

# Knowledge Management Enablers, Knowledge Creation Process and Innovation Performance: An Empirical Study in Tunisian Information and Communication Technologies Sector

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## **Abstract**

In today's complex and dynamic environment, survival and competitiveness of companies are based on their capacity to continuously create and use new knowledge. In this perspective, this paper focuses on the enabling factors that boost Knowledge Creation Process (KCP) within organizations. On the basis of previous studies, this research examines the most important factors that have been recognized to be critical for KCP: collaboration, trust, learning, incentives and rewards, decentralized and low formalized structure, T-shaped skills

and information technology (IT) support and transformational leadership. The purpose of this paper is also to examine the relationship between KCP and innovation performance. Conceptually, we develop a research model highlighting the relationship between all these variables. This model was tested using structural equation modeling within Tunisian ICT sector. Based on a survey of 202 companies, results reveal that the best path for Tunisian ICT companies to foster knowledge creation is through incentives and rewards, collaboration, trust, learning, decentralized and low formalized structure and IT support. Findings show also that KCP significantly affects firms' innovation performance.

**Keywords:** Knowledge Creation Process, Knowledge Creation Enablers, Innovation performance

## 1. Introduction

Nowadays, in an increasingly complex and turbulent environment, companies should explore new ways in order to survive and improve their competitiveness. Innovation is therefore a strategic factor enabling them to stand out from the competition. In this perspective, the innovative capacity of companies is based on their ability to accumulate knowledge from internal and external sources. Indeed, as highlighted by Nonaka and Takeuchi (1995), in today's knowledge economy, "*organizational knowledge creation is the key to the distinctive ways that companies innovate*". The same idea was advocated by Wang and Wang (2012) who claimed that explicit and tacit knowledge sharing is positively linked to innovation speed and quality. Garcia-Morales et al. (2008) suggested also that innovation is the result of combination of existing knowledge and generation of new knowledge. Cantner et al. (2011) highlighted the importance of knowledge management in companies' innovative success. Companies must therefore integrate knowledge management as a strategic process whose main objective is to make good use of knowledge as a source of innovation.

Many studies have focused on the topic of knowledge management and its relation with innovation. In particular, through empirical investigations conducted in Japanese companies, Nonaka and Takeuchi (1995) discovered that firms' innovative capacity is the outcome of a dynamic knowledge creation process (KCP). By studying the KCP and innovation projects of these companies, they conceptualized a generic model called SECI, which describe how companies create knowledge. This model is structured by four basic modes of knowledge creation (socialization, externalization, combination and internalization). In the perspective of this research, we have hence chosen to focus on Nonaka and Takeuchi (1995)'s knowledge creation approach, as the pillar on which is based the conceptual arguments related to knowledge management.

Many researchers have emphasized the importance of KCP, and in particular the dimensions of the SECI model, in improving firm's innovative capacity (Nonaka and Takeuchi, 1995; Popadiuk and Choo, 2006; Ramírez and Kumpikaite, 2012; Sankowska, 2013). Despite this important literature on KCP and innovation, the relationship between these two concepts is still controversial. In particular, Schulze and Hoegl (2008) pointed out that two dimensions of the model SECI, especially externalization and combination, do not contribute to generation of new product idea. In addition, Nonaka and Takeuchi (1995)'s model has the particularity of having been conceptualized in the context of industrial Japanese companies characterized by a culture of knowledge sharing (Glisby and Holden, 2003). It would be therefore interesting to test the application of this model in the Tunisian context and in particular in the information and communication technologies (ICT) sector that presents different characteristics compared to the industrial sector. In this perspective, many authors (Gibby and Holden, 2003; Hutchings and Weir, 2005) suggested that the applicability of SECI model in other cultural contexts, requires conditions that facilitate KCP. Nonaka and Takeuchi (1995) claimed that the SECI model involves several conditions related to the construction of a suitable environment in which there are driving forces promoting the KCP. Hutchings and

Weir (2005) challenged the universal applicability of SECI model. They pointed out that in Arab countries trust is considered as a crucial condition for KCP success. Lee and Choi (2003) identified collaboration, trust, learning, centralization and formalization of the structure, T-shaped skills and information technology (IT) support as Knowledge management enablers (KME). The same idea was advanced by Nejatian et al. (2013). Migdadi (2005) and Charoenngam and Teerajetgul (2006) added leadership and incentives to this list of enablers of Knowledge management.

This research is devoted to identify the KME and to highlight the effect of KCP on innovation performance. Additionally, the purpose of this study is to explore the relationships between these variables within Tunisian ICT sector.

This paper is structured as follows. First, On the basis of literature review, we develop a research model that highlights the effect of KME on KCP, which in turn contributes to innovation performance. Next, we present the research methodology and the obtained results. Finally, we discuss findings, on the basis of which we also provide managerial implications, the major limitations and the future perspectives of this study.

## **2. Literature Analysis**

### *2.1 Knowledge Creation Process (KCP)*

In today's complex and dynamic environment, survival and competitiveness of companies are based on their capacity to continuously create, disseminate and use knowledge. Most researchers agree that knowledge is a critical factor for innovation (Miller and Morris, 1999; Nonaka and Takeuchi, 1995; Sankowska, 2013), organizational performance (Ramírez et al., 2011) or even more for companies' competitiveness (Nonaka et al., 2006).

As highlighted pertinently by Nonaka and Takeuchi (1995), the KCP made the success of Japanese companies. By analyzing how these companies innovate, these authors found that the secret of their success was their ability to create new knowledge. Nonaka and Takeuchi (1995) noted that it is not sufficient to exploit existing knowledge, it is also important to explore and create new knowledge. They created a knowledge creation theory based on the SECI model. This model highlighted how knowledge is created through interaction between explicit and tacit knowledge and amplified from individual to groups and then to organizational level. Particularly, Nonaka and Takeuchi (1995)'s approach recognized the central role of tacit knowledge. Because it is difficult to imitate this kind of knowledge, it stands out as a vehicle for creating value for companies. SECI model includes four modes of knowledge creation:

- **Socialization:** results in the conversion of tacit knowledge into new tacit knowledge. It is defined as "*the degree of tacit knowledge accumulation, extra-firm social information collection, intra-firm social information gathering and transfer of tacit knowledge*" (Nonaka et al., 2000). In this stage, there is no explicitness of knowledge; it is simply an implied sharing and creation of tacit knowledge. Socialization is illustrated by Nonaka and Takeuchi (1995) in

particular through sharing direct experiences by observation and imitation of experts. It can also involve sharing tacit knowledge across brainstorming camps and interactions with customers, suppliers and competitors (Nonaka and Takeuchi, 1995).

- Externalization: is the process by which tacit knowledge is converted into explicit knowledge and can thus be exploited by other employees. Explicitness of tacit knowledge is based on creative dialogue, collective reflection and exchange of ideas (Nonaka and Takeuchi, 1995). In this stage, learning takes place from the individual to the group level. In order to illustrate externalization, Nonaka and Takeuchi (1995) gave the example of Japanese managers who use metaphors and analogies to articulate their tacit knowledge and create new product concept.

- Combination: is the process of conversion of explicit knowledge into new explicit knowledge. In this stage, knowledge is transferred from groups to organizations. Combination induces the restructuring of acquired explicit knowledge of internal or external sources and dissemination of the new systemic knowledge generated among organizational members (Nonaka and Takeuchi, 1995). It is based in particular on interaction through meetings, conversations and computerized communications networks. Nonaka (1991) illustrated combination by Japanese managers who reconfigure existing explicit knowledge in the form of a manual in which they specify a new prototype of product.

- Internalization: is the process of conversion of explicit knowledge into tacit knowledge. In this stage, individuals absorb organizational explicit knowledge, put it into practice and acquire new tacit knowledge (Nonaka and Takeuchi, 1995). This process is initiated by 'learning by doing', simulations, experimentation and personal experiences (Nonaka and Toyama, 2003). In particular, internalization is exemplified by the case of employees who internalize knowledge through training programs or reading and using documents about their tasks.

In this paper, we aim to identify factors that can foster KCP in the perspective of SECI model and which are identified by numerous studies as 'Knowledge Management Enablers' (KME).

## 2.2 Knowledge Management Enablers (KME)

In the perspective of the SECI model, KCP is based on all mechanisms that optimize socialization, externalization, combination and internalization. In fact, this process requires an appropriate context in which there are stimulating conditions for knowledge creation. In particular, the tacit nature of knowledge makes necessary to build a favorable environment in order to make it explicit and to transfer it to organization's members. Prax (2003) introduced the concept of 'Knowledge Enabling' which refers to the fact that "*companies must manage the conditions by which people can create, share, validate and disseminate knowledge*". In reality, many KME have been identified in the literature.

Nonaka and Takeuchi (1995) suggested that KCP involves conditions (intention, fluctuation and creative chaos, autonomy and requisite variety) relating to the construction of a suitable space promoting knowledge creation. These factors are related to managerial procedures, organizational culture and leadership characteristics. Nonaka and Konno (1998) claimed also

that companies must build shared spaces or ‘ba’ in order to boost knowledge creation. In fact, several researchers studied the KME in organizations (Dunk and Jeng, 2013; Lee and Choi, 2003; Nejatian et al., 2013). An analysis of the literature allowed us to highlight the main KME which revolve around five aspects: organizational culture, organizational structure, leadership, IT support and T-shaped skills.

### 2.2.1 Organizational Culture

As a system of shared values, culture shapes employees’ behaviors. Organizations should therefore create a culture that promotes knowledge sharing and creation. According to many authors, organizational culture is recognized as the most preeminent factor for KCP success (Lee and Choi, 2003; Nonaka and Takeuchi, 1995). Davenport and Prusak (1998) stressed that a knowledge-friendly culture creates a favorable climate to knowledge management process. Nejatian et al., (2013) argued that “*culture provides the basic infrastructure for the implementation of knowledge management system*”.

Particularly, researchers explored the primary organizational culture characteristics that positively influence KCP. Most of them found that an appropriate culture that supports KCP is characterized by trust, collaboration, learning and incentives/rewards (Dunk and Jeng, 2013; Lee and Choi, 2003; Nejatian et al., 2013). The relationships between these four cultural aspects and KCP are examined in this paper.

- **Trust:** can be defined as positive expectations of the behavior and intentions of other persons, based on an evaluation of their attributes including integrity, ability and benevolence (Mayer et al., 1995). This element is the cornerstone of good social relationships in organizations. Hence, it catalyzes the intensity of effective knowledge sharing and creation. Previous researches have shown that trust affects positively KCP (Dunk and Jeng, 2013; Lee and Choi, 2003; Nejatian et al., 2013). According to Davenport and Prusak (1998), trust is a fundamental component of knowledge management process. Ribiere and Tuggle (2005) identified trust as an essential precondition for collaborative climate and for the success of knowledge management. Ngah et al., (2008) established also that individuals are more willing to reveal their tacit knowledge and generate new knowledge only if they trust others. Otherwise, distrust leads them to protect their precious knowledge (Sankowska, 2013). Numerous studies focused on the enabling conditions for KCP in the perspective of SECI model (Nonaka and Takeuchi, 1995; Nonaka et al., 2000; Nonaka et al., 2006). They emphasized the importance of mutual trust as a crucial foundation for externalization of tacit knowledge. Sankowska (2013) pointed out that in order to optimize knowledge sharing and to stimulate creative behaviors, there must be an atmosphere of safety and trust in organization. Dovey (2009) argued in turn that “*trust is indispensable to the creation of a social environment in which ideas are freely generated, honestly assessed and selected and collectively transformed into profitable new products and services*”. Specifically, Hutchings and Weir (2005) noted that trustful relationships are drivers for knowledge sharing in the perspective of the SECI model across Arab cultures.



Thus, we predict that:

H1.1. Trust has a positive effect on KCP.

- **Collaboration:** refers to “*the degree to which people in a group actively help one another in their work*” (Lee and Choi, 2003). Researches indicated that collaboration represents a key factor for KCP success (Dunk and Jung, 2013; Gururajan and Hafeez-Baig, 2012). It allows individuals to access to diverse sources of knowledge. Knowledge creation is highly correlated to collaboration among different organization members (Poitou, 1996). Nonaka and Takeuchi (1995) argued that an organization creates knowledge through the conversion of knowledge process which is function of dynamic social interactions. The same idea was advocated by Nonaka and Konno (1998) who baptized the shared context in which employees interact with each other and create knowledge as the ‘ba’. As they stated, companies must create a field of interaction between knowledge holders in order to increase knowledge exchange and creation. Nejatian et al., (2013) noted that knowledge exchange “*can be fostered by collaborative interactions to reduce fear and increase openness to other members*”.

Thus, we expect that:

H1.2. Collaboration has a positive effect on KCP.

**Learning:** Many scholars recognized learning as a driver for KCP. This concept is defined as the “*degree of opportunity, variety, satisfaction and encouragement for learning and development in organization*” (Lee and Choi, 2003). It is also described as a: “*social process of individual interactions that aims to produce new organizational knowledge*” (Ingham, 1994). Building on this, knowledge creation is the result of organizational learning. The same idea was advocated by Nonaka and Takeuchi (1995) who emphasized that KCP is function of continuous internal and external learning capacity of the organizations. Through SECI model, they represented the dynamics of knowledge creation within the learning organizations and highlighted the importance of learning culture as the essence of KCP. “*For successful knowledge creation, organizations should develop a deeply ingrained learning culture*” (Lee and Choi, 2003). Managers have to encourage employees to learn in particular by supporting training, constant questioning and collaborative problem solving and reflections. López et al. (2004) claimed that “*knowledge management and learning go hand in hand*”. They added that “*learning processes define the quality of knowledge distributed across the organization as well as the effectiveness with which knowledge is put to use*”. In addition, the amount of time spent on learning affects the extent of knowledge creation (Kanevsky and Housel, 1998). Al-Hakim and Hassan (2012) provided evidence that learning has a significant positive effect on knowledge management in the case of the Iraqi mobile telecommunication sector. The same result was found in the Korean context (Lee and Choi, 2003) and in the Indian context (Gururajan and Hafeez-Baig, 2012).

Hence, we predict that:

H1.3. Learning has a positive effect on KCP.

**Incentives and rewards:** Individuals are not always able to express what they know. Furthermore, they may not want to share their knowledge because they may feel deprived of some power by revealing it. Hence, managers should motivate them to share their knowledge. In particular, they can establish motivational drivers such as incentives and rewards in order to valorize employee's efforts. Menon and Pfeffer (2003) suggested that an employee, who is not rewarded, may refuse to share knowledge inside the organization. Incentives such as recognition, promotion and monetary rewards, help companies in building a collaborative culture (Wang and Noe, 2010) and "*in aligning the interests of employees and organizations*" (Scekic et al., 2013). It stimulates knowledge sharing and contributions to knowledge repositories (Bartol and Srivastava, 2002) and enhances trust among organization's members (Davenport and Hall, 2002). It also improves work productivity (Charoenngam and Teerajetgul, 2006). Organizational incentives and rewards systems encourage employees to share the best practices and ideas (Davenport and Hall, 2002). The study of Gururajan and Hafeez-Baig (2012) indicates that these factors are significant determinants of knowledge management enablers among Indian companies. Charoenngam and Teerajetgul (2006) suggested also that incentives are significant predictors of KCP.

Hence, we predict that:

H1.4. Incentives and rewards have a positive effect on KCP.

### 2.2.2 Organizational Structure

To accommodate with today's turbulent environment and knowledge creation, organizations have to adopt suitable structure. In particular, Nonaka and Takeuchi (1995) advocated a new type of flexible structure: 'hypertext organization' which characterizes knowledge creating companies. In fact, many researchers demonstrated the importance of organizational structure. This variable can promote KCP or on the contrary may constitute a barrier for the success of this process (Dunk and Jeng, 2013; Lee and Choi, 2003; Nonaka and Takeuchi, 1995). In this paper, we examine the effect of two essential characteristics of organizational structure on KCP, namely degree of centralization and degree of formalization.

Centralization refers to "*the degree of authority and control over decisions*" (Lee and Choi, 2003). Centralized structure inhibits KCP and decrease creativity (Nonaka and Takeuchi, 1995). Hence, organizations have to adopt structure that encourages decentralization of decision-making (Al-Alawi et al., 2007). This type of structure encourages autonomy, increases communication, allows a company to benefit from a wide range of new ideas generated by various employees and generate new opportunities for knowledge creation. It also "*facilitates spontaneity, experimentation and the freedom of expression*" (Lee and Choi, 2003). Dunk and Jeng (2013) and Zheng et al. (2010) suggested that decentralized structure has a positive effect on KCP. Furthermore, Lee and Choi (2003) found that centralization is negatively related to KCP.

Therefore, we propose to test the following hypothesis:



H2.1. Centralized organizational structure has a negative effect on KCP.

Moreover, formalization refers to “*the degree to which decisions and working relationships are governed by formal rules, standard policies and procedures*” (Lee and Choi, 2003). The structure characterized by strict formal rules limits new ideas’ creation (Lee and Choi, 2003). In fact, when individuals continually refer to the organizational procedures to accomplish their tasks, they don’t experiment new ways of doing things and thus they don’t create new knowledge. Nonaka and Takeuchi (1995) argued that in order to support KCP, organizations have to adopt flexible work rules and procedures and encourage autonomy. KCP is based on ‘creative chaos’ defined as challenging existing routines and practices (Nonaka and Takeuchi, 1995). An organizational structure that affects positively KCP is hence characterized by a low degree of formalization (Dunk and Jeng, 2013; Lee and Choi, 2003). This type of structure permits variation which promotes creation of new ideas (Dunk and Jeng, 2013). Thus, we predict that:

H2.2. Formalized organizational structure has a negative effect on KCP.

### 2.2.3 Leadership

To manage human capital, companies need a manager who has the ability to connect employees around a common goal particularly in order to boost KCP. Managers must adopt the best leadership style that motivates and empowers knowledge workers. The role of leadership was identified by Nonaka et al. (2000) who stated that leaders “*provide the knowledge vision, develop and promote sharing of knowledge assets, create and energize and enable and promote the continuous spiral of knowledge creation*”. Moreover, Nonaka and Toyama (2005) emphasized the role of leadership in implementing a mindset of sharing, communication and trust that enhance KCP. Gururajan and Hafeez-Baig (2012), Kumar et al. (2013) and Von Krogh et al. (2012) provided also that leadership is a significant factor influencing KCP. According to Singh (2008), consulting and delegating styles of leadership are significant predictors of knowledge management process. In addition, Politis (2001) highlighted the importance of transformational leadership in enhancing knowledge acquisition. This style of leadership refers to “*the leader moving the follower beyond immediate self-interests through idealized influence, inspiration, intellectual stimulation or individualized consideration*” (Bass, 1999). Crawford (2005) and Migdadi (2005) stressed that transformational leadership has a positive effect on workers’ motivation to create and to share knowledge. Al-Hakim and Hassan (2012) noted also the importance of transformational leadership on knowledge management success within Iraqi context.

Hence, this leads to:

H3. Transformational leadership has a positive effect on KCP.

#### 2.2.4 T-shaped Skills

Organizational knowledge creation depends on human resources. In particular, many researchers considered employees' T-shaped skills as crucial variable in knowledge creation. T-shaped skills refer to "*the degree of understanding by employees their own and others' task areas*" (Lee and Choi, 2003). Employees who have T-shaped skills can "*combine theoretical and practical knowledge and enlarge their ability by integrating varied knowledge assets, across numerous areas and therefore create new knowledge*" (Lee and Choi, 2003). These employees are experts in a particular discipline and also know how this discipline interconnects with other disciplines (Gururajan and Hafeez-Baig, 2012). Gururajan and Hafeez-Baig (2012) provided evidence that T-shaped skills have a direct effect on the knowledge sharing and building. These types of skills catalyst creative interactions and represent a vehicle enabling synergetic combination of various knowledge (Madhavan and Grover, 1998). Migdadi (2005) suggested also that T-shaped skills have a significant effect on KCP in the perspective of SECI model.

Therefore, we propose the following hypothesis:

H4. T-shaped skills have a positive effect on KCP.

#### 2.2.5 IT support

Degree of information technology (IT) support is defined as "*the degree to which IT support for collative work, communication, searching, accessing, simulation and prediction, and systematic storing use*" (Lee and Choi, 2003). Many researchers highlighted the importance of IT infrastructure in supporting KCP (Lopez-Cabrales et al., 2009; Mallet et al., 2006; Prax, 2003). IT makes available for organizations a range of tools such as Internet, Intranet, groupware, workflow, datamining, videoconferences which help them in managing knowledge. It permits to "*connect people with reusable codified knowledge, as well as a conduit between newly created knowledge*" (Dunk and Jeng, 2013).

These technologies have a "*catalytic effect on the development and systematization of knowledge management practices*" (Mallet et al., 2006). The same idea was advocated by Davenport and Prusak (1998) who argued that IT infrastructure enhances collaboration, knowledge discovery and rapid decision-making. With these technologies, organizations can absorb innumerable masses of information, share, apply and create knowledge (Gold et al., 2001). Lopez et al. (2009) provided evidence for the effect of the IT infrastructure on knowledge generation, transfer, codification and storage. Lee and Choi (2003) stated that IT support promotes KCP and is not restricted to the transfer of codified knowledge. However, these authors concluded that IT support is only considerably linked to combination through an empirical study they conducted in Korean context.

Building on this, we predict that:

H5. IT support has a positive effect on KCP

### *2.3 KCP and Innovation Performance*

Innovation is defined by Afuah (1998) as new knowledge integrated into products, processes or services. In this perspective, the role of KCP as a catalyst for innovation has been mainly studied in the literature. This relationship was particularly highlighted by Nonaka and Takeuchi (1995) who suggested that KCP based on the four components of SECI model is the key of innovation. They claimed that firms' innovation capacities are based on their ability to create both tacit and explicit new knowledge and to exploit it in order to create new products, processes or organizations. The same idea was advocated by Popadiuk and Choo (2006) who pointed out that permanent innovation require a continuous knowledge creation that enables companies to identify new opportunities and to generate new original ideas. Furthermore, Kluge et al., (2001) emphasized the major role of KCP speed on innovation success.

In particular, in the process of socialization, direct interactions with internal and external actors help to absorb strategic knowledge, especially on new technologies developed in the market, new sources of raw materials, new production processes... Interactions with customers may permit to imagine new products that meet their needs. In addition, the process of externalization facilitates the expression of new ideas and represents a key enabler of exploratory innovation (Popadiuk and Choo, 2006). Miller and Morris (1999) pointed out that innovation found its germs in the explanation of tacit knowledge. Moreover, Popadiuk and Choo (2006) claimed that the potential of companies to generate exploitative innovation is based on combination and internalization processes.

Otherwise, Svetina and Prodan (2008) provided evidence, through an empirical study within companies operating in seven European countries, that the extent of use of internal and external knowledge has a positive impact on their innovative performance. In this perspective, we aim to identify in this paper the effect of SECI and in particular each process of this model on innovative performance.

Despite this important literature about knowledge creation in the perspective of SECI model and innovation, the relationship between these two variables remains controversial. Lee and Choi (2003) stated that each dimension of SECI model is a significant driver of organizational creativity. Refaiy (2002) showed that only combination and externalization affect positively innovation in the case of Egyptian context. Berraies (2012) concluded that socialization, externalization and internalization have a positive impact on innovation performance in the case of Tunisian context. According to Schulze and Hoegle (2008), while socialization and internalization have a positive effect on the novelty of product ideas, externalization and combination have a negative influence on the generation of new product ideas. Thus, we expect that:

H6. KCP has a positive effect on innovation performance.

*2.4 Research Model*

On the basis of the theoretical debates synthesized, we developed a research model (Figure 1). This model highlights that KCP, including socialization, externalization, combination and internalization, is affected positively by enabling factors namely trust, collaboration, learning, incentives and rewards, transformational leadership, decentralization, low formalization, IT support and T-shaped skills. In turn, this process affected positively innovation performance.

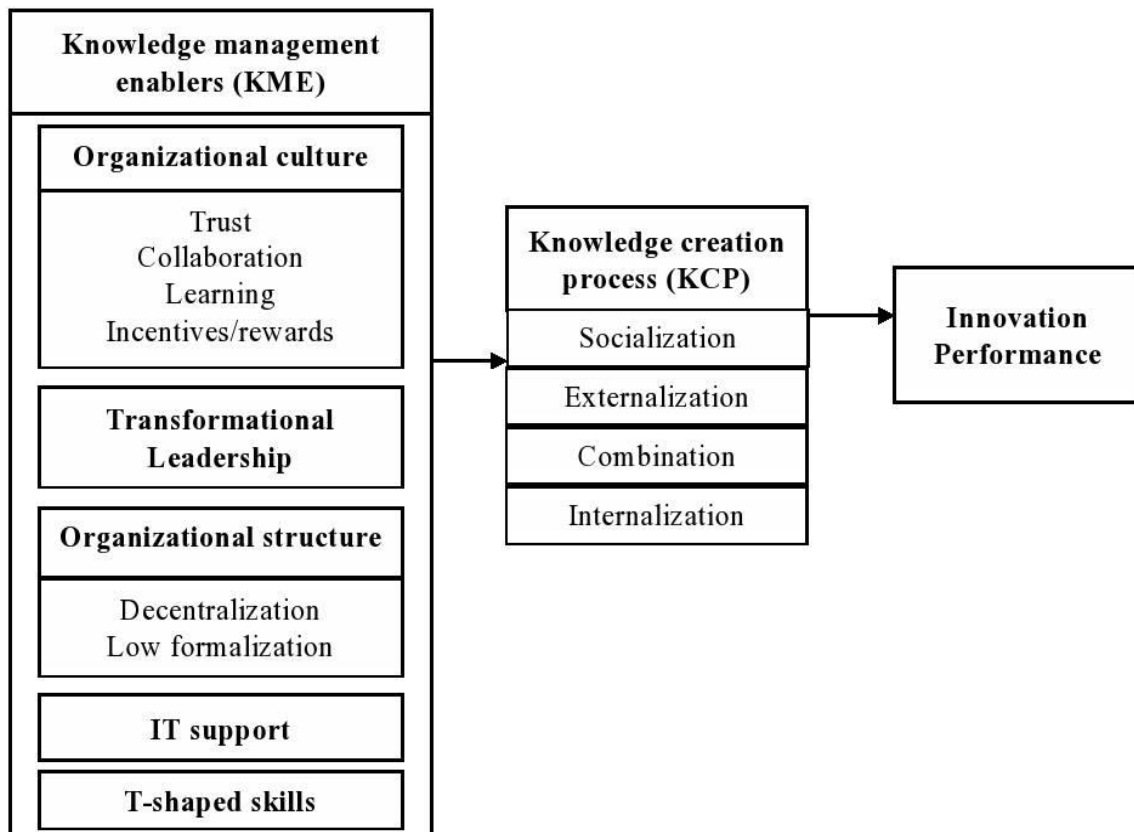


Figure 1. Theoretical model

This model has been tested empirically in the case of Tunisian ICT sector.

**3. Empirical study**

*3.1 Research Methodology*

We choose to base our empirical study on the Tunisian ICT sector, which has been relatively little studied. Following a quantitative method and a proportionate stratified random sampling technique, we administrated a questionnaire, after having pretested it, in paper form, to 300 managerial staff of Tunisian ICT companies. Finally, we obtained 202 valid questionnaires, representing a response rate of 67%.

49% of respondents have over five years' experience in the companies in where they work. 86% of them are graduated of higher education. The majority of them was males (58%) and belonged to small and medium enterprises (SMEs) (91%). The sample is therefore

homogeneous compared to the basic population which is composed mostly of SMEs.

Research variables were measured using existing published scales in the management literature. For all variables, multi-items measures were used and each item was based on five point Likert type scale (1=strongly disagree; 5=strongly agree). Innovation performance was measured by Svetina and Prodan's (2009) scale which contains 5 items. Trust (6 items), collaboration (5 items), organizational learning (5 items), centralization (5 items), formalization (5 items), T-shaped skills (5 items) and IT support (5 items) were measured through Lee and Choi's (2003) questionnaire. Transformational leadership was operationalized by 7 items developed by Carless et al. (2000). Incentives and rewards were measured through 4 items validated by Charoengam and Teerajetgul (2006). We employed also Nonaka et al.'s (2000) scale (19 items) to measure KCP. Moreover, a Structural Equation Modeling (SEM) analysis was used to test the research hypothesis.

### 3.2 Measurement assessment of variables

Through SPSS 18.0 software, Exploratory Factor Analysis (EFA) was performed. First, principal component analysis with varimax rotation was used in order to assess the dimensionality of each variable. We delete items with factor loading values less than 0.5. In this case, five items related to KME (trust, T-shaped skills, transformational leadership and centralization) and three items related to KCP were abandoned. Results confirmed the unidimensionality of each KME and innovation. Findings assessed also the multidimensionality of KCP, which contains four dimensions namely socialization, externalization, combination and internalization. Then, to verify reliability, Cronbach's alpha test was used. For this index, a higher cutoff value of 0.7 was adopted in order to assess reliability as recommended by Nunnally and Bernstein (1994). Results provide evidence that reliability of all instruments is established (see Table 1).

Table 1. Reliability and convergent validity of measurement instruments

Variables	Number of items	Percentage of variance explained	Cronbach's Alpha	Jöreskog's Rh ôs	Rh ô of convergent validity
<b>Trust</b>	5	72.076%	0.902	0.895	0.708
<b>Collaboration</b>	5	71.107%	0.896	0.883	0.696
<b>Learning</b>	5	77.489%	0.926	0.914	0.652
<b>Incentives and rewards</b>	4	78.355%	0.901	0.887	0.628
<b>Transformational leadership</b>	5	79.430%	0.934	0.923	0.643
<b>Centralization</b>	4	86.720%	0.949	0.926	0.760
<b>T-shaped skills</b>	4	76.552%	0.891	0.889	0.676
<b>Formalization</b>	5	91.078%	0.975	0.973	0.880
<b>IT supports</b>	5	66.749%	0.874	0.858	0.677
<b>Socialization</b>	4	65.716%	0.806	0.793	0.611

<b>Externalization</b>	4	97.159%	0.990	0.989	0.876
<b>Combination</b>	4	71.782%	0.868	0.863	0.619
<b>Internalization</b>	4	68.381%	0.839	0.840	0.634
<b>Innovation performance</b>	5	74.945%	0.915	0.879	0.693

In addition, Confirmatory Factor Analysis (CFA) was conducted via AMOS 18.0 software. In this stage, fit measurement models was evaluated referring to the most important indices recommended by Chin and Todd (1995) and Bentler and Hu (1999). These authors advocated a ratio between the Chi-Square value and the degrees of freedom ( $\chi^2/df$ ) value less than 3, a Goodness-of-fit index (GFI) value greater than 0.9, a Comparative Fit Index (CFI) value greater than 0.95, and a Root Mean Square Error of Approximation (RMSEA) value less than 0.06. Results revealed that all measurement models fitted the data satisfactorily.

We also verified the assumption of normality of distributions for all variables by examining the Skewness and Kurtosis indicators. Moreover, the reliability of each variable was confirmed by examining Jöreskog Rhô's index, which must exceed 0.7 (Fornell and Larcker, 1981) (Table 1). Convergent validity was also assessed by ensuring that the rhô of convergent validity ( $\rho_{vc}$ ) value for each constructs was greater than 0.5 (Fornell and Larcker, 1981), as shown in Table 1. Discriminant validity was evaluated by comparing the average variance extracted and the squared correlation between each pair of constructs (Fornell and Larcker, 1981). Building on this, discriminant validity is verified for the variables.

### 3.3 Results

In order to verify the relationship between research variables, Structural Equation Modeling (SEM) has been performed within AMOS 18.0 Maximum likelihood method and a bootstrap procedure with 200 iterations was applied. For further analysis, we test two models. In the first model, KCP represents a second order construct including the four modes of knowledge creation. In the second model, KCP has been divided into socialization, externalization, combination and internalization.

First, models adjustment was verified by examining the most relevant fit indices. We concluded that all of them exceeded their acceptance levels according to Bentler and Hu (1999) and Chin and Todd (1995). Results, in Table 2, show appropriate models fitness.

Table 2. Fit indices of models tested

<b>Fit indices</b>	<b><math>\chi^2 /ddl</math></b>	<b>GFI</b>	<b>RMSEA</b>	<b>CFI</b>
<b>Level of acceptance</b>	<b><math>\leq 3</math></b>	<b><math>&gt; 0,90</math></b>	<b><math>&lt; 0,08</math></b>	<b><math>&gt; 0,95</math></b>
<b>First model tested</b>	2.391	0.918	0.063	0.974
<b>Second model tested</b>	2.301	0.902	0.078	0.969



$\chi^2/df$ =Chi-Square value/degrees of freedom, GFI: Goodness-of-fit index, CFI: Comparative Fit Index, RMSEA= Root Mean Square Error of Approximation

Next, in order to clarify the relationships between research's variables, standard regression coefficients ( $\beta$ ), critical ratio (C.R.) and level of significance (P) have been used. A relationship is significant at a level of 5% when C.R. value exceed 1.96 in absolute value and P is smaller than 0.05. Tested relationships are highlighted in Table 3.

On one hand, this research aims to determine the variables that foster KCP. All organizational culture factors namely trust ( $\beta= 0.202$ ;  $P<0.001$ ), collaboration ( $\beta= 0.250$ ;  $P<0.001$ ), learning ( $\beta= 0.154$ ;  $P<0.01$ ) and incentives and rewards ( $\beta= 0.722$ ;  $P<0.001$ ) were significant predictors of KCP, which supports H1. In particular, rewards and incentives stand out as the most important enablers for knowledge creation. This variable has a significantly positive influence on socialization ( $\beta= 0.784$ ;  $P<0.001$ ), externalization ( $\beta= 0.263$ ;  $P<0.001$ ), combination ( $\beta= 0.579$ ;  $P<0.001$ ) and internalization ( $\beta= 0.727$ ;  $P<0.001$ ). Trust is also a significant predictor of socialization ( $\beta= 0.089$ ;  $P<0.01$ ) and externalization ( $\beta= 0.214$ ;  $P<0.001$ ). Results reveal in addition that collaboration has a positive and significant effects on socialization ( $\beta= 0.313$ ;  $P<0.01$ ) and externalization ( $\beta= 0.102$ ;  $P<0.01$ ). Learning has meanwhile, a positive and significant impact on socialization ( $\beta= 0.138$ ;  $P<0.001$ ) and internalization ( $\beta= 0.093$ ;  $P<0.01$ ).

Moreover, organizational structure factors examined in this paper, namely centralization ( $\beta= -0.238$ ;  $P<0.001$ ) and formalization ( $\beta= -0.262$ ;  $P<0.001$ ) had a negative and significant effect on KCP, which supports H2. In particular, centralization is negatively related to socialization ( $\beta=-0.472$ ;  $P<0.001$ ), combination ( $\beta=-0.638$ ;  $P<0.001$ ) and internalization ( $\beta=-0.590$ ;  $P<0.001$ ). Formalization has a negative effect on socialization ( $\beta=-0.240$ ;  $P<0.001$ ) and externalization ( $\beta=-0.241$ ;  $P<0.001$ ). However, this variable has a positive impact on combination ( $\beta= 0.192$ ;  $P<0.001$ ).

Transformational leadership and T-shaped skills were not significantly linked to KCP, which did not support H3 and H4. However, transformational leadership is a significant predictor of socialization ( $\beta= 0.114$ ;  $P<0.01$ ) and externalization ( $\beta= 0.152$ ;  $P<0.01$ ).

IT support has a positive and significant effect on KCP ( $\beta= 0.194$ ;  $P<0.001$ ), which supports H5. This variable has a significant positive effect on socialization ( $\beta= 0.085$ ;  $P<0.01$ ), externalization ( $\beta= 0.189$ ;  $P<0.001$ ), combination ( $\beta= 0.101$ ;  $P<0.01$ ) and internalization ( $\beta= 0.116$ ;  $P<0.01$ ).

Table 3. Effects of KME on KCP

Independent variable	KCP	S	E	C	I
<b>Trust</b>	$\beta=0.202$ ; C.R.=3.643 ; P=***	$\beta=0.089$ ; C.R.=2.936; P=**	$\beta=0.214$ ; C.R.=3.337; P=***	$\beta=0.005$ ; C.R.=0.140; P>0.05	$\beta=0.041$ ; C.R.=1.384; P>0.05
<b>Collaboration</b>	$\beta=0.250$ ; C.R.=3.994 ; P=***	$\beta=0.313$ ; C.R.=4.045; P=***	$\beta=0.102$ ; C.R.=2.543 ; P=**	$\beta=0.162$ ; C.R.=0.455 ; P>0.05	$\beta=0.077$ ; C.R.=1.613 ; P>0.05
<b>Learning</b>	$\beta=0.154$ ; C.R.=2.916 ; P=**	$\beta=0.138$ ; C.R.=4.422 ; P=***	$\beta=0.072$ ; C.R.=1.149 ; P>0.05	$\beta=0.045$ ; C.R.=1.531 ; P>0.05	$\beta=0.093$ ; C.R.=2.528 ; P=**
<b>Incentives/ rewards</b>	$\beta=0.722$ ; C.R.=6.954 ; P=***	$\beta=0.784$ ; C.R.=15.114 ; P=***	$\beta=0.263$ ; C.R.=4.160 ; P=***	$\beta=0.579$ ; C.R.=14.213 ; P=***	$\beta=0.727$ ; C.R.=12.969 P=***
<b>Centralization</b>	$\beta=-0.238$ ; C.R.=-4.137 P=***	$\beta=-0.472$ ; C.R.=-11.499 ; P=***	$\beta=-0.004$ ; C.R.=-0.064 ; P>0.05	$\beta=-0.638$ ; C.R.=-14.246 P=***	$\beta=-0.590$ ; C.R.=-11.599 P=***
<b>Formalization</b>	$\beta=-0.262$ ; C.R.=-4.533 P=***	$\beta=-0.240$ ; C.R.=-7.547; P=***	$\beta=-0.241$ ; C.R.=-3.887; P=***	$\beta=0.192$ ; C.R.=2.889; P=***	$\beta=0.034$ ; C.R.=1.206; P>0.05
<b>Transformational leadership</b>	$\beta=0.014$ ; C.R.=0.299 ; P>0.05	$\beta=0.114$ ; C.R.=2.299 ; P=**	$\beta=0.152$ ; C.R.=2.441 ; P=**	$\beta=0.014$ ; C.R.=0.375 ; P>0.05	$\beta=-0.047$ ; C.R.=-1.639 ; P>0.05
<b>T-shaped skills</b>	$\beta=-0.029$ ; C.R.=-0.616; P>0.05	$\beta=-0.007$ ; C.R.=-0.234 ; P>0.05	$\beta=-0.034$ ; C.R.=-1.676 ; P>0.05	$\beta=0.018$ ; C.R.=0.488 ; P>0.05	$\beta=-0.015$ ; C.R.=-1.251 ; P>0.05
<b>IT support</b>	$\beta=0.194$ ; C.R.=3.232 ; P=***	$\beta=0.085$ ; C.R.=2.630 ; P=***	$\beta=0.189$ ; C.R.=2.766 ; P=***	$\beta=0.101$ ; C.R.=2.560 ; P=**	$\beta=0.116$ ; C.R.=3.448 ; P=***

S= Socialization, C= Combination, E= Externalization, I= Internalization, \*\*\*: significant at the 0.001 level.  
 $\beta$ = Standardized estimate, C.R.= critical ratio, P=level of significance, \*\* : Significant at the 0.01 level

One the other hand, this research seeks to examine the relationship between KCP and innovation performance. As shown in Table 4, KCP has a positive and significant influence on innovation performance ( $\beta$ = 0.793;  $P < 0.001$ ), which supported H6. In particular, socialization ( $\beta$ = 0.718;  $P < 0.001$ ) and externalization ( $\beta$ = 0.186;  $P < 0.001$ ) are significant predictors of innovation performance. However, combination and internalization have not a significant influence on innovation performance ( $P > 0.05$ ).

Table 4. Effect of KCP on innovation performance

	$\beta$	C.R.	P
<b>KCP</b>	0.793	6.657	***
<b>Socialization</b>	0.718	6.860	***
<b>Externalization</b>	0.186	3.983	***
<b>Combination</b>	0.036	0.435	0.664
<b>Internalization</b>	0.072	0.654	0.519

$\beta$ = Standardized estimate, C.R.= critical ratio, P=level of significance,

\*\*\*: significant at the 0.001 level.

The Figure 2 highlights the positive relationships between variables of our research, emerged from the empirical study that we conducted in the case of Tunisian companies.

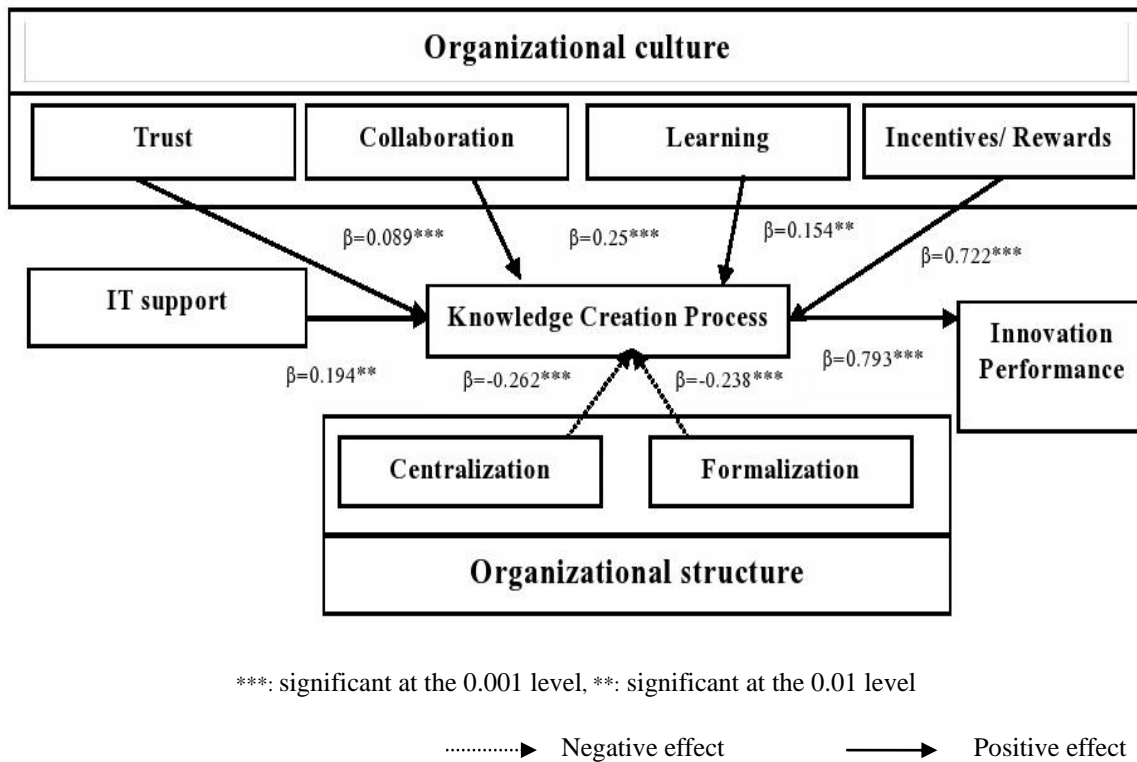


Figure 2. Results of analysis

#### 4. Discussion

This study confirms that organizational culture is the most fundamental success factor of KCP. This finding is consistent with previous researches (Al-Hakim and Hassan, 2012; Lee and Choi, 2003; Nejatian et al., 2013; Nonaka and Takeuchi, 1995). Results highlighted that incentives and rewards are the most crucial cultural factor enabling the four modes of KCP. These elements have a significant effect on creation of both explicit and tacit knowledge. Such motivational drivers encourage employees to share what they know and to create new knowledge as Charoenngam and Teerajetgul (2006) and Gururajan and Hafeez-Baig (2012) suggested.

Moreover, trust is a key enabler of KCP and in particular a significant predictor of socialization and externalization. This result is in accordance with previous researches (Dunk and Jeng, 2013; Lee and Choi, 2003; Nejatian et al., 2013). Trust-based culture fosters collaborative atmosphere, leads to acceptance between employees and increase their willingness to share tacit knowledge and develop new ideas (Golipour et al., 2010). Findings confirm also the study of Hutchings and Weir (2005) who emphasized that in Arab countries such as Tunisia, trust is a very important factor for KCP success. They stated that in Arab culture, trustful relationship is a precondition for knowledge sharing.

In addition, our findings demonstrated that collaboration is considerably related to KCP (Dunk and Jeng, 2013; Lee and Choi, 2003; Nejatian et al., 2013; Nonaka and Konno, 1998;

Poitou, 1996) and in particular to socialization and externalization. This result supports in particular Nonaka and Konno (1998) who stressed that these two modes of KCP are forged in an environment that fosters interaction between employees.

Our research indicated also that learning is a significant enabling of KCP which confirms the findings of some studies (Al-Hakim and Hassan, 2012; Gururajan and Hafeez-Baig, 2012). Results support especially Choi and Lee (2003) who found that learning is positively related to socialization and internalization. These authors claimed that KCP success depends on the development of learning culture within the organization.

In addition, as expected, results show that formalization constitutes a barrier for knowledge creation. As highlighted by Gururajan and Hafeez-Baig (2012) and Nonaka and Takeuchi (1995), less emphasize on work rules and employees autonomy gives them the possibility to extend their knowledge. Thus, KCP is based on the level of non-formalization (Gururajan and Hafeez-Baig, 2012). Moreover, as emphasized by Lee and Choi (2003), formalization inhibits socialization and externalization and promotes combination. Indeed, Lee and Choi (2003) suggested that a formalized structure may inhibit tacit-based activities (socialization and externalization) and may foster explicit-based activities (combination and internalization). However, results show that formalization has not significant impact on internalization. Our findings are consistent with Lee and Choi (2003) who didn't found a significant relationship between formalization and internalization.

In addition, this research indicates that centralization has a negative effect on KCP. Our findings corroborate the studies of Dunk and Jeng (2013) and Lee and Choi (2003). Indeed, knowledge creation is promoted within a decentralized organizational structure, which permits a high degree of interaction and knowledge sharing between organizational members.

This study attested the close relationship between IT support and all modes of KCP (Alavi and Leidner, 2001; Davenport and Prusak, 1998; Mallet et al., 2006; Prax, 2003). Therefore, as advocated by Mallet et al. (2006), technology infrastructure has a catalytic effect on knowledge creation. In this perspective, we based our empirical study on the ICT sector which is characterized by an increased use of IT support. This finding is in line with López et al. (2009) who found that the extent of use of IT will contribute to increase knowledge generation, transfer, codification and storage. However, this result contradicts with the findings of Lee and Choi (2003) and Dunk and Jeng (2013) suggesting that IT support hasn't significant impact on KCP. In particular, Lee and Choi (2003)'s empirical research reveals that IT support is correlated only to combination. These authors stated that these technologies do not affect directly the other modes of knowledge creation. They added that IT supports "*facilitate communication but cannot replace face-to-face contact for tacit-to-tacit knowledge transfer*" (Lee and Choi, 2003). Our results are consistent with Lee and Choi (2003)'s study that pointed out that these technologies represent a key support for the combination phase: they are a vector for the transmission of explicit knowledge. In contrast with Choi and lee (2003), our findings reveal that IT support facilitates also tacit knowledge sharing and creation. In fact, technologies have evolved to integrate tools allowing the transfer and

creation of tacit knowledge such as collaborative working tools, e-learning and video conferencing. For example, Guittard et al., (2008) argued that Internet forum is “*a place where the explicit knowledge as well as tacit is exchanged. The Forum is a true environment that encourages knowledge, a true 'Ba'*”. According to this author, the four modes of knowledge conversation of SECI model can be realized through this ‘cognitive platform’.

Our study presents no relationship between T-shaped skills and KCP. These findings corroborate the study of Lee and Choi (2003) who found no significant relationship between T-shaped skills and KCP. In the perspective of these authors, we concluded that managers should implement practices that encourage employees with T-shaped skills to share their knowledge and to create new one.

Our research contradicts with Kumar et al. (2013) and Al-Hakim and Hassan (2012) who provided evidence that transformational leadership has a positive effect on KCP. In fact, results show in particular that transformational leadership is correlated only to socialization and externalization. In this line, Bryant (2003) suggested that transformational leadership “*is more effective at creating and sharing knowledge at the individual and group levels*”. This author argued that another type of leadership namely ‘transactional leadership’ “*is more effective at exploiting knowledge at the organizational level*”. This result requires further exploration by examining especially the effect of these two styles of leadership on KCP.

Finally, our findings confirm the importance of KCP for innovation performance and highlight the most crucial dimensions of SECI model in contributing to innovation. It shows that innovation in ICT Tunisian sector is based on tacit linked activities namely socialization and externalization.

## **5. Conclusion**

As mentioned above, several studies emphasized the role of knowledge creation as driver for firms’ innovation. In this perspective, we have endeavored to understand the effect of KCP on innovation performance inspired by the SECI model of Nonaka and Takeuchi (1995). This model was conceptualized in a Japanese cultural context. In fact, the basic premise of this research is that the applicability of SECI model in other cultural contexts requires enabling conditions that foster KCP.

In this study, we identified the KME that promote knowledge creation within Tunisian ICT companies. This paper suggests that successful KCP among Tunisian ICT companies needs critical success factors in the form of trust, collaboration, incentives and rewards, organizational learning, IT support, decentralization and low formalization. A key finding in the present study is that incentives and rewards are the most critical enabling of KCP. Although, this research was useful for establishing links between KCP and innovation performance. Especially, we also highlighted the importance of tacit knowledge as a catalyst for innovation performance.

This research provides contributions on both theoretical and managerial perspectives. On a



theoretical level, we develop a conceptual model that explains the effects of KME on KCP, which in turn contribute to innovation performance. From a practitioner standpoint, this paper provides an opportunity for managers to better recognize the enablers enhancing knowledge creation in the organizations.

Our study contains some limitations. The main one is probably that it only focused on ICT sector. Scholars may extend the field of this research to other sectors. In addition, they may examine the mediating role of KCP in the relationship between KME and innovation performance. Also, it would be interesting to investigate other potential KME. Finally, a comparative cross-cultural study would be interesting for further research.

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### **Glossary**

- **ICT:** Information and Communication Technology.
- **IT:** Information Technology
- **KCP:** Knowledge Creation Process.
- **KME:** Knowledge Management Enablers.
- **SECI:** Socialization, Externalization, Combination, Internalization.