

Influence of Intellectual Capital in the Organizational Innovation

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Abstract—corporate bodies or institutions have used the knowledge management structure, thereby utilising the system approach in knowledge management systems (KMS) to better achieve their aim and objectives. This reflects an improvement and performance of business processes, because KMS is the discipline of enabling individuals, teams, and entire organisations to collectively and systematically create and share an atmosphere of learning, applying the knowledge of growth in organisational innovation. The present study aimed at investigating the impact of dimensions of intellectual capital (human, structural, of customers) upon organisational innovation in the companies of the study field. Consequently, the research has launched the hypothesis which confirmed that there is an impact for an intellectual capital in organisational innovation. However, to accomplish the objectives of this study, 60 sampling forms were sent to companies, and the acceptance was impressive. 52 per cent were acknowledged, and this confirmed a good response from the companies. Furthermore, comparisons were made with experimental testing and the results were analysed. The results indicated that structural and human capital have an influence upon organisational innovation, while the rest of the components have no moral effect. Therefore, the study has rejected the main hypothesis for research. In addition, the study has suggested an important set of recommendations that will give greater attention to customer capital, for purposeful builds of humans’ capabilities and the expansion of relations between customers should be adhered to. This is because for the companies there was a weakness in public relations with their suppliers, clients, and partners.

Index Terms—Intellectual capital, knowledge systems, organizational innovation.

I. INTRODUCTION

Many organisations have realized the important fact that their real value is not reflected in their materialistic capital, but in their intellectual capital. This view has required of the manufacturing companies the complete transformation from present structures, perceptions and approaches in management and organisational ambience. One of the approaches processing this transformation possible is the acquired intellectual capital.

Accordingly, this research gives a primary conceptual model for KM, intellectual capital and their role in creating organisational capital. This view is based on the premise which considers that the intellectual capital is nowadays a strategic element in industrial enterprises. [1] has considered intellectual capital as the most strategic source for the

companies. Consequently, this paper has discussed some issues that are displayed in the framework).

II. INTELLECTUAL CAPITAL

The collective knowledge of employees in the companies can be used to produce wealth. This is because intellectual capital offers significant resources and it can be considered non-material wealth in a broader perspective, determining its scope and components [2]. Therefore, Stewart has defined intellectual capital as a package from useful knowledge [3], while Reid sees that the intellectual capital is knowledge group, information, skills and experiences which hold the economic value and enable growth achievement, when applied in the industrial projects [4]. Also, Drucker has highlighted six master factors which could help companies enhance their knowledge productivity; task, autonomy, continuing innovation, continuing learning, quality and worker assets [5]. That means, intellectual capital research can cater to changes in realisation or behaviour of individuals, which is essential for learning and enhancement. However, according to Plessis, the following factors are very important in the KM: “(1) initiate action based on knowledge; (2) support business strategy implementation; (3) become an intelligent enterprise; (4) increase competitive advantage; (5) create an innovative culture and environment; (6) entrench collaboration as a work practice; and (7) ultimately improve work efficiency” [6], as shown in Fig. 1.

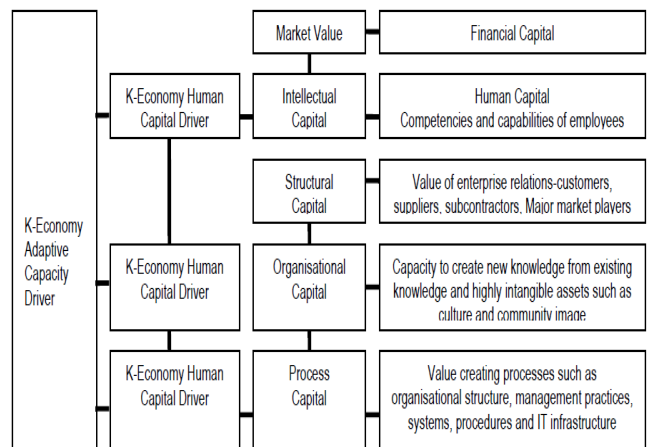


Fig.1. The drivers for organisational learning and knowledge [7].

Accordingly, there were many views and propositions to determine and give clear vision for the components of intellectual capital. Sveiby believes that intellectual capital consists of workers and efficiency of the internal structure of the management, organisation and software, the organisation culture (the external structure represented in the benchmarking), and organisation culture and relationships

with customers [8]. Devenport and Prusak have limited intellectual capital by three sorts too: human capital, intellectual property, and individual capital [9]. Stewart identifies also three types of intellectual capital: human capital, structural capital and customer capital [3]. At the same time, Edvinsson says the main distinction is between human capital and structural capital, which can then be divided into organisational capital and customer capital [10]. As well, Edvinsson explains that the main differentiation is between human capital and structural capital, which can then be divided into organisational capital and customer capital [10]. From the above we note the existence of a convergence of views on the components of intellectual capital. Therefore, the study will be based on three components (human capital, structural capital, customer capital) as variables relied upon in this research.

III. KNOWLEDGE MANAGEMENT SYSTEM

KM is nowadays the hottest topic. This is because knowledge is actually “a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experience and information”. It “originates and is applied in the minds of knowers” [11]. In other words, new knowledge acquisition is indispensable in the development and improvement of new skills in work. That is because ease of understanding and effectiveness in learning by employees are significant considerations for organisations in corporate knowledge acquisition [12].

Furthermore, for many organizations, innovation is at present a required and fundamental element of the firms’ sustainability in the marketplace. This is because it considers significant and complex dimensions of learning in work due to using a mix of rationale, the spontaneous processes affecting practising communities [13], whereas according to Liao, knowledge acquisition and creation are considered internally in the companies as the first steps in acquiring knowledge from the external environment to turn it into effective action that can be applied or used within organizations [14]. Consequently the companies must work hard and quickly in disseminating knowledge practically in all of its districts to create innovation among employees.

According to Puranam is believed that the organisational learning process during knowledge acquisition is considered as ‘grafting’, as its purpose is to acquire complex patterns of information or knowledge [15]. This is because knowledge-grafting through imitation is faster from knowledge acquisition with experience, and therefore the firms are lunged towards a grafting of the new capabilities at the organisations’ current knowledge base in order to develop the processes of the manufacturing, when human resources contain knowledge offered by employees in formats of capacity, commitment, motivation and loyalty, additionally in form of advice or comments.

Consequently, some of the master components are experience, technical expertise, and problem-solving competence, innovation, education, attitude, and entrepreneurial spirit [16]. At the present time, the companies have considered that the combination process between

intellectual capital, knowledge management and technologies collectively is a thrilling challenge to leaderships. This allows creating institutions with the possibilities of modern information [17]. This means viewing the knowledge as roots to intellectual capital, which will result in future benefits to the companies [18].

IV. ORGANIZATIONAL INNOVATION

Innovation nowadays is considered the fundamental source of value creation in companies. Therefore, it has been defined in many different concepts. One of these concepts is defined as the creation of new knowledge and ideas to develop new products and facilitate business operations continually, with the aim of enhancing processes and internal business structures to create market-driven products [19, 20].

In this sense, innovation is the principal mechanism of competition for many companies, particularly in technology and knowledge-based industries. Commonly, the innovation practice can be understood as a complex activity in which new knowledge is applied for commercial ends [21]. Accordingly, study of the relation between innovation and intellectual capital should take into account the various types of innovation to cover the gap. Where some authors have classified the innovation as administrative and technical, this type of innovation refers to the changes in organisational structure and processes, such as authority, task-structuring, personnel recruitment, resources allocation and rewards. Technical innovation indicates the knowledge that links methods, components, and techniques with processes to create a product or service. Radical innovation is the main change that represents a new technological pattern, and requires more organisational capabilities and superior profundity of knowledge. Finally, incremental innovation is defined as slight technological changes in organisation to create products or services. However, these authors have considered these sorts of innovation as main reasons to a survival and growth of companies [22, 23, 24, 25, 26, 27].

V. METHODOLOGY

A. Research Method

The study in the methodology has adopted the questionnaire survey that was conducted in Iraqi manufacturing companies. The industry is concentrated in clusters in the Middle Euphrates region, especially in Babylon, in two organised industrial zones, where there is Automaker, which represents the only company to use an assembly line for the vehicle production in Iraq. There was a line to small oil refineries production. In addition, there was a company in the textile industry that contains two plants for the production of the miscellaneous fabrics.

Fig. 2 and 3 explain the theoretical research model and the relationships among all the variables. The study model has highlighted the influence of intellectual capital in the organisational innovation through a diagnosis and determines the relationship and the effect between the components of intellectual capital and organisational creativity for the companies of the study field.

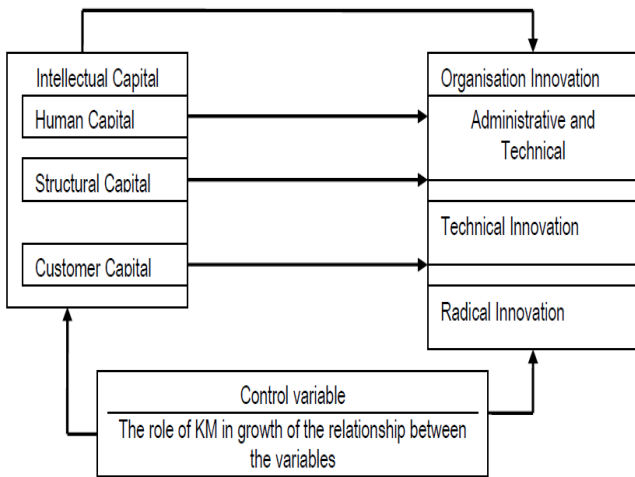


Fig. 2. Research framework.

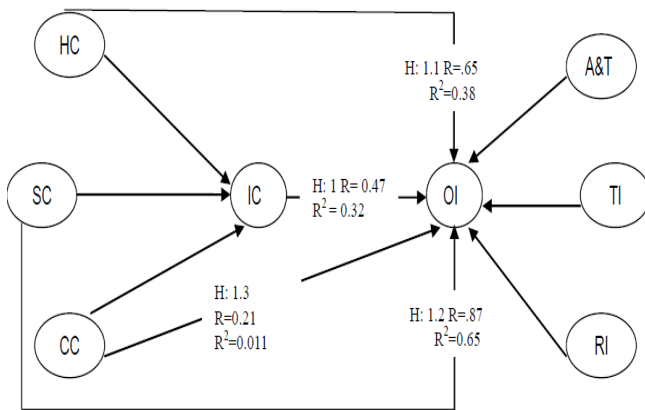


Fig. 3. A model of the relationships among the variables.

B. Significance of Research

Importance of research stems from the importance of the variables that are discussed in the contemporary administrative thought. This represents intellectual capital, a resource from resources of the industrial companies and reflects a feature of the companies and its value. The change and rapid development in the environment in which they compete requires of companies more creativity in the industrial and technological aspects. Accordingly, for the purpose of the adoption, of innovation there must be exploitation by the companies of its internal resources, including intangible resources, which are equal to three quarters of the resources.

C. Data Collection and Samples

The data for this study was collected throughout the manufacturing companies in a field survey. The names and addresses of the companies were obtained from the Database of the Iraq Ministry of Industry and Minerals. The survey was made in January 2011. The respondents of the questionnaires were managers of the production R and D department and quality control, with 34 forms for two companies, i.e. 17 forms for each. The acceptance was 100% for the Textile Industry, and 88% for the Automotive Industry Company.

This means that a total of 32 forms were sent and the acceptance of 94% was a good percentage of response of the sample in these companies to the questionnaire supplied. To increase the valid survey response rate, the researcher has used Skype software for a discussion with the respondents

for the purpose of explaining anything unclear to both sampled companies. Also, the researcher explained the objectives of the study and the questionnaire content, and confirmed the names and job titles of the respondents prior to questionnaire-mailing. The researcher was asked to return the completed questionnaires within one month through mailing. Tables I-IV explain sample characteristics in these companies.

TABLE I: DISTRIBUTION OF THE SAMPLE ACCORDING TO SEX

Sex	Frequency	Percentage
Female	12	37.5%
Male	20	62.5%
Total	32	100%

TABLE II: DISTRIBUTION OF THE SAMPLE ACCORDING TO AGE

Age	Frequency	Percentage
20-25	6	19%
26-30	5	16%
31-35	8	25%
36-40	9	28%
41UP	4	21%
Total	32	100%

TABLE III: DISTRIBUTION OF THE SAMPLE ACCORDING TO ACADEMIC QUALIFICATION

Age	Frequency	Percentage
PhD	-	-
MSc	3	9%
Diploma	5	16%
BSc	18	56%
Institute	5	16%
Secondary	1	3%
Total	32	100%

TABLE IV: DISTRIBUTION OF THE SAMPLE ACCORDING TO CAREER YEARS

Age	Frequency	Percentage
Less than Two years	-	-
3-6	2	6%
7-10	5	16%
11-14	9	28%
15-18	10	31%
19UP	6	19%
Total	32	100%

VI. RESULTS AND DISCUSSION

The researcher has tabulated data for a sample study, according to the variables of study that has been displayed in the study model and a model of the relationships among the variables, and the results in Tables 5-8 were as follows according to Eq. 1,

$$WAC = \frac{V1xW1 + V2xW2 +VnWn}{N} \tag{1}$$

A. Human Capital

Table V highlighted the items that are related to human capital, which is related to the companies' staff in the study field. Therefore, it has explained that the paragraph minimum achieved in the third question, and the arithmetic average of 4.3 which is not quite different from what appeared in the other averages. This question is related to the developing of a high skill level in employees.

TABLE V: FREQUENCY DISTRIBUTION AND RELATIVE FOR ANSWERS OF STUDY SAMPLE'S ON HUMAN CAPITAL

Item	Agreed		Mostly agreed		Neither agree nor disagree		Mostly disagree		Disagree		Average %
	F	R %	F	R %	F	R %	F	R %	F	R %	
The company relies on employees with experience and skill in job.	20	63	8	25	3	9	1	3	-	-	4.5
The company has employees with great confidence in the business performance and without hesitation.	20	63	9	28	3	9	-	-	-	-	4.5
The employees have a level of high-skill developed.	19	59	7	22	4	13	2	6	-	-	4.3
The job vacancies in company dictate a staff of experience and highly skilled.	22	69	8	25	2	6	-	-	-	-	4.5
Emphasises the company's ongoing promotion of qualified personnel and does not allow upgrade of those who have weak performance.	21	66	7	22	5	16	1	3	-	-	4.7
The company is struggling to provide workers with practical skills from thorough intensive training programs.	23	72	7	22	-	-	2	6	-	-	4.6

B. Structural Capital

Table VI indicates that the highest average was in paragraphs 2 and 3, where the average for both items was 4.8. This indicates that the company is concerned with the intellectual rights to develop the quality of its products and stimulate employees to continue in creating innovative ideas.

Also, it indicates these ideas are employed in the company for excellence in work. A low average has been achieved in the first paragraph, which confirms that there is not support by the company to patents, where there has been an average value of 3.2.

C. Customer Capital

Table VII shows the results of the sample answers about the customer capital, where the lowest average was found for

the fifth question. The question checks whether the efforts are directed by the company to engage customers in its operations; average value was 3.6. The highest average has been achieved in the first question, which confirms that the company operates at full capacity in order to satisfy customers. Also, with question six, which emphasizes that the company is struggling to gain potential for new customers, the average was 4.7, which was a good result.

TABLE VI: FREQUENCY DISTRIBUTION AND RELATIVE FOR ANSWERS OF STUDY SAMPLE'S ON STRUCTURAL CAPITAL

Item	Agreed		Mostly agreed		Neither agree nor disagree		Mostly disagree		Disagree		Average %
	F	R %	F	R %	F	R %	F	R %	F	R %	
The firm supports the patents and carries out operations.	5	16	1	3	4	13	10	31	12	37	2.3
Firm buys the copyright of its employees.	17	53	6	19	7	22	1	3	1	3	4.2
The processes of assessing the quality of the firm's products are good.	20	63	8	25	3	9	1	3	-	-	4.5
The firm is interested with trademark and gives it special attention due to its importance to the company and the customer.	16	50	4	13	2	6	3	9	7	22	3.6
The firm's information system works very well because it allows transfer of the required information from all over the company.	19	59	4	13	6	19	-	-	3	9	4.1
The regulations and regulatory procedures in the firm are supporting innovation.	18	56	8	25	1	3	-	-	5	16	3.6

TABLE VII: FREQUENCY DISTRIBUTION AND RELATIVE FOR ANSWERS OF STUDY SAMPLE'S ON CUSTOMER CAPITAL

Item	Agreed		Mostly agreed		Neither agree nor disagree		Mostly disagree		Disagree		Average %
	F	R %	F	R %	F	R %	F	R %	F	R %	
	The firm operates at full capacity to satisfy customers.	24	75	6	18	2	6	-	-	-	
The firm is conducting dialogue with customers to identify their needs and desires.	21	66	5	16	4	12	2	6	-	-	4.4
The firm is working on the exchange of information that contributes to opening new horizons for cooperation with customers.	17	53	8	25	4	13	3	9	-	-	4.2
The firm seeks to reduce the solution of problems with customers.	19	59	7	22	1	3	3	9	2	6	4.2
The firm is seeking the participation of customers in its operations and transactions.	12	38	9	28	3	9	2	6	6	19	3.6
The firm is struggling to gain potential for new customers.	22	69	5	16	2	6	3	9	-	-	4.4

D. Organisational Innovation

Table VIII explains that the highest average value achieved in the sixth question confirms that the companies have used computer systems in the administrative processes, and the ninth question confirms that the company uses practical methods to improve the design and computer-assisted processes (automation).

The average value for both questions was 4.6. This result indicates that the company is using the process methods in the design of production processes. The lowest average was achieved in the third question, which confirms that the companies are holding down the amendments on the composition of raw materials within the labour and the average value was 3.9.

TABLE VIII: FREQUENCY DISTRIBUTION AND RELATIVE FOR ANSWERS OF STUDY SAMPLE'S ON ORGANIZATIONAL INNOVATION

Item	Agreed		Mostly agreed		Neither agree nor disagree		Mostly disagree		Disagree		Average %
	F	R %	F	R %	F	R %	F	R %	F	R %	
	The firm enhances and develops its products based on existing skills and experiences.	21	65	5	16	6	19	-	-	-	
The firm is continually modifying the performance of production processes.	16	50	8	25	6	19	2	6	-	-	4.2
The firm is holding down the amendments on the composition of raw materials within the labour.	14	44	6	18	4	13	3	9	5	16	3.7
The firm is designing new production processes.	13	41	12	38	5	16	2	6	-	-	4.1
The production processes are enhanced by the capabilities and expertise available in the firm.	10	31	14	44	6	19	-	-	2	6	3.9
The firm is using computer systems in the administrative processes.	23	72	6	19	3	9	-	-	-	-	4.6
The firm has introduced a modern information system to help complete the processes.	21	66	5	16	-	-	3	9	3	9	4.2
The firm aims by improving processes to increase productivity and efficiency.	22	69	3	9	1	3	-	-	6	19	4.1
The firm uses practical methods to improve the design and computer-assisted processes (auto-mation)	24	75	3	9	5	16	-	-	-	-	4.6
The firm's created outputs are consistent with the needs of customers.	16	50	10	31	6	19	-	-	-	-	4.3

However, in order to verify the analysis of morale by

assumptions underlying the research, the study has used other statistical methods to test hypotheses of morale between the independent variable and dependent variables. Accordingly, the study launched components in analysis of intellectual capital that were adopted in this study, and represented in organisational innovation (human capital, structural, and customer). The study has used the following equations to account of regression coefficient and Adjusted R² respectively in Tables 9-12, and as follows;

$$R = \hat{\beta}_1 = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sum (x_i - \bar{x})^2} \text{ and } \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \quad (2)$$

$$R^2 = 1 - (1 - R^2) \frac{n - 1}{n - p - 1} = 1 - \frac{SS_{err}}{SS_{tot}} \frac{df_t}{df_e} \quad (3)$$

$$\text{T-test. } t = \frac{\bar{x} - \mu_0}{\delta / \sqrt{n}} \quad (4)$$

$$F - \text{Test} = \frac{\left(\frac{RSS_1 - RSS_2}{p_2 - p_1} \right)}{\left(\frac{RSS_2}{n - p_2} \right)}$$

(5) Table IX highlights the test results of correlation and regression, a coefficient between the intellectual capital and organisational innovation. Test results showed that there is a positive correlation between intellectual capital and organisational innovation. Where the value of the correlation coefficient is equal to 0.47, this explains that there is no significant relationship between the two variables. Additionally, Table IX shows value (t), calculated as equal to 1.75, and it is less than the tabular value (1.88), with a degree of confidence of 95%. This confirms that the intellectual capital with these three variables has no effect on organisational innovation in these companies. Also, test result (f) supports previous analysis, when the calculated value of 2.66 is less than the tabular value (5.12); the degree of confidence is 95% and the degree of freedom 1.9. This indicates that the hypothesis is not statistically acceptable, as the table shows the value of the coefficient of determination (R²) is equal to 0.32, this being a very weak figure.

TABLE IX: RESULTS OF CORRELATION AND REGRESSION COEFFICIENT BETWEEN THE INTELLECTUAL CAPITAL AND ORGANIZATIONAL CREATIVITY

D.F	R	R ²	T Test		F Test	
			Tab.	Cal.	Tab.	Cal.
1.9	0.47	0.32	1.88	1.75	5.12	2.66

At the same time, the study has highlighted the results of testing the relationship between human capital and organizational innovation. Test results showed a positive relationship between the two variables, where the value of the correlation coefficient was 65%, showing a significant correlation positive between the two variables as shown in Table X, also indicating the value of (t) calculated as 2.12, which is less than the tabulated value of 1.88, and shows degree of confidence of 95%. This indicates that human capital has an effect on organizational innovation, as inferred during test (f), when the calculated value was 5.87. It was

greater than the tabular value of 5.12, with degree of freedom of 1.9. This indicates acceptance of the relationship statistically, showing in Table X that the value of the coefficient of determination R² = 0.38, which explains a high explanatory ability.

TABLE X: RESULTS OF TESTING THE RELATIONSHIP BETWEEN HUMAN CAPITAL AND ORGANIZATIONAL INNOVATION

D.F	R	R ²	T Test		F Test	
			Tab.	Cal.	Tab.	Cal.
1.9	0.65	0.38	1.88	2.12	5.12	5.87

This study also set out to assess the correlation association and regression between structural capital and organisational innovation through Table XI. The results have shown that there is a positive relationship between the two variables. Where the value of the correlation coefficient was 87%, this indicates a strong relationship and morale between the two variables. Table XI also illustrates the value of (t) calculated as 5.76, greater than tabular value of 1.88, the degree of confidence being 95%. This confirms that the variable structural capital has impact on the organisational innovation. This conclusion is drawn by testing (f), where the calculated value was 5.72, larger than the tabular value of 5.12, with a degree of confidence of 95%, and the degree of freedom of 1.9. The findings are indicating that the association is statistically accepted, and Table XI shows that the value of the coefficient of determination R² = 0.65. This means that the determination value can be explained as acceptable.

TABLE XI: ASSESSING THE CORRELATION AS OCIALATION AND REGRESSION BETWEEN STRUCTURAL CAPITAL AND ORGANISATIONAL INNOVATION

D.F	R	R ²	T Test		F Test	
			Tab.	Cal.	Tab.	Cal.
1.9	0.87	0.65	1.88	5.76	5.12	5.72

However, further statistical tests revealed results from testing the relationship between the customer's capital and organisational innovation in Table XII. Here the results have shown the correlation coefficient with regression between the two variables, and the correlation value was 0.21. These results indicate significant positive correlation between customer capital and organisational innovation, as it appears that the test value (t) was calculated as 0.37, which is less than the value tabular of 1.88, and a degree of confidence of 95%.

These results confirm that the customer capital has influence in organisational innovation. This inference was confirmed by use of test (f), when the calculated value of 0.19 is less than the tabular value of 5.12 with a degree of confidence of 95% and the degree of freedom of 1.9. This means that the results are demonstrating an acceptance statistically between the two variables. Table XII also shows that the value of the coefficient of determination R² = (0.011). This value highlights a good explanatory ability for the relationship between two variables.

TABLE XII: RESULTS OF TESTING THE RELATIONSHIP BETWEEN CUSTOMER CAPITAL AND ORGANISATIONAL INNOVATION

D.F	R	R ²	T Test		F Test	
			Tab.	Cal.	Tab.	Cal.
1.9	0.21	0.011	1.88	0.37	5.12	0.19

VII. CONCLUSION

For the time being, most of the industrial organisations are focusing on the intellectual capital because of its important role in creating and sharing an atmosphere of learning, and applying knowledge of growth in organisational innovation. The innovation is viewed as a major source of competitive advantage and is perceived to be a prerequisite for organisational success and survival. Accordingly, the study has started from this view, but it has found there are not relevant studies exploring the relationship between intellectual capital and organisational innovation.

Therefore this study has focused on this research gap. In conclusion, the present study was designed to determine the effect of three types of intellectual capital, i.e. human capital, structural capital, and customer capital, on organisational innovation. Additionally, the study has considered the growth rate of the automotive industry and textile industry as a moderator to explore whether the positive relationships between intellectual capital and organisational innovation are stronger or not when the growth rate of the industry is higher.

Consequently, this study has investigated and tested hypotheses with a questionnaire survey conducted in an Iraqi automotive industry and a textile industry. The aim of this study was to find out the impact of intellectual capital on organisational innovation at the Iraqi automotive industry and textile industry.

One of the main inferences of this study is that there were two of the three types of cultural capital (structural and human capital) that had obvious positive relationships with organisational innovation, whereas the relationship between customer capital and organisational innovation did not have a moral effect on organisational innovation.

Therefore, the study has suggested an important set of recommendations that will give greater attention to customer capital, for the purposeful building of humans' capabilities. The expansion of relations between customers should be adhered to. This is said because there was weakness in public relations in the companies with their suppliers, clients, and partners. On the other hand, in this investigation the study was assessed for these variables and has accounted their mean values respectively, as a reference for directors in Iraqi companies to evaluate their intellectual capital for the purpose of a diagnosis and assessment of strength points and the weakness in their intellectual capital. This is because it considers significant factors to create innovation, which it helps to create with new products development, as well as aiding customers' satisfaction and retaining it, which leads to the reduction of operating costs.

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