirm
	Axis technology sustainability	V5	5	0.50	5.10	0.55	Confirm
	Sustainability of inclusive value creation	V6	5.50	0.75	6.10	0.82	Confirm
Mutual learning link propositions (exploratory/for-profit)	Strategic orientation	W1	5.20	0.65	5.50	0.75	Confirm
	Innovation	W2	5	0.50	5.10	0.55	Confirm
	Competencies	W3	5.50	0.75	6.10	0.82	Confirm
	Structure	W4	5.30	0.65	5.50	0.75	Confirm
	Culture	W5	5.20	0.65	5.50	0.75	Confirm

As can be seen, all the identified components and propositions about the research variables were confirmed during the two stages of Delphi analysis.

6.1. Quantitative section findings

Intuitive fuzzy set analysis is used in this section. Based on this analysis, one must first choose one of the three analytical methods of this evaluation, namely FAHP, VIKOR, and EDAS, evaluate the most appropriate implementation method in terms of validity, and finally perform the analysis based on it.

6.2. Intuitive fuzzy set validation

It can effectively perform intuitive fuzzy sets when the decision-making action faces multiple options and decision-making indicators. This method can help create more integration in choosing the best solution based on a pairwise comparison of the components' characteristics. In performing intuitive fuzzy analysis, choosing the best basis for analysis is a presupposition that must be considered before beginning. Therefore, based on the set of intuitive fuzzy analyses, analytical methods, namely FAHP, VIKOR, and EDAS, should be compared with the actual value to determine, based on the test values, which of the above three methods acts as a set of intuitive fuzzy sets, and which analysis is the most effective according to the collected data set. According to the actual and intuitive values and comparing three FAHP, VIKOR, and EDAS analyses as fuzzy sets, the best analysis method is selected by comparing them. Figure 1 shows the excellent agreement between the analysis methods.

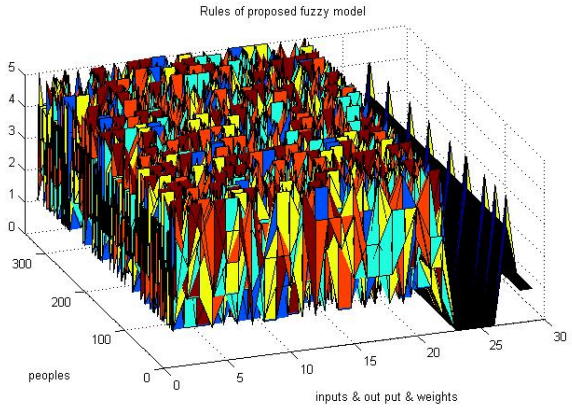

Figure 5: The basis for matching real value with intuitive-fuzzy values

The validation and testing will be performed. In an artificial intelligence system called fuzzy, the training method is used to determine the validation. The CV method is a developed and accepted method for predicting the accuracy of predictions. This method is mainly used for random or *k*-fold subsets of the test and training suite. This method is known as a component sampling method, a simple validation approach. The *k*-fold validation method divides the data set into *k* separate sections. We repeat the modeling process *k* times, and each time *k* – 1 parts of the data are used for the training process; a portion of the data not included in the training process is used for the testing and validation process of the predictive model. Finally, the prediction error calculated in each *k* step is the mean. The advantage of using random data sub-setting in this method is that it eliminates the effect of how the data is distributed for the modeling process. The variance of the averaging results will be minimal for the case where the value is enormous. The performance evaluation of the algorithms described above has been done using different criteria based on the sensitivity and detection perspective. Sensitivity and detection in statistics are two indicators of evaluating the result of a binary (two-state) classification. When data can be divided into positive and negative groups, the accuracy of the results of an experiment that divides information into these two categories can be measured and described using sensitivity and specificity indices. This section uses MMC, f-measure, recall, precision, and accuracy criteria.

Precision is the ratio of the number of correctly classified items by an algorithm to a specific class to the total number of items that the algorithm has classified, either correctly or incorrectly, in that class.

Recall calculates the ratio of the correct number of items classified by an algorithm from one class to the number of items in that class.

Measure: Based on the precision and recall criteria in this step, the weighted quantity f-measure can be calculated. This criterion is a suitable parameter for evaluating the quality of classification, and it describes the weighted mean between the two quantities of precision and recall. For a classification algorithm under ideal conditions, the value of this quantity is equal to one, and in the worst case, it equals zero.

MMC is another parameter used to evaluate the performance of machine learning algorithms. This parameter also indicates the classification quality for a binary set. MMC measures the relationship between a binary class's observed values and its predicted values. The expected values for this quantity in the range of –1 to +1 are variable, and a value of +1 indicates an accurate and error-free prediction of the learning algorithm of the binary class. A value of zero indicates a random prediction of a learning algorithm of a binary class, and a value of –1 indicates a complete mismatch between the predicted items of the binary class and the observed items.

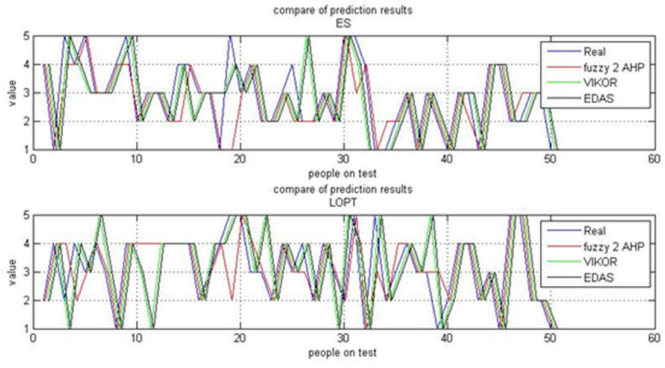

Figure 6: Validation of matrix analyses

As can be seen, validation for FAHP, VIKOR, and EDAS based on the following criteria indicates the validation of research statements based on VICOR values. The total points of the above diagram are presented in Table 8.

Table 8: Validation of research propositions

Amounts	MMC	f-measure	Recall	Precision	Accuracy	Rank
Fuzzy amounts	64.32	48.17	77.18	63.21	91.37	C
VIKOR amounts*	88.12	71.09	49.32	91.29	94.38	A
EDAS amounts	62.54	69.18	92.38	55.18	81.28	B

As can be seen, the value of VIKOR is selected for this analysis as the only criterion of intuitive fuzzy analysis due to its higher validity than other models in this set. It determines the most crucial dimension of intellectual capital maturity based on mutual learning.

6.3. Intuitive fuzzy VIKOR set analysis process

The VIKOR method in the intuitive fuzzy analysis is an extended method of AHP that finds the disadvantage of AHP when the number of pairwise comparisons of decision options concerning the sub-criterion is high, and large volumes cause deviations in the participants' responses, in which case the adaptation rate increases. VIKOR analysis is one of the most widely used multi-criteria decision-making methods to prioritize recurring decision-making options. To perform this analysis, first, the fuzzy hierarchy analysis steps must be explained to determine the importance of the selected criteria in the proposal evaluation process, and then the priorities must be determined by creating intuitive fuzzy VIKOR steps. According to this analysis and experts, tangible and common expression items in the fuzzy pairwise comparison questionnaire should be used instead of the usual definite ratios common in traditional methods such as AHP. Therefore, this part of the following five steps is estimated using the following equations.

6.4. Preparation of pairwise comparison matrix

The criteria or sub-criteria are compared in pairs to prepare a pairwise comparison matrix. A scale of 1 to 9 can be used for this purpose: a score of 1 indicates the equal importance of the two elements, and a score of 9 indicates the highest importance of one element (the matrix row) compared to the other (the matrix column). The scale used in this study is a five-point fuzzy scale proposed by Tesfamariam and Sadiq (2006) based on the hourly scale. Using a five-point scale gives experts more leeway when making pairwise comparisons.

Table 9: Linguistic scales for determining fuzzy hierarchical priorities

Explanation	Fuzzy number scale	Linguistic value	Numerical value
The index *i* is equal to or has no precedence over *j*.	(1,1,1)	Same preference	1
Option or index *i* is slightly more critical than *j*.	(1,3,5)	Somewhat preferred	3
Option *i* is more important than *j*.	(3,5,7)	Preferred	5
Option *i* has much more priority than *j*.	(5,7,9)	Very preferred	7
Option *i* is absolutely not more critical than and comparable to *j*.	(7,9,9)	Absolutely preferred	8

After determining the comparison of row *i* and column *j*, the geometric mean of each comparison is determined based on the fashion index. It is important to note that in intuitive fuzzy VIKOR analysis, components are selected as the basis based on propositions as a reference, so in the hierarchical matrix analysis section, prioritized propositions must first be identified.

Table 10: The matrix comparison questionnaire related to research propositions

		Symbols	W1			W2			W3			W4			W5			
Main components	Strategic orientation	W1	1	1	1													Fuzzy comparison of principal components
	Innovation	W2				1	1	1										
	Competencies	W3							1	1	1							
	Structure	W4										1	1	1				
	Culture	W5													1	1	1	

Axel and Saati (1983) introduced using the geometric mean as the best way to combine paired comparisons. Therefore, a geometric mean is taken from the data of each row. The weights obtained are not normal. Normal weight means that the sum of the weights is equal to one. Therefore, the geometric mean obtained in each row is divided by the sum of the elements of the geometric mean column. The new column containing each criterion's normalized weight is called the Eigenvalue. The final weight of each matrix is the resulting particular vector column. Therefore, Table 11 determines the weight of each component based on the above relation.

6.5. Aggregation of pairwise comparison matrices

After gathering experts' opinions about the research propositions, this step aggregates them using the geometric mean. It is assumed (*lk*, *mk*, *rk*) is a triangular fuzzy number corresponding to the opinion of the most trustworthy *k,* in which *lk*, *mk*, and *rk* are the most pessimistic, most probable, and most optimistic values, respectively. Then, the aggregate value of the experts' opinions is calculated using Equation (1):

$$\tilde{a}_{ij} = \left(\sqrt[k]{l_1 \times l_2 \times \cdots l_k}, \sqrt[k]{m_1 \times m_2 \times \cdots m_k}, \sqrt[k]{r_1 \times r_2 \times \cdots r_k}\right) \quad (1)$$

6.6. Defuzzification expert opinions

After forming the aggregate fuzzy pairwise comparison matrix, de-fuzzy is performed at this stage. The center of the area (COA) method is used for the defuzzification of the matrix of fuzzy pairwise comparisons assembled into actual values (Islam et al., 2017). $\widetilde{\mathrm{R}}_{\mathrm{i}} = \left(\mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}}, \mathrm{M}\widetilde{\mathrm{R}}_{\mathrm{i}}, \mathrm{U}\widetilde{\mathrm{R}}_{\mathrm{i}}\right)$ is assumed to be a triangular fuzzy number, so based on the approach of Wu et al. (2009), the fuzzy value is calculated as follows:

$$\mathrm{BN}\widetilde{\mathrm{P}}_{\mathrm{i}} = \frac{\left[\left(\mathrm{U}\widetilde{\mathrm{R}}_{\mathrm{i}} - \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}}\right) + \left(\mathrm{M}\widetilde{\mathrm{R}}_{\mathrm{i}} - \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}}\right)\right]}{3} + \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}} \quad (2)$$

Using the above relation, the matrix elements of the fuzzy aggregate pairwise comparisons are transformed into definite numbers.

6.7. Calculating local weights

After collecting the data and converting the views of each news item into the corresponding fuzzy numbers, matrices of matched comparisons are obtained. Expert opinions are then aggregated using the geometric mean. $\tilde{\mathrm{A}}$ matrix of pairwise comparisons is assumed to be aggregated, then based on the approach of Wu et al. (2009), the fuzzy local weight for the criteria or sub-criteria from Equations (3) to (5) is calculated as follows:

$$\tilde{\mathrm{A}} = \begin{bmatrix} 1 & \tilde{\mathrm{a}}_{12} & \dots & \tilde{\mathrm{a}}_{1n} \\ \tilde{\mathrm{a}}_{21} & 1 & \dots & \tilde{\mathrm{a}}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{\mathrm{a}}_{n1} & \tilde{\mathrm{a}}_{n2} & \dots & 1 \end{bmatrix} \quad (3)$$

$$\tilde{r}_i = \left(\tilde{\mathrm{a}}_{i1} \times \tilde{\mathrm{a}}_{i2} \times \cdots \times \tilde{\mathrm{a}}_{in}\right)^{1/n} = \quad (4)$$

$$\tilde{w}_i = \left(\tilde{r}_i \times \left(\tilde{r}_1 + \tilde{r}_2 + \cdots + \tilde{r}_n\right)^{2}\right) \quad (5)$$

where $\tilde{a}_{ij}$ is the value of the aggregated pairwise comparison of criterion *i* compared to criterion *j*; $\tilde{r}_i$ is the geometric mean of the fuzzy pair comparison value of criterion *i* compared to other criteria; $\tilde{w}_i$ indicates the solution weight of criterion *i*. Finally, the final weight of each sub-criterion is calculated by multiplying the local weight of the main criterion by the local weight of that sub-criterion. After collecting the opinions of the research participants in the form of expressive items presented in Table 7, the matrix of fuzzy pairwise comparisons is formed based on their opinions. In fact, after creating the pairwise comparison matrix, it is about the main criteria. The participants' opinions are first aggregated using the following equation to form a fuzzy pairwise comparison matrix for the main criteria.

$$\tilde{a}_{ij} = \left(\sqrt[k]{l_1 \times l_2 \times \cdots l_k}, \sqrt[k]{m_1 \times m_2 \times \cdots m_k}, \sqrt[k]{r_1 \times r_2 \times \cdots r_k}\right) \quad (6)$$

Therefore, Table 9 presents a fuzzy pair comparison matrix that summarizes research participants' views about research propositions. A pairwise comparison between the research propositions should be determined at this stage. Relying on linguistic scales in hierarchical fuzzy, the score is as follows.

$$\mathrm{BN}\widetilde{\mathrm{P}}_{\mathrm{i}} = \frac{\left[\left(\mathrm{U}\widetilde{\mathrm{R}}_{\mathrm{i}} - \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}}\right) + \left(\mathrm{M}\widetilde{\mathrm{R}}_{\mathrm{i}} - \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}}\right)\right]}{3} + \mathrm{L}\widetilde{\mathrm{R}}_{\mathrm{i}} \quad (7)$$

These weights are presented in Table 11. Notably, the compatibility rate (CR) for the pairwise comparison matrix of the original criteria is 0.08. Since the compatibility rate is less than 0.1, the matrix of pairwise comparisons of research propositions is consistent.

Table 11: The fuzzy local weight of research propositions

		Symbols	Weight of matrix comparison matrix criteria		
Main components	Strategic orientation	W1	(0.295; 0.334; 0.463)	1th	Rank
	Innovation	W2	(0.198; 0.277; 0.310)	3th	
	Competencies	W3	(0.213; 0.288; 0.322)	2th	
	Structure	W4	(0.121; 0.156; 0.254)	5th	
	Culture	W5	(0.178; 0.251; 0.297)	4th	
		CR = 0.08 < 0.1			

As Table 9 shows, based on the fuzzy local weight of the research propositions, the most critical parameter for the development of mutual learning to assess the maturity of intellectual capital is the strategic orientation, which has the highest importance rate compared to other fuzzy weights. It has other research propositions. After completing this step, based on the research propositions, the most strategic component of the research, i.e., the most effective basis for evaluating the maturity of intellectual capital, should be selected. Accordingly, if $D = [x_{ij}]_{m\times n}$ is a fuzzy-intuitive decision matrix for a multi-criteria decision problem where $A_1, A_2, \ldots, A_m$ are the options for decision-makers, and $C_1, C_2, \ldots, C_n$ are the criteria for review. Therefore, x_{ij} is the rank of the A_i option according to the C_j criterion, which will be expressed in a similar intuitive fuzzy way. First, in this section, it is necessary to define linguistic variables to rank the components.

Table 12: The expression variables for ranking

Expressive terms	Corresponding intuitive fuzzy number
Very weak	⟨[(0,0,1); 0.10], [0,0,1.5); 0.90]⟩
Weak	⟨[(0,1,2.5); 0.20], [0.5,1,2.5); 0.75]⟩
Medium downward	⟨[(0,3,4.5); 0.35], [1/5,3,5.5); 0.60]⟩
Medium	⟨[(2.5,5,6.5); 0.50], [3.5,5,7.5); 0.45]⟩
Medium upward	⟨[(4.5,7,8); 0.65], [5.5,7,9.5); 0.35]⟩
Good	⟨[(5.5,9,9.5); 0.80], [7.5,9,10); 0.15]⟩
Very good	⟨[(8.5,10,10.5); 0.90], [9.5,10,10); 0.10]⟩

Given the knowledge of this scale, in a group decision-making environment, k should first evaluate each option's status according to the criteria using the mean method according to Equation (17).

$$x_{ij} = \frac{1}{K}[x_{ij}^1 + x_{ij}^2 + \cdots + x_{ij}^k] \quad (8)$$

Then, the following equations are used to rank the factors based on the intuitive fuzzy VIKOR analysis. The best rank x_i^+ and the worst rank x_i^- of each criterion must first be calculated:

$$x_i^+ = \max x_{ij}, x_j^- = \min x_{ij} \quad (9)$$

$$A^+ = \{x_1^+, x_2^+, \cdots x_n^+\}, A^- = \{x_1^-, x_2^-, \cdots x_n^-\} \quad (10)$$

where A^+ and A^-points are positive and negative ideals, respectively, that are subjective and cannot be assigned to a candidate. So far, no one has been able to offer a perfect solution, which is not strange. In the second drama, S_i and R_i for $i = 1, 2, 3, \ldots, m$, which represent the mean and worst group scores for option A_i, respectively, are calculated according to the following equations:

$$S_i = \sum_{j=1}^{n} w_j \times \left(\frac{x_i^+ - x_{ij}}{x_i^+ - x_j^-}\right) = \langle [S_{1i}, S_{2i}, S_{3i}); \mu_{s_i}], (S'_{1i}, S'_{2i}, S'_{3i}); \nu_{s_i}\rangle \quad (11)$$

$$R_i = \max\left(w_j \times \left(\frac{x_i^+ - x_{ij}}{x_i^+ - x_j^-}\right)\right) = \langle [R_{1i}, R_{2i}, R_{3i}); \mu_{s_i}], (R'_{1i}, R'_{2i}, R'_{3i}); \nu_{R_i}\rangle \quad (12)$$

Calculate the rating index (Q_i) $i = 1, 2, 3, \cdots, m$ according to the following relation:

$$Q_i = V\left(\left|\frac{S_i^+ - S_{ij}}{S_i^+ - S_j^-}\right|\right) + (1 - V)\left(\left|\frac{R_i^+ - R_{ij}}{R_i^+ - R_j^-}\right|\right) = \langle [Q_{1i}, Q_{2i}, Q_{3i}); \mu_{Q_i}], (Q'_{1i}, Q'_{2i}, Q'_{3i}); \nu_{Q_i}\rangle \quad (13)$$

$$S^- = Max_i S_i, S^* = Min_i S_i, R^- = Max_i R_i, R^* = Min_i R_i$$

Note: The weight of the majority of the strategy agrees with the standard or maximum group desirability.

In the above relation, $\left|\frac{S_i^+ - S_{ij}}{S_i^+ - S_j^-}\right|$ indicates the ratio of the distance to the negative ideal solution of option *i*. In other words, the majority agrees with ratio *i*; $\left|\frac{R_i^+ - R_{ij}}{R_i^+ - R_j^-}\right|$ shows the ratio of the distance to the ideal solution of option *i* and indicates opposition to the ratio of option *i*. Therefore, the value of *v* is greater than 0.5, and Q_i leads the majority to agree; when the value is less than 0.5, index Q_i indicates the negative attitude of the majority. In general, when the value of *v* is equal to 0.5, it indicates the agreed attitude of the experts. The following equation converts the intuitive fuzzy Q_i calculated to a definite Q_i

$$Q_i = \frac{\langle [Q_{1i}, Q_{2i}, Q_{3i}); \mu_{Q_i}], (Q'_{1i}, Q'_{2i}, Q'_{3i}); \nu_{Q_i} \rangle}{6} \quad (14)$$

Based on the calculated Q_i value, the options are prioritized. Based on the equations developed in the intuitive fuzzy VIKOR analysis, the research criteria are prioritized as the basis of research in this section. Considering that in order to determine the importance of each of the components and themes determined for choosing the decision basis (strategic capabilities), the participation of 50 members of the target community in a small part was used, according to the *Mode* index, the highest frequency distribution for each of the verbal expressions was used. The *Mode* index was used to reduce the complexity of significant processes so as to determine the importance of each criterion, i.e., its components and themes, in the form of tables; thus, the importance of the decision basis (assessment of intellectual capital maturity) could be determined. Then, in Table 12, the importance of the decision basis (assessment of intellectual capital maturity) was determined concerning the themes (two-way learning propositions). In Table 12, the *fashion* index was used for the importance of the decision basis (strategic capabilities).

Table 13: Determining the importance of the decision basis (assessment of intellectual capital maturity) concerning the topics

			Themes ambidextrous learning propositions				
		Symbols	Strategic orientation	Innovation	Competencies	Structure	Culture
			W1	W2	W3	W4	W5
Assessing the maturity of intellectual capital	Sustainability of knowledge creation	V1	Good	Relatively bad	Medium	Good	Good
	Sustainability of education	V2	Fair	Medium	Bad	Fair	Fair
	Sustainability of participation	V3	Good	Bad	Relatively bad	Fair	Fair
	Stability of effective communication	V4	Fair	Fair	Bad	Fair	Fair
	Axis technology sustainability	V5	Medium	Relatively bad	Relatively bad	Medium	Relatively bad
	Sustainability of inclusive value creation	V6	Fair	Medium	Very bad	Fair	Medium

The verbal ratios assigned to determine the importance of the decision basis (the assessment of intellectual capital maturity) to the themes, i.e., ambidextrous learning propositions, should be converted into triangular intuitive fuzzy numbers. Then, the decision-makers' opinions should be aggregated.

Table 14: The intuitive fuzzy decision matrix and the weight of each theme based on the decision basis

		Research components			
	Symbols	V1	V2	⋯	V6
Research topics	W1	⟨[(5.15/6.65/385); 0.50, [(7.15/5.5/805); 0.20]⟩	⟨[(4.25/5.15/315); 0.40, [(6.5/5/765); 0.20]⟩	⋯	⟨[(2.2/3/155); 0.25, [(3.3/3.1/275); 0.20]⟩
	W2	⟨[(4/5.2/305); 0.35, [(5.65/5/645); 0.25]⟩	⟨[(3,7/4.1/270); 0.30, [(4.4/4/425); 0.20]⟩	⋯	⟨[(3/3.85/235); 0.25, [(4.15/3.9/410); 0.20]⟩
	⋮	⋮	⋮	⋯	⋮
	W5	⟨[(3.5/4.25/275); 0.30, [(4.5/4/425); 0.25]⟩	⟨[(4/5.05/300); 0.30, [(5.6/5/625); 0.20]⟩	⋯	⟨[(2/2.8/155); 0.25, [(3/3.3/280); 0.20]⟩

At this stage, the most influential component to determine the essential basis of the decision, namely the assessment of intellectual capital maturity, must be combined to determine which of the themes (ambidextrous learning) has a more fundamental role in assessing intellectual capital maturity.

Table 15: The determination of intuitive fuzzy weights

		Symbols	Weight of matrix comparison matrix criteria		
Research topics	Strategic orientation	W1	⟨[(0.65/0.9/0.965); 0.75, [(0.85/0.95/1); 0.20]⟩	1th	Rank
	Innovation	W2	⟨[(0.25/0.35/0.5); 0.25, [(0.3/0.35/0.60); 0.75⟩	5th	
	Competencies	W3	⟨[(0.60/0.85/0.95); 0.75, [(0.8/0.85/0.9); 0.20]⟩	2th	
	Structure	W4	⟨[(0.32/0.40/0.65); 0.40, [(0.35/0.40/0.60); 0.55⟩	4th	
	Culture	W5	⟨[(0.55/0.8/0.885); 0.60, [(0.65/0.8/0.85); 0.30]⟩	3th	

Accordingly, in ranking the components of the evaluation of intellectual capital maturity, it was determined that strategic orientation considered ambidextrous learning the basis of effectiveness in evaluating intellectual capital maturity. After preparing the fuzzy aggregate decision matrix, they were first normalized by Equations (15)–(19). This matrix will become a finite decision matrix using Equation (7).

$$R = \left|\tilde{r}_{ij}\right|_{m\times n} \quad (15)$$

$$\tilde{r}_{ij} = \left[\frac{a_{ij}}{C_j^{max}}, \frac{b_{ij}}{C_j^{max}}, \frac{C_{ij}}{C_j^{max}}\right], j \in B \quad (16)$$

$$\tilde{r}_{ij} = \left[\frac{a_j^{min}}{C_{ij}}, \frac{a_j^{min}}{b_{ij}}, \frac{a_j^{min}}{a_{ij}}\right], j \in C \quad (17)$$

$$C_j^{max} = \max_i C_{ij} \text{ if } j \in B \quad (18)$$

$$a_j^{min} = \min_i a_{ij} \text{ if } j \in C \quad (19)$$

where *m* is the number of matrix options; *n* indicates the number of target sub-criteria; *B* is a set of desirability criteria; *C* represents the set of criteria with unfavorable (cost criteria); r_{ij}^{p}; r_{ij}^{m}, and r_{ij}^{o} are the worst, most probable, and best computational values of the normalized fuzzy decision matrix, respectively.

Table 16: The deposited matrix of themes to determine the most effective dimension of intellectual capital maturity

			Themes of ambidextrous learning propositions				
		Symbols	Strategic orientation	Innovation	Competencies	Structure	Culture
			W1	W2	W3	W4	W5
Assessing the maturity of intellectual capital	Sustainability of knowledge creation	V1	0.717	0.814	0.796	0.609	0.571
	Sustainability of education	V2	0.782	0.493	0.683	0.255	0.279
	Sustainability of participation	V3	0.092	0.098	0.075	0.111	0.083
	Stability of effective communication	V4	0.428	0.638	0.629	0.362	0.293
	Axis technology sustainability	V5	0.109	0.121	0.048	0.318	0.251
	Sustainability of inclusive value creation	V6	0.510	0.164	0.355	0.404	0.415

After forming this matrix, selecting the ideal positive and negative solutions from the two-way learning themes is necessary to select the most desirable solution for evaluating the maturity of intellectual capital. Therefore, based on Equations (20) and (21), this section performs the analysis.

$$S_i = \sum_{j=1}^{n} w_j(\tilde{f}_j^* - \tilde{f}_{ij})/(\tilde{f}_j^* - \tilde{f}_{ij}^-) \qquad (20)$$

$$R_i = \underset{j}{Max}\left[w_j(\tilde{f}_j^* - \tilde{f}_{ij})/(\tilde{f}_j^* - \tilde{f}_{ij}^-)\right] \qquad (21)$$

In the above relations, S_i represents the ratio of the distance of option i from the positive ideal solution (best combination); R_i indicates the ratio of the distance of option i to the solution of the negative ideal (worst combination); w_j is the weight below the standard j; According to these relationships, the highest rank is based on the value of S_i, and the worst rank is based on the value of R_i.

Table 17: Ideal positive and negative solutions in intuitive fuzzy VIKOR method

		Themes of ambidextrous learning propositions				
	Symbols	Strategic orientation	Innovation	Competencies	Structure	Culture
		W1	W2	W3	W4	W5
Positive ideal solution	S_i	o.658	0.641	0.403	0.418	0.590
Negative ideal solution	R_i	0.376	0.507	0.493	0.352	0.298

As can be seen, the highest level of a positive ideal is related to the content of strategic orientation (W1) for the effectiveness of the assessment of intellectual capital maturity, which has achieved the highest level of a positive ideal (S_j = 0.658). The lowest negative ideal is also related to the culture theme (W5), with an R_j of 0.298. The following are the values of S_i; R_i and Q_i are calculated based on Equations (13) and (14). In fact, Table 17 is based on the Q_i index of prioritizing the criteria for assessing the maturity of intellectual capital as a decision option. As Equation (14) explains, the optimal value of the Q_i index, i.e., v, equals 0.5. Based on the Q_i index and according to the fuzzy VIKOR analysis guidelines, the decision option with the lowest value is selected as the most effective strategic capability of sustainable development. These results are presented in Table 18.

Table 18: Determining the most desirable option for assessing the maturity of intellectual capital based on the implementation of the fuzzy VIKOR method

		Evaluation criteria				
Description of strategic capabilities	**Symbol**	S_i	R_i	Q_i		
Sustainability of knowledge creation*	V1	0.254	0.076	0.025	1th	**Rank**
Sustainability of education	V2	0.318	0.164	0.093	2th	
Sustainability of participation	V3	0.555	0.296	0.525	6th	
Stability of effective communication	V4	0.493	0.206	0.385	4th	
Axis technology sustainability	V5	0.517	0.264	0.413	5th	
Sustainability of inclusive value creation	V6	O.461	0.193	0.337	3th	

As it turned out, the stability of knowledge creation was determined based on the value of the Q_i index equal to 0.025, which indicates that the most desirable dimension of evaluating the maturity of intellectual capital is based on the content of strategic tendencies as an ambidextrous learning proposition.

7. Conclusions

This study aimed to investigate the maturity of intellectual capital based on the themes of the two-way learning link in oil and gas knowledge-based companies based on intuitive fuzzy sets. According to the first and second questions of the research and based on AHP hierarchical fuzzy analysis in the surveyed companies, we found that the most significant proposition of the two-way learning link was related to strategic tendencies in learning. It shows companies' efforts to find low-cost ways to develop organizational learning and new products. The role of strategic tendencies in achieving such a goal is undeniable, and companies must build their first learning infrastructure within their development strategies. In other words, given that today's organizations operate in a competitive environment, only companies can remain in this competitive arena which can plan with a competitive approach under constantly changing environmental conditions. Strategic trends can redraw conventional competitive models in the industry to create new values for the stakeholders and strive for sustainability based on their capacities and capabilities. Strategic tendencies will cause a metamorphosis in a competitive environment so that the company can create strong interactions with the external environment through knowledge and experiences gained within it to strengthen its sustainable development capacity in a competitive environment. Following the results, in line with the third question of the research, which aimed to determine the most effective basis for assessing intellectual capital maturity based on the existence of ambidextrous learning link, it should be stated that under strategic tendencies, knowledge creation sustainability is the most effective basis for evaluating intellectual capital maturity. In other words, as explained, strategic trends cause the company's approaches to environmental change to be purposefully assessed within the company's structures.

Moreover, the second was to recognize external opportunities and threats to identify the knowledge needed to seize opportunities and reduce threats. In this case, the company can strengthen knowledge creation by increasing education and skill capabilities through a series of codified strategies. It is noteworthy that through the sustainability and effectiveness of identifying environmental capacities, strategic trends enable the company to acquire knowledge based on environmental changes and, by combining them, to increase productivity. Instead of simply reacting defensively to environmental changes, the company should create knowledge through the functions of its intangible assets to increase its effectiveness and strengthen its competitive foundations. With the maturity of intellectual capital, knowledge creation will become a continuous process under coherent strategic tendencies. Moreover, it causes a cycle of information to flow within the company's structures and replaces up-to-date and constantly acquired knowledge with traditional and fixed knowledge in all parts of the company. The maturity of intellectual capital in the form of the sustainability of knowledge creation helps improve existing knowledge, refine past practices, and implement the integrated values of sharing individual skills and experiences across the company.

Moreover, the sustainability of training in strategic learning orientations helps the company strengthen intellectual capital maturity. Strategic trends recognize the changing needs of the environment through needs-

tested training programs to use all the capabilities and capacities of companies to provide an influential role of human resources, thereby increasing the organization's productivity. By continuing its training programs, a company will be able to mature the functions of intellectual capital by creating a valuable understanding of human resources and, through it, create the knowledge needed by the company in harmony with the external environment, corresponding to the results obtained by Leon and Ferris (2011), Ubrina et al. (2009), Naieji et al. (2018), and Khalil Nezhad et al. (2020).

Based on the results obtained, it is suggested that companies, given the existing limitations in the field of environmental instability, should strengthen their strategic capacities with other companies active in the industry based on strategic models such as consortiums. In this way, they can create practical knowledge to advance their goals. It should be noted that undiscovered capacities in the performance nature of companies are among the weaknesses and challenges of companies, which shows that they ignore the analysis of strategic trends. Therefore, by changing the traditional procedures and redundant structural layers in identifying development-oriented capacities, it is necessary to act, so that intellectual capital reaches maturity only from the point of view of valuable assets and realizes the continuity of intangible assets. On the other hand, since it has been found that the competency proposition as a link between utilization and exploration in ambidextrous learning has been given second priority, it is suggested that the internal processes of participation in human resource strategies be strengthened to combine knowledge, skills, abilities, and motivations with the level of task performance in companies. Thus, companies can improve the level of intellectual capital while creating knowledge to assess the training needs in the framework of written programs and can strengthen the necessary effectiveness in competitive functions.

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