



RESEARCH ARTICLE

The Impact of Knowledge Sharing on Open Innovation (An analytical Study of Telecommunications Companies in Iraq)

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ABSTRACT

This study aims to identify the impact of knowledge sharing on open innovation processes within telecommunications companies in Iraq. The findings of this study are of significant importance, as they can be used to enhance innovation strategies and practices in telecommunications companies, sparking a new level of interest and engagement in the industry. To achieve this, the study relied on a scientifically validated questionnaire and a sample of (200) individuals from specialized workers in (5) telecommunications companies in Iraq. The study used various statistical methods to analyze and process the data, including the structural equation model (SEM) method, which was implemented using (SPSS, vr.24) and (AMOS, vr.24). The results of the study revealed that knowledge sharing (K.S) within telecommunications companies in Iraq has a direct impact on open innovation processes (OI). The study suggests the need to pay great attention to and activate knowledge-sharing practices as they increase innovation processes.

INTRODUCTION

Contemporary business organizations, operating in a dynamic and changing environment with increasing competition and rapid growth in the technology sector, rely on new work strategies, changing work methods and updating their internal operations. All this is done to develop the services provided to customers, raise performance levels and add economic value to them. Therefore, interest in employing knowledge-sharing activities and behaviors has increased as it leads to the dissemination of information as accumulated knowledge for companies and enables companies to make optimal use of available resources. In addition, information sharing leads to better use of knowledge and enables companies to develop knowledge and support innovation processes (Gulfraz, 2020). Knowledge-sharing practices also drive innovation. Previous studies' main findings and gaps showed the impact of knowledge-sharing behaviors on innovation and creativity processes based on resource-based and knowledge-based views (Singh et al., 2021). Our current study addressed knowledge sharing and its support for open innovation processes to overcome the challenges facing telecommunications companies in Iraq, represented by the lack of resources and various knowledge and obstacles related to knowledge sharing, including individualism represented by lack of time, fear, lack of awareness, monopoly of knowledge and its sharing, differences between individuals in levels of experience, capabilities, learning and culture, lack of communication, interaction and interaction between employees, lack of trust between employees within those companies, in addition to organizational obstacles such as the lack of a strategic direction for telecommunications companies regarding knowledge sharing, the lack of an incentive system that encourages knowledge sharing practices, the lack of a culture that supports knowledge sharing, an organizational structure and a work environment designed in a way that restricts the application of knowledge sharing, as well as technological obstacles represented by the lack of integration of systems and information technology processes, lack of technical support, lack of integration between individual requirements and technological processes, and lack of training in modern information technology. In response to these challenges, it has become necessary for telecommunications companies in Iraq to adopt strategies

that enable them to obtain a competitive advantage and unique resources, as resources are the key to the organization's success. The most important of these means are knowledge-sharing processes, the exchange of skills, experiences, and information between individuals, and their essential role in forming new knowledge, achieving performance excellence, increasing competitive capabilities, and activating creativity and innovation processes. In addition, knowledge has become the main factor for survival, growth, and sustainability. This study addressed knowledge sharing and its support for open innovation processes for telecommunications companies in Iraq to overcome the lack of resources and knowledge. All this is to obtain unique resources, the key to the organization's success. Knowledge has become the main factor for survival, growth, and sustainability. Therefore, companies work to obtain external knowledge and information and cooperate in research for continuous innovation processes. This makes them more adaptable and helps them improve performance and provide high-quality services. This enhances open innovation processes, as open innovation processes, which include aspects of internal innovation and external innovation, refer to an essential feature: openness to the external environment that links external knowledge with the internal knowledge of companies (Gao et al., 2020). It is assumed that companies should use external ideas, information, and knowledge as well as internal ideas, information, and knowledge to reach markets and provide distinguished services to customers (West & Bogers, 2017) (Bogers et al., 2018a). By taking advantage of the previous systematic literature review related to the study variables, this study aims to identify the theoretical basis and its development over the earlier periods. To achieve this goal, descriptive analysis was used to measure (the impact of knowledge sharing on open innovation processes), representing the study problem's focus. To achieve this goal, descriptive analysis was used to measure the size of the effect between the study variables, which represents the focus of the study problem. To be more specific, the study problem revolves around finding out the answer to the following question: What is the extent of the impact of using knowledge sharing on internal and external open innovation processes among specialized workers in telecommunications companies in Iraq? The current study makes several contributions as we expect that knowledge-sharing activities, behaviors and practices will be reflected in stimulating and increasing open innovation processes for telecommunications companies. This study also seeks to demonstrate the relationship between knowledge-sharing and open innovation, in addition to predicting the extent of the impact of knowledge-sharing processes on internal and external open innovation processes. The current study supports companies adopting a knowledge-sharing strategy to support open innovation and obtain sustainable competitive advantages. The current study includes several sections. The following section presents the theoretical framework and hypotheses of the study. The practical framework of the study follows it, followed by the results and their discussion, the conclusion, and the proposals reached by the survey.

THEORETICAL FRAMEWORK

1. Knowledge sharing (KS)

A. Knowledge sharing concept

The current study makes several contributions as we expect that knowledge-sharing activities, behaviors and practices will be reflected in stimulating and increasing open innovation processes of telecommunications companies. This study also seeks to demonstrate the relationship between knowledge-sharing and open innovation, in addition to predicting the extent of the impact of knowledge-sharing processes on internal and external open innovation processes. The current study supports companies adopting a knowledge-sharing strategy to support open innovation and obtain sustainable competitive advantages. Knowledge sharing is one of the reasons for the success of organisations as it is a successful strategy that helps organizations acquire new knowledge in addition to achieving a sustainable competitive advantage and activating innovation processes. Researchers have different views regarding defining the concept of knowledge sharing. (Bhatt, 2001) defined knowledge sharing as the transfer of information within and between organizations at all administrative levels and between different organizational bodies. (Lee, 2001) expressed as activities to transfer or disseminate knowledge between individuals or groups between teams and groups or between organizations. Studies have shown that knowledge-sharing processes are essential for organizations because they increase and enhance creative performance and reduce learning efforts, especially in training and development (518: Calantone et al., 2002). (Chua, 2003)

expressed it as the process by which individuals repeatedly share their ideas, opinions and suggestions based on previous work experiences. (Moss et al., 2007) knowledge is a process of cognitive accumulation that enables individuals to share and use information to apply knowledge and make decisions to address various problems. (Yi, 2009) indicated that it is a set of behaviors related to individuals sharing knowledge and work experience. (Villamizar Reyes & Castañeda Zapata, 2014:67) expressed it as the ability of employees to exchange knowledge, skills, experiences, values, information, and ideas, as well as the aim of obtaining new knowledge, experiences, and information. (Malik & Kanwal, 2018) Explain that it is the exchange of experiences, facts, skills and knowledge across all organization departments. As (99: Khuram & Wang 2018) view knowledge sharing as the process of transferring knowledge by individuals about their experiences in a way that is understood and accepted by the recipient. (Ahmed et al., 2019) (Ahmed 2019) explains that due to the development of communication media and digital technologies, new means and methods have been created to share knowledge invested in providing distinctive products and services. (Swanson et al., 2020) confirm that knowledge sharing focuses on exchanging information and experiences between individuals to accomplish specific organizational tasks. Knowledge sharing is a critical success factor leading to creativity, through which employees benefit best from accumulated knowledge. This reduces costs and improves team and organizational performance (Kremer et al., 2019). Knowledge sharing works as a means for the success of organizations by supporting creativity processes, which leads to the generation of new knowledge and innovative ideas. There is a need to transfer, disseminate and share knowledge in all departments of the organization, as the interaction between technology, techniques and individuals has a direct positive impact on the effectiveness of knowledge distribution (Cabrera & Cabrera, 2005:720). Knowledge sharing leads to greater productivity and better use of existing resources through optimal use of knowledge to develop knowledge and creativity (Argote & Ingram, 2000). Knowledge sharing emphasises the organizational aspect of employees and understanding how to determine the use of individuals for their expertise and intelligence (Gulfraz, 2020). Knowledge-sharing activities create opportunities to improve employee self-efficacy, improve learning processes, and share knowledge with different employees (Azeem et al., 2021). Knowledge-sharing processes improve the quality of services provided to customers, taking into account novelty and creativity (Haque & Islam, 2018). It encourages employees to contribute to the development of business organizations through means that enable them to retain available knowledge. It is believed that there is an increasing interest in the role it provides to the organization and that knowledge enables employees in the organization to feel cognitive empowerment, increase rates of commitment to performing the work tasks required of them, raise job satisfaction rates and employ available knowledge and experiences in performing activities, making and taking decisions, and solving problems, as well as building an added and sustainable competitive advantage (546: Razak et al., 2016).

B. Implicit and explicit knowledge (E&T)

Most previous studies confirm that knowledge is divided into two main sections, which are (Nonaka, 1994) ; (Neurink, 2013) ; (Arnett et al., 2021) ; (Ávila, 2022) ; (M. Wang et al., 2023): Explicit knowledge is objective, reliable and rational knowledge that can be documented, clarified, encoded and stored in databases and electronic documents. It also means documents and processes that can be retrieved by displaying them as data, charts, statistics and formal rules in different forms. It can also be published and shared by various means and methods. As for tacit knowledge, it is intangible, exclusive and private knowledge that is difficult to express and obtain because it exists in the minds of individuals in addition to the difficulty of learning and publishing it. It is related to personal experiences, expertise, skills, actions, contexts and the ability to create. In addition to its high cost, it requires more interaction, communication and time to display its understanding, perception and observation. It is worth noting that there is a reciprocal relationship between implicit and explicit knowledge, as the former is affected by the latter. Therefore, organizations try to achieve interaction between these two types of knowledge to achieve added value to the organization. Our study focuses on the activities of sharing explicit and implicit knowledge among employees, which are likely to enhance the internal and external open innovation capabilities of telecommunications companies in Iraq.

C. Knowledge sharing practices (KSP)

Many studies have shown the critical role of knowledge-sharing practices in activating, stimulating and increasing creativity processes in organizations (Singh et al., 2021). Creativity depends on the sharing of employees' knowledge, experiences and skills in these organizations; for example, companies use modern methods, techniques and technologies to solve problems they face at work (Du Plessis, 2007). (2003 -Chong) showed that knowledge-sharing practices are achieved through direct communication and informal cooperation between individuals. His study shows that knowledge is enhanced in this environment by encouraging a culture of knowledge sharing, increasing learning and developing the skills and capabilities of individuals. Through knowledge-sharing practices, creative ideas are generated to exploit opportunities available in the external environment (Lundvall & Nielsen, 2007). (Rastogi, 2000) emphasized that organizational culture needs an appropriate social environment with trust, shared values, principles, and goodwill to facilitate knowledge-sharing practices. This emphasizes the importance of trust in a knowledge-sharing culture. While (Norris et al., 2003) indicated that knowledge becomes tangible digital content as a context that can be shared digitally and through direct and indirect interactions, knowledge can be created by asking a question and watching the responses that elicit conversations, responses and interactions, between participants. Different platforms can also be used to share knowledge professionally through non-professional training such as side table discussions, job rotation or informal business databases (Alavi & Leidner, 2001:117). Thus, these organizations benefit from knowledge-sharing practices using administrative and organizational practices that reflect knowledge-sharing behaviors (Foss et al., 2011). Therefore, telecommunications companies in Iraq should seek to establish and maintain knowledge sharing practices as they nurture open innovation. Our study assumes that companies have the necessary resources and knowledge through which they can maintain levels of open innovation. The process of implementing and using knowledge sharing practices in these companies can be a difficult task. However, we expect that these practices will push towards achieving open innovation.

2. Open innovation (OI)

A. Open innovation concept

Open innovation (OI) is a vital topic in the contemporary business environment and one of the success factors for organizations of all types and sizes. Open innovation (OI) has gained the attention of scholars and researchers through their scientific contributions and outputs according to scientific and technical foundations that organizations can be guided by in providing distinguished and influential services to their customers. (H. W. Chesbrough, 2003) expressed it as valuable ideas that can be from within or outside the organization that can be taken to the market and to clarify the opinions of researchers and specialists about the concepts of open innovation (OI) due to the breadth of the concept and the different standards and practices used in studies and research. (H. Chesbrough, 2006) defined open innovation as "the purposeful use of internal and external knowledge flows to increase and expand internal innovation and develop the market for external use of innovation, respectively." (Laursen & Salter, 2006) stated that "the open innovation model uses a wide range of effective tools and external sources that help achieve and sustain innovation." (Lichtenthaler, 2011) indicates that "open innovation processes are the systematic exploration, storage, and investment of knowledge within and outside the organization." (H. Chesbrough & Bogers, 2014) confirm that "open innovation is a continuous innovation process that relies on knowledge flows in a way that achieves goals across organizational boundaries by using financial and non-financial mechanisms in line with the organization's business model." (Obradović et al., 2021) see open innovation as relying on the organization's dynamic capabilities in managing internal and external technology, i.e. acquiring and investing in technology throughout the innovation process.

Open innovation (OI) brings many advantages and benefits to companies. These benefits include searching for and discovering new talents from human resources, a more significant division of labor, exchanging and sharing ideas with the external environment, and new cooperation and coordination between geographically distant organizations. It also achieves increased profits, research and development, providing innovative and new services and products, and increasing knowledge processes and sharing (Dahlander & Gann, 2010); (Chiang & Hung, 2010). In addition, open

innovation meets the needs and requirements of customers, improves innovation processes, keeps up with competitors, increases sales, reduces costs, and improves overall performance (Van de Vrande et al., 2009) (Hossain & Kauranen, 2016); (Cheng & Huizingh, 2014). In addition to obtaining external technology and investing in internal technology to significantly improve the innovative performance of companies by selling and buying licenses and patents and investing in intellectual capabilities through a combination of value gained from internal and external innovations (Bigliardi et al., 2021); (Bigliardi et al., 2020). Open innovation (OI) compensates for the lack of internal resources and competencies by using external resources and new technologies, integrating technologies that contribute to the development of products and services provided, as well as sharing risks and increasing the competitiveness of companies (Henttonen & Lehtimäki, 2017); (Ye & Kankanhalli, 2013).

Open innovation (OI) includes internal and external innovation (Singh et al., 2021); (Popa et al., 2017); (Carrasco-Carvajal & García-Pérez-De-Lema, 2021); (Leitão et al., 2020); (Bigliardi et al., 2020); (Almeida, 2021); (Moradi et al., 2021).

B. Open innovation internal (OII)

Internal open innovation refers to the external practices of companies that go beyond their internal boundaries and through which they obtain new knowledge (Bagherzadeh et al., 2019). The company benefits from external knowledge to gain new sources of creative ideas (Hosseini et al., 2017). (Leitão et al., 2020) see it as a type of openness that provides resources from the external environment through internal resources and capabilities, absorption and acquisition. Internal open innovation includes all technology purchases and research and development processes. It also includes interactions with customers, suppliers, competitors, all stakeholders, universities and all research institutions to explore different knowledge from outside the company (X. Wang, 2018). In addition to all external knowledge investment processes through the purchase of patents, licensing and all cooperation processes with other organizations while simultaneously developing the intellectual property of those organizations (Remon, 2012); (Savitskaya et al., 2010). As a result, internal open creativity enhances and motivates organizations to achieve high levels of performance excellence (Limaj & Bernroider, 2019).

Based on the above, we propose the following hypotheses:

H₁: Explicit and tacit knowledge sharing (E&T) positively affects internal open creativity (OII).

H₂: Knowledge-sharing practices (KSP) positively affect internal open creativity (OII).

C. Open innovation external (IOE)

External open innovation refers to external practices in which companies invest their internal knowledge and transfer it to the external environment (Hu et al., 2015); (Bogers et al., 2018b). It represents all unexploited knowledge and information flows through agreements, contracts and joint cooperation (Mubarak et al., 2021). External open innovation includes ideas and technologies that a company transfers to other companies to obtain financial returns, i.e. exploiting the internal knowledge and innovations it possesses, which include activities related to developing technologies, products and services, and all cooperation processes, knowledge and information exchange, patent sales, technology and idea transfer, and licensing to other companies (Pereira et al., 2015); (H. Chesbrough & Crowther, 2006). (Lichtenthaler, 2009). In addition to spin-off organizations, joint ventures, forward and backward integration, and strategic alliances (Heritage College source) (Cui et al., 2015). Based on the above, we propose the following hypotheses:

H₁: Explicit and tacit knowledge sharing (E&T) positively affects external open innovation (IOE).

H₂: Knowledge-sharing practices (KSP) positively affect external open innovation (IOE).

Justifications for choosing telecommunications companies in Iraq

Telecommunications companies such as (Zain Iraq Telecommunications Company, AsiaCell Telecommunications Company, Korek Telecom Telecommunications Company, Earthlink Telecommunications Company, and the Iraqi General Company for Telecommunications and Information Technology) are the best and largest in terms of the number of subscribers and their

services cover all geographical areas in Iraq. The telecommunications sector constitutes a vital aspect of the national economy, and therefore raising the level of performance of companies operating in this sector and introducing them to modern concepts in the field of knowledge sharing and its reflection on open innovation processes is extremely important. In addition, many job opportunities are available in Iraq, and the above-mentioned telecommunications companies have the largest market share of customers and provide distinguished services to customers. In addition, there are percentages of knowledge, experience and skills sharing processes in these companies, which made them distinguished in their field of work.

EMPIRICAL FRAMEWORK

Method and the instrument

The current study adopted the descriptive analytical approach to reach the results and future proposals. The study relied in its applied aspect on field visits to the centers and departments of telecommunications companies in Iraq to obtain the necessary data, in addition to personal interviews with department managers and technical cadres. Thus, the questionnaire was adopted to obtain the necessary data and information based on the scientifically validated sources, including its paragraphs according to the five-point Likert scale. The study community represents the telecommunications companies operating in Iraq that have centers and branches in different geographical areas of Iraq. Due to the multiplicity of these companies, we will present an idea on the largest and most prominent companies in our study community, including: (Zain Iraq Telecommunications Company, (AsiaCell) Telecommunications Company, (Korek Telecom) Telecommunications Company, (Earthlink) Telecommunications Company, and the Iraqi General Company for Telecommunications and Informatics). The study sample was represented by specialized workers (administrative and technical) in those companies, as the opinions of individuals working at all administrative levels were surveyed, as they represent the best source of information about the study variables. (205) questionnaire forms were distributed, with (41) forms in each of the above companies, and the number of returned forms was (200) forms, and (5) forms were excluded from them due to their unsuitability for statistical analysis. Thus, the number of valid forms became (200) forms, representing approximately (%) of the total distributed forms.

The current study adopted the descriptive analytical approach to reach the results and future proposals. The study used the questionnaire in its applied aspect to obtain the necessary data and information. (200) individuals participated in this questionnaire who were randomly selected from (5) telecommunications companies in Iraq, namely (Zain Iraq Telecommunications Company, (AsiaCell) Telecommunications Company, (Korek Telecom) Telecommunications Company, (Earthlink) Telecommunications Company, and Iraqi General Company for Telecommunications and Informatics).

To study the effect of Knowledge Sharing (KS) on Open Innovation(OI), we used a 5-point Likert scale for items for each variable. (Angot, 2007) . For each construct, we determine lists of items based on literature and international practices. The items are presented in the following table.

Table 1: Items of constructs

Constructs	Item description
<p>Knowledge Sharing (KS) Adapted from (Singh et al. ,2021)& &(Shujahat et al. ,2019) (philsoophian , et al.,2021) &(Gulfraz,2020) (Swansona et al. ,2020)& (Wang,et al.,2023)</p>	<p><u>Knowledge Sharing Practices (KSP):</u> -The company directs its employees to share knowledge -The company emphasizes teamwork -The company publishes data on past experiences and lessons learned -The company uses information technology systems to share knowledge -The company has different mechanisms and procedures for knowledge sharing -The company encourages employees to share knowledge by giving them various incentives</p>

	<p><u>Tacit and Explicit Knowledge (E&T):</u></p> <ul style="list-style-type: none"> -We share work notes -Sharing manuals provides access to intellectual resources helpful in performing work -We share models and techniques - The company's employees exchange practical experiences among themselves
<p>Open Innovation(OI) Adapted from &)Singh et al., 2021((Leitão et al., 2020) (Carrasco-Carvajal & García-Pérez-De-Lema, 2021) ;</p>	<p><u>Internal Innovation (OII):</u></p> <ul style="list-style-type: none"> -The company obtains technology, information and ideas from the external environment -The company seeks to obtain knowledge and expertise to develop new products -Find external sources to complete research and development operations -Purchase and use intellectual property from other companies -Share customers in the company's innovation operations -Develop activities based on external networks to support innovation operations -Cooperate with other companies to access their knowledge -Purchase research and development services from other scientific organizations and institutions -Share suppliers in the company's innovation operations -Share information from competitors in the communications sector -Cooperate with consultants, experts and the R&D center -Benefit from universities and higher education institutions -Obtain information from scientific journals and publications -Acquire other external knowledge <p><u>External Innovation (OIE):</u></p> <ul style="list-style-type: none"> -The company sells new information and knowledge to other companies -The company sells knowledge that has been previously used internally -The company markets the technologies used -The company sells the basic modern technologies outside the company -The company starts new businesses through internal knowledge -The company benefits from knowledge and initiatives Employee suggestions for innovation -Provided new or significantly improved services -The company introduced new or significantly improved support activities for operations -The company introduced new business practices in organizing procedures -The company adopted new methods for organizing external relations with other companies -The company introduced new technologies and means of communication to promote services

	-The company introduced new distribution methods and sales channels
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Statistical Analysis: Cronbach's alpha coefficient was used to verify the stability of the questionnaire data, with a value ranging between zero and one. We note that the value of the Cronbach's alpha test reached (0.99), which is considered reliable and a good value, as it is greater than the permissible value, which is equal to (0.70) and very close to the correct one. It indicates the strength of the stability and credibility of the questionnaire questions and, thus, the possibility of generalizing the results. The following table shows the value of the Cronbach's alpha coefficient for the entire model:

Table 2: Cronbach's alpha coefficient results for the entire model

Reliability Statistics	
Cronbach's Alpha	N of Items
.990	6

To verify the validity of the Cronbach's alpha test results for the entire model, all the axes of the questionnaire were examined in their various dimensions. The results showed that all the variables in their various dimensions were within the acceptable range, as shown in the following table:

Table 3: Cronbach's alpha coefficient results for the dimensions of the variables

Item-total statistics	
	Cronbach's Alpha if Item Deleted
KSP	.991
IOI	.988
EOI	.987
ET	.988
OI	.987
K.S	.987

The table below shows the statistical description of the study variables. It included the use of different statistical methods such as the arithmetic mean, standard deviation, coefficient of variation, and the lowest and highest values according to the general information of the study sample:

Table 4: Statistical description of study variables

Statistics							
		KSP	IOI	EOI	ET	OI	K.S
N	Valid	200	200	200	200	200	200
Mean		4.42	4.42	4.42	4.40	4.40	4.40
Median		4.00	4.00	4.00	4.00	4.00	4.00
Std. Deviation		.524	.524	.524	.530	.521	.511
Variance		.275	.274	.275	.280	.271	.261
Minimum		3	3	3	3	3	3
Maximum		5	5	5	5	5	5

Analysis of the relationship between (KS) and (OI)

Here, the results of the correlations were discussed and their significance was tested according to the study hypotheses, as follows:

Table 5: Correlation matrix between (KS) and (OI)

		IOI	EOI	OI
KSP	Pearson Correlation	.918**	.909**	.927**
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200
ET	Pearson Correlation	.928**	.956**	.973**
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200
K.S	Pearson Correlation	.935**	.945**	.962**
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200

The results from Table (5) show that there are several relationships between the dimensions of the knowledge sharing variable (KS) and the dimensions of the open creativity variable (OI) and can be formulated as follows:

There is a statistically significant direct correlation between knowledge sharing (KS) and open creativity (OI). The value of the simple Pearson correlation coefficient for the knowledge sharing variable (KS) was equal to (.962**) and had a significant significance with a value (Sig) of (0.000) which is less than (0.05). This result indicates the acceptance of the above hypothesis, which means the existence of a direct correlation between knowledge sharing (KS) and open creativity (OI).

The existence of a direct correlation between knowledge sharing practices (KSP) and internal open creativity (IOI). The value of the simple Pearson correlation coefficient for the dimension of knowledge sharing practices (KSP) was equal to (.918**) and was significant with a value (Sig) of (0.000) which is less than (0.05). This result indicates the acceptance of the above hypothesis, which means that there is a strong direct correlation between knowledge sharing practices (KSP) and internal creativity (IOI).

The existence of a direct correlation between tacit and explicit knowledge (E&T) and internal open creativity (IOI). The value of the simple Pearson correlation coefficient for the dimension of tacit and explicit knowledge sharing (E&T) and internal open creativity (IOI) was equal to (.928**) and was significant with a value (Sig) of (0.000) which is less than (0.05). This result indicates the acceptance of the above hypothesis, which means that there is a direct correlation between tacit and explicit knowledge sharing (E&T) and internal open creativity (IOI). There is a direct correlation between knowledge sharing practices (KSP) and external open innovation (EOI). The value of the simple Pearson correlation coefficient for the dimension of knowledge sharing practices (KSP) was equal to (.927**) and had a significant significance with a value (Sig) of (0.000) which is less than (0.05). This result indicates the acceptance of the above hypothesis, which means that there is a direct correlation between knowledge sharing practices (KSP) and external innovation (EOI). There is a direct correlation between tacit and explicit knowledge (E&T) and external open innovation (EOI), as the value of the simple Pearson correlation coefficient for the dimension of sharing tacit and explicit knowledge (E&T) and external open innovation (EOI) reached (.956**) and has a significant significance with a value (Sig) of (0.000) which is less than (0.05). This result indicates the acceptance of the above hypothesis, which means the existence of a direct correlation between sharing tacit and explicit knowledge (E&T) and external open innovation (EOI).

Analysis of the impact of the (KS) on the (OI)

Here, the results of the direct effect of the knowledge-sharing variable (KS) and its dimensions on the open innovation variable (OI) and its dimensions were studied. Accordingly, structural equation

models were designed using the statistical program (AMOS vr.24). The effect and its significance were tested according to the study hypotheses as follows:

H1: Testing the existence of an effect of knowledge sharing (KS) on open innovation (OI)

From Table (5), the results related to the coefficient of determination and the corrected coefficient of determination appear, reaching (0.926) and (0.926), respectively, indicating that the results explain (93%) of the total differences. In contrast, other variables outside the scope of our study in this research explained the remaining percentage.

Table 5: Values of the coefficient of determination and the corrected coefficient of determination

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.962 ^a	.926	.926	.139
a. Predictors: (Constant), OI				

Table (6) shows the results of the variance analysis. The value of the (F) test appears equal to (2487.913), and the significance level (sig) is equal to (0.00), which is less than (0.05). This indicates the significance of the model used.

Table 6: Analysis of variance table for the regression model

ANOVA ^a						
	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	48.167	1	48.167	2487.913	.000 ^b
	Residual	3.833	198	.019		
	Total	52.000	199			
a. Dependent Variable: K.S						
b. Predictors: (Constant), OI						

Table 7: The value of the regression parameter and its significance for the regression model

Coefficients ^a						
Model		Unstandardised Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.244	.084		2.914	.004
	OI	.944	.019	.962	49.879	.000
a. Dependent Variable: K.S						

The study found, through Table (7), that the regression parameter for the open creativity variable (OI) is significant and statistically significant when the dependent variable is knowledge sharing (KS).

The proposed model was designed as follows:

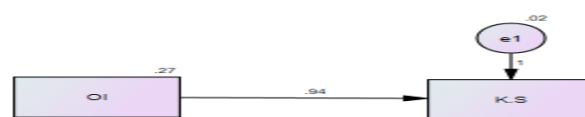


Figure 1: The proposed and designed model for the structural model diagram

Table 8: Values of the significant estimators of the critical ratios of the direct effect

			Estimate	S.E.	C.R.	P	
K.S	<---	OI	.944	.019	50.005	***	

From the results of Table (8) above, it was found that there is a direct effect with a significant moral significance below the significance level (5%) for the variable (KS) on the variable (OI). The effect value reached (.944) with a critical percentage of (50.005), and this value is significant since (p-value) was equal to zero. It is less than the significance level (5%). We conclude that there is a direct effect relationship; in other words, an increase in the value of the variable (KS) by one unit leads to an increase in the variable (OI) by (0.94).

H2: Testing the existence of an impact of knowledge-sharing practices (KSP) on internal open innovation (IOI)

Table (9) shows the results related to the coefficient of determination and the corrected coefficient of determination, which reached (0.842) and (0.841), respectively. This indicates that the results explain (84%) of the total differences, while other variables outside the scope of our study in this research explained the remaining percentage.

Table 9: Values of the coefficient of determination and the corrected coefficient of determination

Model Summary				
Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.918 ^a	.842	.841	.209
a. Predictors: (Constant), IOI				

Table (10) shows the results of the variance analysis table. The value of the (F) test appears equal to (1056.333), and the significance level (sig) is equal to (0.000), which is less than (0.05). This indicates the significance of the model used.

Table 10: Analysis of variance table for the regression model

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	46.082	1	46.082	1056.333	.000 ^b
	Residual	8.638	198	.044		
	Total	54.720	199			
a. Dependent Variable: KSP						
b. Predictors: (Constant), IOI						

Table 11: The value of the regression parameter and its significance for the regression model

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.362	.126		2.882	.004
	IOI	.919	.028	.918	32.501	.000
a. Dependent Variable: KSP						

The study found, through Table (11), that the regression parameter for the dimension of internal open creativity (IOI) is significant and statistically significant when the dependent variable is knowledge-sharing practices (KSP).

The proposed model was designed as follows:



Figure 2: The proposed and designed model for the structural model diagram

Table 12: Values of the significant estimators of the critical ratios of the direct effect

	Estimate	S.E.	C.R.	P
KSP <--- IOI	.919	.028	32.583	***

Through the results of Table (12) above, it is clear that there is a direct effect with a significant moral significance below the significance level (5%) for the dimension (KSP) on the dimension (IOI). The effect value reached (0.92) with a critical percentage of (32.583). This value is significant since the (p-value) was equal to zero and is less than the significance level (5%). We conclude that there is a direct effect relationship; in other words, an increase in the value of the dimension (KSP) by one unit leads to an increase in the dimension (IOI) by (0.92).

H3: Testing the existence of an effect of sharing tacit and explicit knowledge (E&T) on internal open innovation (IOI)

Through Table (13), the results related to the coefficient of determination and the corrected coefficient of determination appear, reaching (0.914) and (0.913), respectively. This indicates that the results explain (91%) of the total differences, while other variables outside the scope of our study in this research explained the remaining percentage.

Table 13: Values of the coefficient of determination and the corrected coefficient of determination

Model Summary				
Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.956 ^a	.914	.913	.156

a. Predictors: (Constant), EOI

Table (14) shows the results of the variance analysis. The value of the (F) test appears equal to (2099.223), with a significance level (sig) equal to (0.00), which is less than (0.05). This indicates the significance of the model used.

Table 14: Analysis of variance table for the regression model

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	50.986	1	50.986	2099.223	.000 ^b
	Residual	4.809	198	.024		
	Total	55.795	199			

a. Dependent Variable: ET
b. Predictors: (Constant), EOI

Table 15: The value of the regression parameter and its significance for the regression model

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.128	.094		1.370	.172
	EOI	.965	.021	.956	45.817	.000

a. Dependent Variable: ET

The study found, through Table (15), that the regression parameter for the dimension of open internal creativity (EOI) is significant and statistically significant when the dependent variable is knowledge sharing, implicit and explicit knowledge (E&T).

The proposed model was designed as follows:

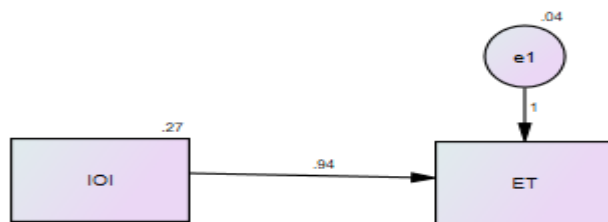


Figure 3: The proposed and designed model for the structural model diagram

Table 16: Values of the significant estimators of the critical ratios of the direct effect

			Estimate	S.E.	C.R.	P
ET	<---	IOI	.939	.027	35.215	***

From the results of Table (16) above, it is clear that there is a direct effect with a significant moral significance below the significance level (5%) for the variable (E&T) on the variable (IOI). The effect value reached (0.94) with a critical percentage of (35.215), and this value is significant since (the p-value) was equal to zero, which is less than the significance level (5%). We conclude that there is a direct effect relationship; in other words, an increase in the value of the axis (E&T) by one unit leads to an increase in the variable (IOI) by (0.94).

H4: Testing the existence of an effect of knowledge-sharing practices (KSP) on external open innovation (EOI)

Through Table (17), the results related to the coefficient of determination and the corrected coefficient of determination appear, reaching (0.826) and (0.825), respectively. This indicates that the results explain (83%) of the total differences, while other variables outside the scope of our study in this research explained the remaining percentage.

Table 17: Values of the coefficient of determination and the corrected coefficient of determination

Model Summary				
Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.909 ^a	.826	.825	.220

a. Predictors: (Constant), EOI

Table (18) shows the results of the variance analysis table. The value of the (F) test appears equal to (937.326), and the significance level (sig) is equal to (0.000), which is less than (0.05). This indicates the significance of the model used.

Table 18: Analysis of variance for the regression model

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	45.177	1	45.177	937.326	.000 ^b
	Residual	9.543	198	.048		
	Total	54.720	199			

a. Dependent Variable: KSP
 b. Predictors: (Constant), EOI

Table 19: The value of the regression parameter and its significance for the regression model

Coefficients ^a				
Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig.

		B	Std. Error	Beta		
1	(Constant)	.404	.132		3.057	.003
	EOI	.909	.030	.909	30.616	.000

a. Dependent Variable: KSP

The study found, through Table (19), that the regression parameter for the external open innovation dimension (EOI) is significant and statistically significant when the dependent variable is knowledge-sharing practices (KSP).

The proposed model was designed as follows:



Figure 4: The proposed and designed model for the structural model diagram

Table 20: Values of the significant estimators of the critical ratios of the direct effect

			Estimate	S.E.	C.R.	P	
KSP	<---	EOI	.909	.030	30.693	***	

Through the results of Table (20) above, it is clear that there is a direct effect with a significant moral significance below the significance level (5%) for the dimension (KSP) on the dimension (EOI). The value of the effect reached (0.91) with a critical percentage of (30.693). This value is significant because the (p-value) was equal to zero and is less than the significance level (5%). We conclude that there is a direct effect relationship; in other words, an increase in the value of the dimension (KSP) by one unit leads to an increase in the dimension (EOI) by (0.91).

H5: Testing the existence of an effect of sharing tacit and explicit knowledge (E&T) on external open innovation (EOI)

Table (21) shows the results related to the coefficient of determination and the corrected coefficient of determination, which reached (0.861) and (0.862), respectively. This indicates that the results explain (86%) of the total differences, while other variables outside the scope of our study in this research explained the remaining percentage.

Table 21: Values of the coefficient of determination and the corrected coefficient of determination

Model Summary				
Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.928 ^a	.862	.861	.197

a. Predictors: (Constant), IOI

Table (22) shows the results of the variance analysis. The value of the (F) test appears equal to (1233.843) and at a significance level (sig) equal to (0.00), which is less than (0.05). This indicates the significance of the model used.

Table 22: Analysis of variance table for the regression model

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	48.079	1	48.079	1233.843	.000 ^b
	Residual	7.716	198	.039		
	Total	55.795	199			

a. Dependent Variable: ET
b. Predictors: (Constant), IOI

Table 23: The value of the regression parameter and its significance for the regression model

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.250	.119		2.107	.036
	IOI	.939	.027	.928	35.126	.000

a. Dependent Variable: ET

The study found, through Table (23), that the regression parameter for the dimension of external open innovation (IOI) is significant and statistically significant when the dependent variable is the sharing of implicit and explicit knowledge (E&T).

The proposed model was designed as follows

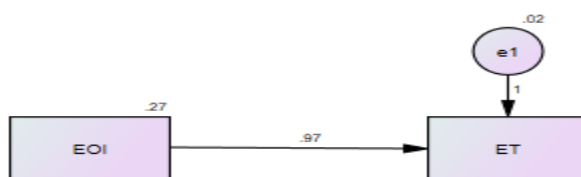


Figure 5: The proposed and designed model for the structural model diagram

Table 24: Values of the significant estimators of the critical ratios of the direct effect

			Estimate	S.E.	C.R.	P
ET	<---	EOI	.965	.021	45.933	***

From Table (24) above, it is clear that there is a direct effect with a significant moral significance below the significance level (5%) for the variable (E&T) on the variable (EOI). The effect value reached (0.97) with a critical percentage of (45.933). This value is significant since (p-value) was equal to zero and is higher than the significance level (5%). We conclude that there is an inverse effect relationship; in other words, an increase in the value of the variable (E&T) by one unit leads to a decrease in the variable (EOI) by (0.97).

RESULTS DISCUSSION

The statistical analysis results confirm that companies with effective practices for sharing explicit and tacit knowledge are the most capable and efficient in obtaining open innovation in the telecommunications sector in Iraq. It was shown that knowledge sharing by individuals in these companies through knowledge-sharing practices and sharing implicit and explicit knowledge played an important role in exploiting, investing, and disseminating knowledge among relevant parties, which was positively reflected in improving all operations and increasing open innovation processes, both internal and external. It became clear that companies that focus on activating knowledge sharing among their members are the most effective and efficient in increasing open innovation capabilities and, as a result, increasing the competitive capabilities of telecommunications companies, increasing their market share, and improving the quality of services provided to customers. The results of our study support what was confirmed by the results of previous studies on the impact of knowledge sharing on open innovation (Singh et al., 2021); (Scuotto et al., 2017); (Del Giudice et al., 2015); (Z. Wang & Wang, 2012); (S. Lee et al., 2010), and our study also indicates the impact of sharing tacit and explicit knowledge among employees in telecommunications companies on open innovation. The most important feature of the results of our study is its reliance on knowledge sharing in improving internal and external open innovation processes in the telecommunications sector, in addition to the intellectual and theoretical contribution of this study, and by relying on the resource-based and knowledge-based theory in the study of knowledge sharing

(Singh et al., 2021), which supports our current study inspired by the resource-based theory and knowledge as a unique strategic resource in increasing its internal and external creative capabilities in general, in addition to that, knowledge sharing processes allow for better application of creative ideas.

CONCLUSION

The statistical analysis results revealed the suitability of the proposed model and the stability and reliability of the questionnaire questions used in the study for all variables in their different dimensions according to the values of the Cronbach's alpha coefficient that were reached. The results of the study concluded that there is a direct and positive correlation and influence of the dimensions of knowledge sharing (K.S) (knowledge sharing practices, implicit and explicit knowledge sharing) within telecommunications companies in Iraq on internal and external open innovation (OI) processes, and the answers of the study sample individuals reflected a positive trend regarding the importance of the study in the field of communications technology; As a philosophy and one of the effective strategies for the success of organizations, the study sees the necessity of activating and spreading the culture of knowledge sharing, whether explicit or implicit, as it leads to increasing internal and external open creativity processes. Telecommunications companies must work to provide the basic requirements that encourage knowledge sharing by building an organizational structure that provides a work environment that supports sharing knowledge and information with transparency, in addition to building work teams characterized by trust and mutual communication capable of producing ideas and sharing knowledge easily. They also need effective leadership that provides support, motivation and training for members of these teams and assistance in solving potential problems, as well as providing knowledge stores that enable them to store knowledge electronically in an easy-to-access manner to ensure the flow of knowledge in an organized manner, and as a result, improve the knowledge sharing process that is reflected in increasing open creativity processes.

Another strategy that telecom companies in Iraq can use to enhance knowledge sharing is technology. Knowledge-sharing technology is used as virtual learning through online social platforms to easily access information and exchange knowledge, experiences, and resources with others that the individual needs, especially when this information cannot be obtained through personal communication. The current study suggests that future studies of knowledge sharing (KS) and open innovation (OI) should be conducted in other industrial or agricultural sectors.

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Data availability statement: The data for this study were obtained from two primary sources:

Direct site visits to telecommunications companies.

Official websites of the telecommunications companies.

These sources provided the necessary information for the analysis presented in the paper..

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(<https://itpc.gov.iq/>)N3-

(<https://earthlink.iq/>)N4-

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