



## Analysis of the effects of ICTs in knowledge management and innovation: The case of Zara Group

María Teresa García-Álvarez \*

Department of Economic Analysis and Business Administration, University of La Coruna, Faculty of Economics and Business, Campus de Elviña s/n, 15071 La Coruna, Spain

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### ABSTRACT

The aim of this paper is to contribute to the study of how information and communication technologies influence on knowledge management processes within organizations and its influence on innovation and co-learning with an economical approach. Although this is a matter of particular relevance in the companies in order to achieve competitive advantages, there is a certain gap in economic literature about such concepts in an integrative way.

We propose a theoretical model that relates these concepts and apply it to the case of the textile group Zara. Results show that this company use different types of tools, such as management systems based on electronic communication or automation processes. The application of the case study of the textile group Zara shows that the combined used of these ICTs involve positive effects on socialization, exteriorization, combination and interiorization processes of knowledge management. Moreover, we identify which technologies and KM processes are most beneficial. Co-learning from ICTs favor the development of “living fashion” that involves the redesign new output lines in two weeks’ time (product innovation) and a short line production and zero stock policy (process innovation) in the company.

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### 1. Introduction

The *resource-based view of the firm* establishes the importance of organizations developing strategic resources that allow them to obtain sustainable competitive advantages over the long term (Edvinsson, 2013; Eisenhardt & Martin, 2000; Wernerfelt, 1984). Over the last few decades, the business environment has been characterized by becoming more dynamic and complex. As a result, organizations must reconsider the strategic resources that allow them to develop these competitive advantages. In this context, the competitiveness of companies is determined to a great extent by the use of information and communication technologies (ICTs), which allow for the creation of value and the establishment of knowledge management processes within the organizations (Kuo & Ye, 2010; Zhang, Ordóñez de Pablos, & Zhou, 2013).

Knowledge management (KM) is defined as “a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise’s information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience

in individual workers” (Duhon, 1998). In the present business environment, this concept plays a key role as it is concerned with the management of intangible assets in organizations. The majority of these types of assets involve processes that entail, in one way or another, the reception, structuring and transmission of knowledge. It is therefore a dynamic concept that involves the development of outputs with higher added value. In this context, intellectual capital (IC) is defined as a “combination of intangible actives which generate growth, renewal, efficiency, and stability in the organization” (Sveiby, 1997).

There is a large body of literature in the field of economics which studies: (a) ICTs, especially papers that analyze their effects on productivity and economic variables (e.g. Draca, Sadun, & Van Reenen, 2006), (b) KM, where research is centered on questions related to the processes of creation, transmission, use and knowledge management (e.g. Ichijo & Nonaka, 2007) and (c) innovation, with papers that analyze the main characteristics of business innovation (e.g. Teece, 2010).

However, a scarce literature examines the relationship between these three concepts. Moreover, it is not clear which technologies and KM processes are most beneficial in the companies. In this context, the objective of this paper is to analyze KM processes associated with ICTs in organizations and to use the results obtained, to identify implications for the innovation process.

\* Tel.: +34 981 167000x2459.

E-mail address: [mtgarcia@udc.es](mailto:mtgarcia@udc.es)

Likewise, co-learning within organizations in these processes will be analyzed because of the transferring and sharing of knowledge are indispensable concepts to obtain sustainable competitive advantages in the present business environment.

To this end, we establish a conceptual theoretical framework that allows us to analyze the relations between ICTs, KM and product and process innovation of the enterprises. Besides, we apply this model to the Zara Group (textile group that belongs to holding Inditex) with the aim of proving the theoretical proposals established in the model and analyze co-learning processes.

To do so, the structure of the paper is as follows: firstly, we analyze the literature about KM and the main characteristics of ICTs and propose a classification, in both the internal and external scope of the organization. From this, we develop a theoretical model where the concepts of KM, ICTs and innovation are related. After that, we apply this proposed theoretical model to the case study of the Zara Group and show the main results obtained. The final section will address the main conclusions and discussion that may be drawn from this paper.

## 2. Theoretical framework

### 2.1. Analysis of the literature about KM

There is an extensive literature about the analysis of KM concept. In this context, Lindblom and Tikkanen (2010) considers KM as “a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that will improve organizational competitiveness”. Bueno, Aragón, Salmador, and García (2010) establishes that “KM is the process of creation, acquisition and transfer of knowledge that is reflected in the behavior of the organization”. Similarly, Nonaka and Takeuchi (1995) consider KM as “company's capacity to create new knowledge, disseminate it within the organization and incorporate it in all organizational processes”. In this context, Edvinsson (2013) establishes “the importance of KM in the value creation from intangible actives in the companies”.

Therefore, in KM concept, there is an essential characteristic in common, related to the identification, sharing and creation of knowledge. It is important to bear these characteristics in mind, as they are a key element in organizational competitiveness. Therefore, as long as a dynamic process of knowledge reception, structuring and transmission has been developed, organizations will tend to develop outputs with a higher added value on the market (Kogut & Zander, 1992; Schmidt & Keil, 2013).

In this context, Nonaka and Takeuchi (1995) distinguish between explicit and tacit knowledge.

Tacit knowledge is a personal knowledge, developed from experience. It is characterized by being difficult to transmit, reproduce or embody. This type of knowledge is shaped by ideas, abilities and values. Know-how and the employees' experience are examples of tacit knowledge (Goffin & Koners, 2011).

On the other hand, explicit knowledge is formal and codified. As a result, it can be defined and transmitted with relative ease. Formulas, equations and company policy manual are examples of explicit knowledge (Hislop, 2013).

Fig. 1 shows KM processes, throughout various stages: socialization, exteriorization, interiorization and combination. By means of combination and socialization, knowledge is discovered. Externalization and internalization allow companies to capture knowledge. Later, these processes establish the possibility of sharing that knowledge in order to be able to apply it in the management by means of the establishment of routines.

Now, we are going to analyze their main characteristics:

- *Socialization*. This involves passing on tacit knowledge to form part of other tacit knowledge. In other words, it is based on the understanding and assimilation of tacit knowledge, derived from the interaction among people, by means of observation, imitation and practice. For example, when employees acquire new knowledge in a company directly from their workmates and managers.
- *Exteriorization*. This consists of moving from tacit to explicit knowledge. Therefore, the objective is to make tacit knowledge explicit by means of any type of medium that would allow other people to learn it, such as language or other formal representations. For example, when transmitted knowledge is encoded by means of the dialogue between employees and managers in a company which involve the possibility of sharing it.
- *Interiorization*. This consists of moving from explicit to tacit knowledge. In this process, knowledge is appropriated and later becomes one's own knowledge. As such, it is the result of learning and implementation. For example, when employees internalize the knowledge contained in the documents or software used in the company and then convert it into their own knowledge.
- *Combination*. This consists of moving from one type of explicit knowledge to another. It is based on the exchange, association and structuring of explicit knowledge from different sources, facilitating the creation of new knowledge of the same type. For example, when explicit knowledge of a company is combined (by means of documents or forums, among others), socialization process is extended.

### 2.2. Proposal of classification of ICTs

Organizations require information for decision-making that is especially relevant in complex and dynamic environments. In this context, there are several tools that manage the acquisition, distribution and use of information stemming from relationships among organizations, with an emphasis on ICTs (Butler & Murphy, 2007; Zhang et al., 2013).

As a result, ICTs are a key concept in obtaining and facilitating the creation of explicit knowledge by means of the collection, storage, aggregation and transmission of quantitative data (Phang & Foong, 2010). Furthermore, these technologies also aid in the creation of tacit knowledge by means of various tools, such as videoconferencing and simulation technologies. However, mere contact among people with explicit knowledge is not sufficient for the generation of tacit knowledge, rather interactions among individuals must occur in order to develop judgments and intuition.

Therefore, ICTs can involve positive impacts on co-learning. Thus, these technologies allow companies to create a shared space, in which employees can see each other actions of their workmates and each employee can contribute to which. Besides, these tools facilitate the creation of communication channels and the storing of commonly built documents that support co-learning (Van Joolingen, De Jong, Lazonder, Savelsbergh, & Manlove, 2005).

In order to promote co-learning, construction of shared knowledge is a key concept. Shared knowledge should be shown explicitly in order to allow employees to see the documents they are working on and talking about. However, it is necessary that the different employees' approaches can be integrated in the joint space created from ICTs too. So, employees would manipulate the documents established in it. Therefore, tacit and explicit knowledge is required from ICTs in order to promote co-learning in the companies.

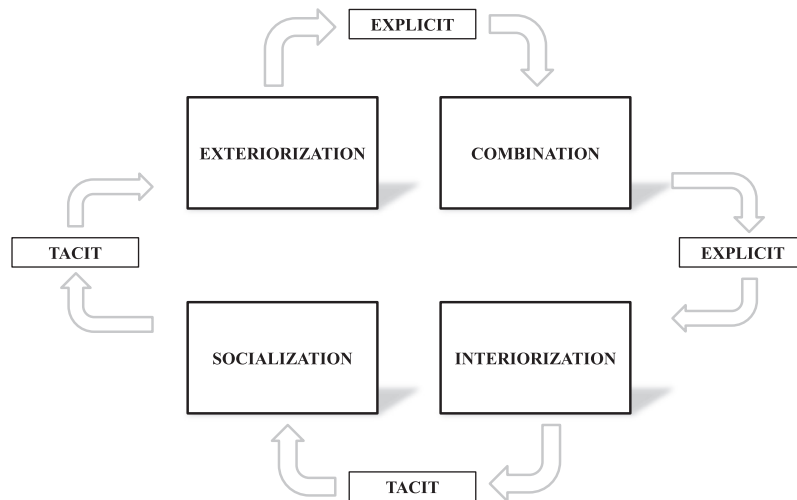


Fig. 1. Processes of KM. Source: Nonaka and Takeuchi (1995).

Research generally shows a positive effect of ICTs on KM, but it fails to clearly establish which technologies and KM processes are most beneficial (Nonaka & Teece, 2001). Within this context, we will proceed to analyze the influence of ICTs on the KM processes in organizations.

There are several classifications of ICTs in economic literature. Some scholars establish that classification in function of the support of ICTs to KM processes. In this context, Teece (1998) distinguish between creation, transfer, assembling, integration, and exploitation. Gottschalk (2000) establishes the classification in function of generation, access, transfer, sharing and codifying. Grover and Davenport (2001) distinguish between generation, codification, transfer, and realization. Gold, Malhotra, and Segars (2001) develop the classification in function of acquisition, conversion and protection.

The relative tools of these works are given below (Bigliardi, Dormio, & Galati, 2010):

- Creation: computer aided design, virtual reality, investment workstations, etc.
- Searching and acquisition: browser, data warehouses, database index system, etc.
- Protection: virtual protection network, firewall, etc.
- Use: e-meetings, group decision support systems, collaboration suite, e-mail message broadcast software, etc.
- Sharing: groupware, computer supported cooperative work, intranet, portals, etc.
- Distribution: word processing, imaging and web publishing, electronic calendars, personal information management, etc.
- Capture and codification: expert systems, neural nets, fuzzy logic, genetic algorithms, intelligent agents, etc.

Carbonara (2005) establishes a classification of ICTs in function of: (a) coordination technologies (e.g. LAN, WAN, database, shared elaboration systems, data modeling support systems, group working support systems, groupware, Internet), (b) process technologies (e.g. CNC, FMS, CAM) and KM technologies (e.g. software agents, groupware, Internet).

Papastathopoulos and Beneki (2010) identify between: (a) enterprise systems (e.g. enterprise resource planning, customer relationship management, supply chain management), (b) information systems (e.g. management information systems, decision support systems, executive support systems), (c) digital technologies (e.g. e-commerce, e-business, e-management), (d) telecommunication systems (e.g. Internet, e-mail, local area networks),

(e) identification and data capture technologies & telematic technologies (e.g. portable data collection, hand held readers, magnetic and smart card readers).

Our proposal of classification for ICTs consider these theoretical frameworks on ICTs classification and it is established according to whether they are used for internal matters (derived from the information and communication needs of the members of the organization) or for external matters (derived from the organization's relationship with its environment -due to the importance of access to market information-).

From an internal point of view, the organization should have technologies which allow it:

- To search for information (specialized database, Internet access, etc.).
- To aid communication (email, videoconferencing, chat, discussion forums, etc.).
- To filter and to personalize information. In this type of technologies, information channels are classified. They are proactive tools based on a set of thematic contents which are selected and made available to network users by an information supplier. Users access information by means of email, their system desktops, intranet or a corporate portal.
- To develop integrated tools applicable specifically to KM (document management systems, storage supports).
- To analyze data (datamining and textmining -they allow the exploitation and analysis of the data stored within the organization by means of the searching for behaviour patterns that cannot be observed directly- and simulation tools -virtually reproduce a particular process according to previous planning-).
- To develop information systems, such as knowledge maps (directories that facilitate the location of knowledge within the organization).
- To establish a learning support (e-learning -a set of methods, technologies, applications and services which are oriented towards facilitating the learning that takes place through web technologies, on-line tutors, etc.-).

From an external point of view, the organization should have the following systems:

- Customer Relationship Management (CRM). Fundamental in the present competitive environment, the aim of this tool is to promote the establishment of relationships with customers. It

permits the creation of databases with relevant information that can facilitate customer retention and loyalty by establishing customized actions for communicating with them according to their preferences.

- *E-Commerce*. It is based on a technology that allows companies to perform economic transactions (sales and purchases) with their stakeholders (including customers, suppliers and creditors) by means of electronic systems. Therefore, this tool permits the reduction of distribution costs and greater proximity to both customers and suppliers.

### 2.3. Development of a theoretical model

KM strategies are not extensively developed in companies as consequence of the problems in managing knowledge for innovation (Xu, Houssin, Caillaud, & Gardoni, 2010). Besides, economic literature does not provide any accepted framework for overcoming such a problem.

Bolisiani and Scarso (1999) use the approach developed by Nonaka & Takeuchi in order to compare and analyze different types of knowledge that can be created and exchanged by companies as well as to detect specific problems raised by KM and the implications of the use of ICTs in that process. By means of the examination of Italian companies, they obtain that ICTs can support knowledge exchange between companies, in which identify the complex knowledge conversion between tacit and explicit knowledge as a core task.

Xu et al. (2010) develop a theoretical meta-model of KM based on two core activities for innovation –knowledge creation and usage– and create a lifecycle of knowledge from the systems thinking perspective. Likewise, they build a KM macro process on the knowledge lifecycle from physical, human and technological KM perspectives. Finally, they unite the meta-model and the KM macro process into innovation and develop a theoretical hierarchical model based on knowledge repository, computer supported, human centered and knowledge synthesis layers. This study shows the importance of use cross-functional teams and ICTs too due to uncertainty and complexity of innovation. Later, Xu, Houssin, Caillaud, and Gardoni (2011) uses that integrated approach of KM and applied it to an industrial application with the use of ICTs related to engineering. Their results show suitable performance of design solution, time of development and investment return.

Akram, Siddiqui, Nawaz, Ghauri, and Cheema (2011) establish an integrated model to analyze innovation, in which knowledge and ICTs are included. Their results show that ICTs allow organizations to manage knowledge in order to improve organizational knowledge assets and abilities. It promotes the development of innovation in these companies.

In this context, we develop a theoretical framework where we show the effects of ICTs on KM and innovation (see Fig. 2). The main contribution of our model is that it establishes which technologies and KM processes are most beneficial for the company and their effects of both types of innovation (product and process).

We can observe the application of these technologies to the KM process proposed by Nonaka & Takeuchi in Fig. 2. In this way, ICTs permit the – the development of socialization, exteriorization, combination and interiorization processes. Besides, the combination of various technologies in every KM process is observed because they are closely interrelated, as in practice they can be developed in a simultaneous manner with a subsequent level of complexity.

Based on these characteristics in this context, we have established the following research questions that relate ICTs to KM:

*Research question 1.* The combined use of a series of ICTs has a positive effect on knowledge socialization.

*Research question 2.* The combined use of a series of ICTs has a positive effect on knowledge exteriorization.

*Research question 3.* The combined use of a series of ICTs has a positive effect on knowledge combination.

*Research question 4.* The combined use of a series of ICTs has a positive effect on knowledge interiorization.

Given that, ICTs affect the knowledge creation and distribution process by making knowledge more coded and transmissible, it is to be expected that organizations using them have a greater capacity for innovation<sup>1</sup> (Asimakou, 2009; Kianto, 2011).

In this context, a more intense use of ICTs is related to a greater capacity to advance through the phases of the innovation cycle (Vilaseca, Torrent, & Lladós, 2006). During the preliminary phase, a process innovation will usually be developed, which will represent greater efficiency, productivity and the qualitative improvement of the organization's output. In the following phase, information technologies will promote product innovation, entailing the development of differentiation strategies. This will permit companies to be competitive in the new economic environment by achieving sustainable competitive advantages.

Furthermore, the application of new ICTs will require changes to be made in the organization. This is due to the fact that the implementation of new technologies makes the knowledge that has been acquired by means of the previous technologies obsolete.

Based on these characteristics, we have established the following research questions that relate ICTs in the area of KM to innovation:

*Research question 5.* The combined use of a series of ICTs in the KM process is a source of product innovation.

*Research question 6.* The combined use of a series of ICTs in the KM process is a source of process innovation.

In this context, the application of ICTs in the KM process permits the development of competitive advantages within the organization (Martin de Castro, Delgado, López, & Navas, 2010). This is accompanied by an increase in the value of the product portfolio, which permits the organization to survive and make continuous advances. Another competitive advantage is growth that is faster, more efficient and more profitable than that of non-innovative competitors.

### 2.4. Research method

Once we have proposed the theoretical model that relates ICTs to KM and innovation, we will test this model by applying it to the case study. This methodology allows us to analyze the study subject in a real-life context by means of numerous sources of evidence, both qualitative and quantitative (Dul & Hak, 2007).

This scientific investigation is especially relevant when the access to first-hand information and/or the understanding of the decision-making processes, implementation and change in organizations require a type of analysis which is not likely to be sufficiently reliable, through the study of a large number of observations (Rialp, 1998).

The use of this methodology is evidenced by various research studies conducted in the field of management, such as those dealing with innovation, KM and ICTs (Baldwin, Heinerth, & Von Hippel, 2006; Govindarajan & Trimble, 2011; Smith & Rupp, 2004).

<sup>1</sup> The innovation is related with the development of new ideas or solutions and supposes the introduction of administrative or organizational technological changes in the output or processes (Lundvall, 2010).



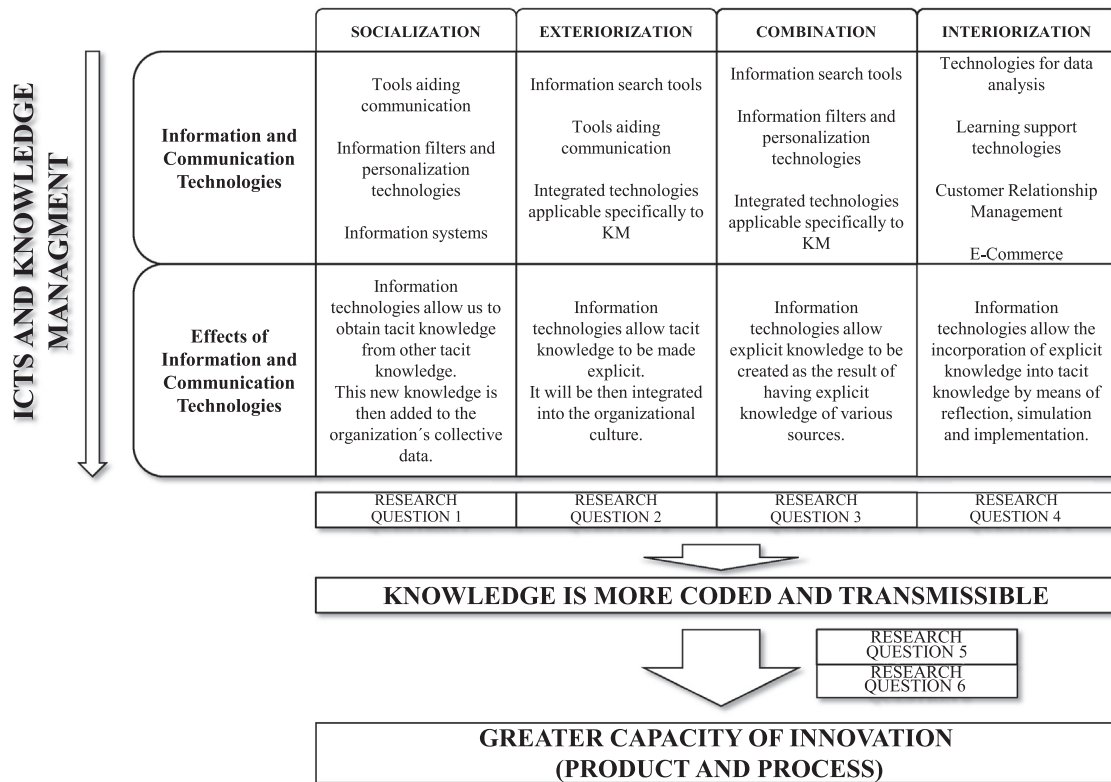


Fig. 2. Proposal of theoretical model ICTs-KM-innovation. Source: Own elaboration.

In order to analyze this methodology, our study was conducted in the following phases:

1. Definition of the research objective.
2. Development of the theoretical model and research question formulation.
3. Selection and identity of the unit of analysis.
4. Data collection and processing.
5. Case analysis.

We will now provide a detailed explanation of the phases.

#### 1. Definition of the research objective

As we have explained before, the objective of this paper is to analyze the influence of ICTs on the creation of different types of knowledge in organizations and their influence on innovation (with regard to both products and processes) in one case study.

#### 2. Development of the theoretical model and research question formulation

In the previous section, we developed a theoretical model that relates ICTs to KM and innovation. Likewise, we established six research questions that include the expected relationships among these variables.

#### 3. Selection and identity of the unit of analysis

In this phase it is necessary to establish a definition for the unit of analysis, which is provided by the "case" definition itself (Yin, 2003). This will determine the core based upon which we will study the research questions established in the model.

In our paper, the unit of analysis is the Zara Group, which belongs to the Spanish holding company Inditex. This group is characterized by its widespread use of ICTs and a highly innovative approach. Therefore, this analysis will allow us to determine whether the research questions established in the model are successfully carried out.

The Zara Group was selected for its importance in the textile industry. Its first shop was opened in 1974, and today Zara has more than 1500 retail outlets throughout Europe, Asia and America, which makes it the star brand in the Inditex holding. In addition, the intensive application of ICTs at Zara has permitted the development of a business model that makes this company stand out among its main competitors. This business model is based on a complete channel, as it maintains control over both the manufacturing and distribution processes. Moreover, its logistical processes are considered to be among the most effective in the world. Order and delivery control is achieved through the application of the just-in-time strategy in all units and departments. Speed and the control over the design-manufacturing-distribution process is another key aspect of its success. This allows new garments to be placed in the retail outlets twice a week, with the aim of adjusting to consumer tastes and preferences.

#### 4. Data collection and processing

Data collection has been based on both internal and external documentary evidence. The internal documentary evidence has been obtained through the analysis of reports and internal studies, websites presentation files and corporate annual reports.

With regard to the external documentary evidence, this has been taken from the specialized publications, databases and the mass media.

The data was subsequently transcribed with the aim of categorizing and combining them according to the proposed theoretical model.

### 5. Case analysis

Finally, it is necessary to analyze whether the research questions established in the theoretical model are supported by the available evidence to assess whether they should be accepted, reformulated or rejected.

To this end, the procedure of “explanation building” is used, which is based on the construction of the analysis starting from the obtained data (Yin, 2003). Therefore, the aim is to find out whether the collected data converge toward a logical sequence that may explain the case results.

### 3. Findings

Fig. 3 shows the main results obtained from the analysis of the Zara case study.

We will now proceed to a detailed analysis of the features observed in the Zara case study with regard to the research questions established in the theoretical model.

*Research question 1. The combined use of a series of ICTs has a positive effect on knowledge socialization.*

Previously, we have established that the technologies which aid communication, filter and to personalize information and develop information systems entail a socialization process of knowledge.

The analysis of the Zara Group shows the existence of this type of ICTs, as the company has a real-time information system. This allows the organization to have a computer system that connects all its retail outlets around the world in real time for purposes related to distribution control. This way, headquarters has access

to information about the garments that are sold in each and every retail shop and therefore knows at any given moment what production levels are necessary to supply them. It is one of the most important sources of sustainable competitive advantage of this group regarding their competitors. In this context, this technology allows Zara to hold valuable, scarce, inimitable and not replaceable resources with the consequent development of value creation strategies.

Likewise, Zara has technologies which permit communication between different members of the organization, by means of their Intranet, e-mail or videoconferencing, for example.

Using these ICTs, Zara employees acquire new knowledge directly from their workmates.

Therefore, as we establish in our proposal of theoretical model, ICTs allow Zara to obtain tacit knowledge from other tacit knowledge. This new knowledge is then added to its collective data. In other words, in the case of Zara, these technologies have had a positive effect on knowledge socialization.

Likewise, it is necessary to consider the beginning of the development process of co-learning at this stage. Employees in retail share their comments with others within the company and, therefore, it is the beginning of the co-creation of documents in it.

*Research question 2. The combined use of a series of ICTs has a positive effect on knowledge exteriorization.*

In the proposed model, we have established that the technologies which help find information, aid communication and develop integrated technologies applicable specifically to KM entail knowledge exteriorization.

The analysis of the selected company shows the existence of this type of technologies. In this way, with regard to the search for information regarding consumer preferences, Zara contracts “cool hunters”. The mission of these employees is to identify innovations and trends to inspire new collections that are

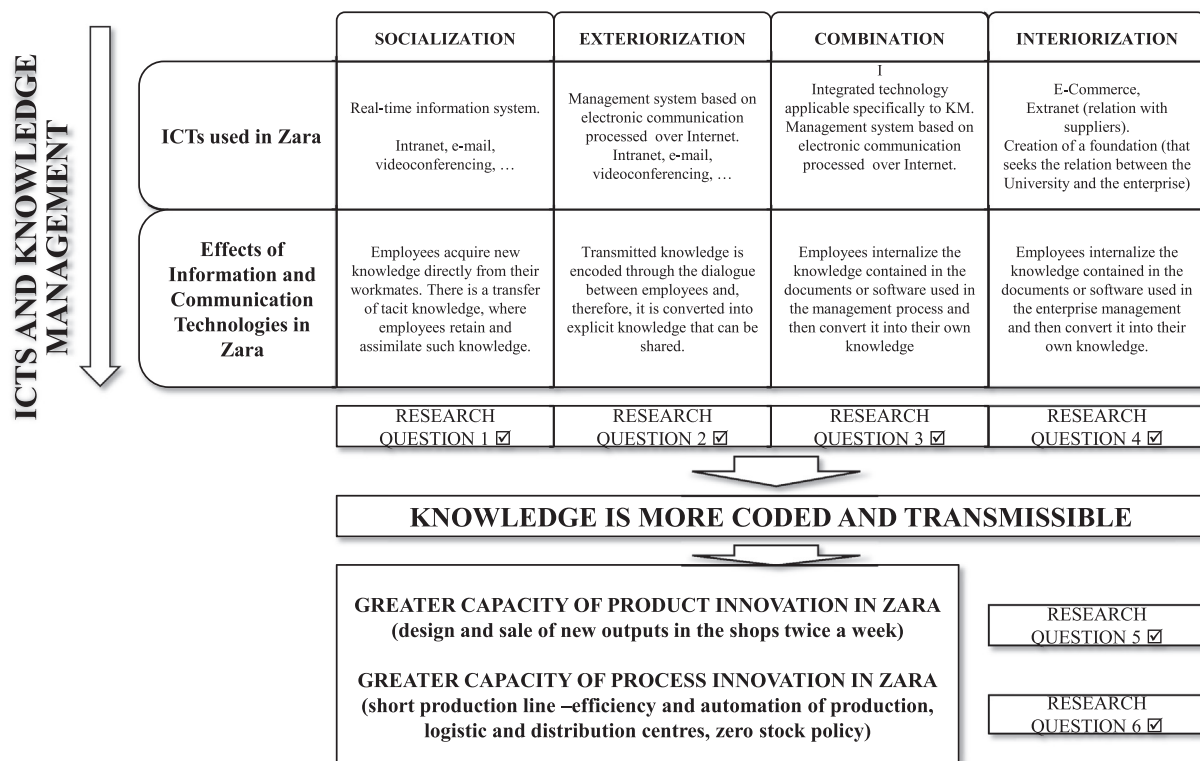


Fig. 3. Application of Zara Group case study to the proposal model of ICTs-KM-innovation. Source: Own elaboration.

successful both in their stores and on the street. This information is transmitted via the Internet to Zara's designers for implementation in the new outputs. Communication technologies, such as video-conferencing and e-mail, also play a role in this process.

Therefore, as we establish in our proposal of theoretical model, ICTs allow Zara to transform tacit knowledge into explicit. This knowledge is then integrated into the organizational culture.

Co-learning process is encouraged in this stage because of transmitted knowledge is encoded through the dialogue between employees and, therefore, it is converted into explicit knowledge that can be shared.

Similar ICTs can be used by competitors of textile industry in order to transmitted knowledge is able to be encoded through the dialogue between employees and, therefore, it can be converted into explicit knowledge that is able to be shared.

*Research question 3. The combined use of a series of ICTs has a positive effect on knowledge combination.*

We have already established that technologies that help find information both filter and customize it, and that the development of integrated technologies applicable specifically to KM entails knowledge combination.

Another example of this type of ICTs, besides those that have already been mentioned, is the periodical reports received from shop assistants over the Internet. These reports include suggestions, opinions, interests and consumer preferences. This information is transmitted telematically to the different departments within the organization. This facilitates the process through which Zara adapts its output to the real demand.

Their competitors, whose competitive strategy is based on product differentiation, can develop similar ICTs in order to satisfy their customers' needs. Therefore, as we establish in our proposal of theoretical model, ICTs allow Zara to create explicit knowledge as the result of having explicit knowledge of various sources. In other words, in the case of Zara, these technologies have a positive effect on knowledge combination.

*Research question 4. The combined use of a series of ICTs has a positive effect on knowledge interiorization.*

In the proposed model, we have commented that the technologies which analyze data, establish a learning support, develop a customer relationship management and ecommerce entail an interiorization process of knowledge.

Although these ICTs are common in textile industry, Zara has developed these systems in function of its specific characteristics and it has allowed this group to be one of the leading companies in that sector.

In this context, Zara has developed E-Commerce which permits the sales of its outputs over the Internet. Likewise, Zara has a private Extranet where company regulations may be found. Company suppliers also have access to this Extranet, where the packing and labeling rules are also specified.

In addition, the Inditex Group has created a foundation, along with five other Spanish companies, to establish a permanent, functional connection between the University and the business world with the objective of promoting the exchange of technology and information.

These technologies allow that Zara employees internalize the knowledge contained in the documents or software used in the enterprise management and then convert it into their own knowledge. Therefore, as we establish in our proposal of theoretical model, ICTs allow Zara to incorporate explicit knowledge into tacit knowledge by means of reflection, simulation and implementation.

Thus, these technologies have a positive effect on knowledge interiorization.

*Research question 5. The combined use of a series of ICTs in the KM process is a source of product innovation.*

Product innovation is a knowledge-intensive activity, in which learning and transfer knowledge are required (Mehra & Dhawan, 2003). Learning can be given by individual, project team or project-to-project levels or by means a combination of them.

In the case of Zara, the use of ICTs permits the development of a business model where fashion is perceived as a perishable output as the result of the fast changes in consumer preferences. It allows new garments to be designed and placed in the shops twice a week, with the aim of adapting to new consumer preferences. This is in sharp contrast to their competitors, who operate based on only two seasons per year.

Therefore, Zara engages in innovation in terms of its product range with "living fashion" in mind; in other words, the design, manufacture, distribution and sales of its outputs occurs almost as fast as the changes in consumer preferences. This type of innovation is promoted in the company by using databases and transferring people between projects which favor co-learning. In this context, tacit knowledge is especially relevant because team learning will be dependent on the interactions between individuals and their shared experiences of solving product innovation problems (Thomke & Fujimoto, 2000). These characteristics allow Zara to develop another of its most important sustainable competitive advantage sources, with the consequent establishment of value creation strategies, regarding their competitors.

*Research question 6. The combined use of a series of ICTs in the KM process is a source of process innovation.*

As mentioned earlier, the use of the ICTs is a source of process innovation at Zara. It has enabled the company to employ an Internet-based system to facilitate the flow of information among the different points of sale that Zara has established in different countries around the world.

Every time that a purchase is made in any shop, the shop assistant records it on an on-line machine. This provides a series of standardized data about consumer preferences. Based on the information collected, the manager of each shop prepares a weekly report that is sent over the Internet to the company's headquarters. There, the design department processes the information and uses the Intranet to send new stock orders to the factories and/or, if appropriate, orders to cut patterns and produce additional garments. In order for outputs to be distributed even more quickly, a fully automated logistics center has been created. Likewise, an integrated telecommunications system has been developed which links Inditex's main headquarters to supply, production and sale centers all over the world.

This system, based on electronic communications processed over the Internet, makes it possible to redesign new output lines in two weeks' time, from their design to the time when they are put on display in shops all over the world (this is compared to an industry average of nine months) (Martínez, 2008).

Therefore, one of the main innovations in Zara is the establishment of fast fashion, managed by customers and organized by a short production line. In this context, the efficiency and automation of its production, logistics and distribution centers constitute one of the main process innovation of Zara. Another process innovation is given by the development of "zero stock" policy in textile industry which involve that there is not the possibility of storing clothes.

This kind of innovation is promoted with the use of ICTs that allows company to restructure the work by means the establishment of a cooperative working model. Therefore, co-learning is a key concept in process innovation too. Co-creation of documents in the company is required that shows the necessities of production, logistics and distribution staff in order to develop “fast fashion” and zero stock policies.

These specific systems allow Zara to develop differentiation strategies regarding its competitors again. They are valuable, scarce, inimitable and not replaceable resources that involve the development of sustainable strengths in the company.

Both product and process innovations in Zara are favored by KM processes (described in research questions 1–4) which involve that knowledge in the company can be more coded and transmissible, as we have established in our theoretical model previously.

In conclusion, we can state that the Zara case study is in agreement with the research questions set out in the theoretical model. As a result, the introduction of ICTs in this organization has entailed both knowledge creation and innovation processes. In fact, the development of ICTs at Zara is intended to fulfill the company's objective, which is to achieve maximum flexibility and speed in order to put what consumers want in the shops and to favor product innovation (the main strategy at Zara), in which co-learning in the organization has been a key concept. This permits this organization to differentiate itself from its competitors and therefore obtain a high market share in the textile industry.

#### 4. Discussion and conclusions

In the current business environment, which is characterized by greater complexity and dynamism, a company's competitiveness depends, to a large extent, on the development of suitable KM techniques. It is really important to provide “right knowledge to the right people at the right time” (O'Dell & Grayson, 1998). This will allow companies to be proactive and therefore facilitate their adaptation to external changes. In this context, ICTs address the information needs of companies, facilitating their decision-making processes, while also permitting knowledge acquisition and transfer. In fact, the development of such technologies has resulted in the creation of special management tools based on information processing and knowledge.

The aim of this paper is to establish a theoretical model intended to contribute to the analysis of the influence of ICTs on KM processes and their subsequent expected implications for innovation in the organization. As a consequence of the importance of ICTs in the creation of shared knowledge in organization, co-learning process is analyzed in our paper too. Besides, we have applied this model to the case study of the Zara textile group in order to analyze the established research questions using empirical evidence. Results of the paper show that the research questions set out in the theoretical model are developed in that company.

In this context, Zara has a series of ICTs in order to create value in both their internal management and in aspects related to their environment. As we established in our theoretical model, case study shows that the use of these technologies allows Zara to obtain positive effects on knowledge socialization, exteriorization, combination and interiorization processes. Therefore, the creation of explicit and tacit knowledge is observed in the company. In this context, employees of Zara transfer and share that knowledge which allow to develop co-learning in the organization with the consequent positive implications in order to obtain a greater organizational flexibility. Furthermore, these characteristics make it possible to implement product and process innovations within the organization, permitting Zara to consolidate itself in its sector with a differentiation strategy that sets it apart from its

competitors. Thus, its use of different types of ICTs (information search tools, integrated technologies applicable specifically to KM, etc.) incorporate a great potential of innovation stimulation by means of the development of collaboration processes between the necessary agents in the innovation dynamic. For example, the use of a business model based on electronic communications processed over the Internet means that Zara can redesign new output lines in two weeks' time -from the design stage until the output has been distributed to every shop- (this is in contrast to the industry average of nine months). Therefore, a suitable combination of ICTs and KM processes involves that Zara can be leader in this dynamic industry.

On the basis of the results obtained in the paper, we obtain the relevance of the establishment of policies of intangible active development (where knowledge is emphasized) as a key concept in the present business environment (Hislop, 2013). Thus, the importance of establishing suitable knowledge creation and transmission strategy in organizations. It will entail the creation and maintenance of sustainable competitive advantages and, therefore, the creation of value in such companies (Schmidt & Keil, 2013).

With this aim, organizations have to adopt a dynamic and systemic approach in order to analyze the specific impact of ICTs in the knowledge management process. This process should be used for the development of the business strategies, according to the needs and expectations of the companies (Barney & Hesterly, 2012; Serenko, Bontis, Booker, Sadeddin, & Hardie, 2010). Besides, ICTs influence positively on a variety of innovation potentials, such as the development of new products, re-engineering business processes or enabling companies to restructure their organizations (Hempell, Van Leeuwen, & Van der Wiel, 2006). This will permit companies to be competitive in the new economic environment by achieving sustainable competitive advantages.

In this context, we can conclude that companies of textile industry should adapt to the new business environment by means of the development of intangible resources and knowledge. The case of Zara shows that this process allowed it to develop value creation strategies as well as the establishment of diversification and internationalization processes that have been successful in their development of sustainable competitive advantage and in their maintenance of market share.

Finally, we establish, as future research lines, to apply our theoretical framework proposal to other companies of textile industry in order to analyze their main strengths and weaknesses regarding leading company. It will allow us to recommend specific action policies that can involve the development of sustainable competitive advantages in these companies. Besides, our model can be used in other alternative industries, in which ICTs, KM and innovation are key concepts, such as telecommunication, financial or education sectors.

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#### References

- Akram, K., Siddiqui, S. H., Nawaz, M. A., Ghauri, T. A., & Cheema, A. K. H. (2011). Role of knowledge management to bring innovation: An integrated approach. *International Bulletin of Business Administration*, 11, 121–134.
- Asimakou, T. (2009). The knowledge dimension of innovation management. *Knowledge Management Research & Practice*, 7(1), 82–90.
- Baldwin, C., Heinerth, C., & Von Hippel, E. (2006). How user innovations become commercial products: A theoretical investigation and case study. *Research Policy*, 35(9), 1291–1313.
- Barney, J. B., & Hesterly, W. S. (2012). *Strategic management and competitive advantage*. London: Pearson.



- Bigliardi, B., Dormio, A. I., & Galati, F. (2010). ICTs and knowledge management: An Italian case study of a construction company. *Measuring Business Excellence*, 14(3), 16–29.
- Bolisiani, E., & Scarso, E. (1999). Information technology management: A knowledge-based perspective. *Technovation*, 19, 209–217.
- Bueno, E., Aragón, J. A., Salmador, M. P., & García, V. J. (2010). Tangible slack versus intangible resources: The influence of technology slack and tacit knowledge on the capability of organisational learning to generate innovation and performance. *International Journal of Technology Management*, 49(4), 314–337.
- Butler, T., & Murphi, C. (2007). Understanding the design of information technologies for knowledge management in organizations: A pragmatic perspective. *Information Systems Journal*, 17(2), 143–163.
- Carbonara, N. (2005). Information and communication technology and geographical clusters: Opportunities and spread. *Technovation*, 25, 213–222.
- Draca, M., Sadun, R., & Van Reenen, J. (2006). Productivity and information and communication technologies: A review of the evidence. *CEP Discussion Papers*, 0749.
- Duhon, B. (1998). It is all in our heads. *Inform*, 12(8), 8–13.
- Dul, J., & Hak, T. (2007). *Case study methodology in business research*. London: Butterworth-Heinemann/Elsevier.
- Edvinsson, L. (2013). IC 21: Reflections from 21 years of IC practice and theory. *Journal of Intellectual Capital*, 14(1), 163–172.
- Eisenhardt, K., & Martin, J. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21, 1105–1121.
- Goffin, K., & Koners, U. (2011). Tacit knowledge, lessons learnt, and new product development. *Journal of Product Innovation and Management*, 28, 300–318.
- Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational perspective. *Journal of Management Information System*, 18(1), 185–214.
- Gottschalk, P. (2000). Predictors of IT support for knowledge management in the professions: An empirical study of law firms in Norway. *Journal of Information Technology*, 15, 69–78.
- Govindarajan, V., & Trimble, C. (2011). Strategic innovation and the science of learning MIT. *Sloan Management Review*, INS0111, 21–27.
- Grover, V., & Davenport, T. H. (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information System*, 18(1), 5–21.
- Hempell, T., Van Leeuwen, G., & Van der Wiel, H. (2006). ICT, innovation and business performance in services: Evidence for Germany and the Netherlands. *ZEW Discussion Paper*, 1–25.
- Hislop, D. (2013). *Knowledge management in organizations*. London: Oxford University Press.
- Ichijo, K., & Nonaka, I. (2007). *Knowledge creation and management. New challenges for managers*. New York: Oxford University Press.
- Kianto, A. (2011). The influence of knowledge management in continuous innovation. *International Journal of Technology Management*, 55(1/2), 110–121.
- Kogut, B., & Zander, E. (1992). Knowledge of the firm, combine capabilities and the replication of technology. *Organizations Science*, 3, 383–397.
- Kuo, Y. K., & Ye, D. K. (2010). How employee's perception of information technology application and their knowledge management capacity influence organizational performance. *Behaviour & Information Technology*, 29(5), 287–303.
- Lindblom, A., & Tikkanen, H. (2010). Knowledge creation and business format franchising. *Management Decision*, 48(2), 179–188.
- Lundvall, B. A. (2010). *National systems of innovation. Toward a theory and innovation and interactive learning*. London: Anthem Press.
- Martin de Castro, G., Delgado, M., López, P., & Navas, J. E. (2010). *Technological innovation. An intellectual capital based view*. London: Palgrave-Mc Millan.
- Martínez, A. (2008). Hacia un nuevo sistema de la moda. El modelo Zara. *Revista Internacional de Sociología*, XVI(51), 105–122.
- Mehra, L., & Dhawan, S. K. (2003). Study of the process of organisational learning in software firms in India. *Technovation*, 23(2), 121–129.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company. How Japanese companies create the dynamics of innovations*. New York: Oxford University Press.
- Nonaka, I., & Teece, D. J. (2001). Research directions for knowledge management. In I. Nonaka & D. J. Teece (Eds.), *Managing industrial knowledge: Creation, transfer and utilization* (pp. 330–335). London: Sage Publications.
- O'Dell, C., & Grayson, C. J. (1998). If only we knew what we know: Identification and transfer of internal best practices. *California Management Review*, 40(3), 154–174.
- Papastathopoulos, A., & Beneki, C. (2010). Organizational forms based on information & communication technologies (ICTs) adoption. *Research in Business & Economics Journal*, 2, 1–18.
- Phang, M., & Foong, S. (2010). Information communication technologies (ICTs) and knowledge sharing: The case of professional accountants in Malaysia. *World Journal of Science, Technology and Sustainable Development*, 7(1), 21–34.
- Rialp, A. (1998). El método del caso como técnica de investigación y su aplicación al estudio de la función directiva. *IV Taller de Metodología ACEDE*, 23–25 de abril, Spain.
- Schmidt, J., & Keil, T. (2013). What makes a resource valuable? Identifying the drivers of firm-idiosyncratic resource value. *Academy of Management Review*, 38(2), 206–228.
- Serenko, A., Bontis, N., Booker, L., Sadeddin, K., & Hardie, T. (2010). A scientometric analysis of knowledge management and intellectual capital academic literature (1994–2008). *Journal of Knowledge Management*, 14(1), 3–23.
- Smith, A., & Rupp, W. T. (2004). Managerial implications of computer-based online/face-to-face business education: A case study. *Online Information Review*, 28(2), 100–109.
- Sveiby, K. E. (1997). The intangible assets monitor. *Journal of Human Resource Costing and Accounting*, 2(1), 73–97.
- Teece, D. (1998). Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *California Management Review*, 40(3), 55–79.
- Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, 2(3), 172–194.
- Thomke, S., & Fujimoto, T. (2000). The effect of front-loading problem-solving on product development performance. *Journal of Product Innovation Management*, 17(2), 128–142.
- Van Joolingen, W. R., De Jong, T., Lazonder, A. W., Savelsbergh, E. R., & Manlove, S. (2005). Co-Lab: Research and development of an online learning environment for collaborative scientific discovery learning. *Computers in Human Behavior*, 21, 677–688.
- Vilaseca, J., Torrent, J., & Lladós, J. (2006). Encouraging innovation by means of IT based cooperation IN3. *Working Paper Series*, WP06-007.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.
- Xu, J., Houssin, R., Caillaud, E., & Gardoni, M. (2010). Macro process of knowledge management for continuous innovation. *Journal of Knowledge Management*, 4(4), 573–591.
- Xu, J., Houssin, R., Caillaud, E., & Gardoni, M. (2011). Foresting continuous innovation in design with an integrated knowledge management approach. *Journal Computers in Industry*, 62, 423–436.
- Yin, R. K. (2003). *Case study research: Design and methods*. California: Sage Publication.
- Zhang, Xi., Ordóñez de Pablos, P., & Zhou, Z. (2013). Effect of knowledge sharing visibility on incentive-based relationship in electronic knowledge management systems: An empirical investigation. *Computers in Human Behavior*, 29(2), 307–313.