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## **Analysis of ICTs Opportunities on Firm's Success: An Innovation Process**

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### **Abstract**

The significant changes detected in both the social and the economic environments have evidenced the key importance of innovation processes in firms' survival. However, the innovation must be considered as one of the main aspects that defines the business culture instead of a mere activity oriented to the development of new products or the adaptation of the existing ones to new market demands (Castells, 2001). Also, those firms that use information and communication technologies (ICTs) in an intensive way are the most innovative and adapted ones to the competitive environment. This fact constitutes a relevant proof of the importance of innovation as a key aspect of competitiveness, and the ICTs as one of the key factors to achieve it (Vilaseca and Torrent, 2005). Innovation is currently considered one of the hottest research topics for both academics and practitioners. However, the research in the innovation field has become a challenging task since it has been very difficult to offer an accurate definition of innovation that fits precisely into the business environment. In addition, there is not only one research stream within this vast field. The investigation on innovation has basically evolved along two main research lines: the type of innovation to be developed, and the risk associated to the innovation processes (Storey and Easingwood, 1996; Oldenboom and Abratt, 2000; Langerak et al., 2004). Both aspects are intrinsically related since sometimes the risk intensity is highly influenced by the type of innovation developed and the perceived risk often impacts the type of innovation.

Bearing in mind the importance of this topic, the present study attempts to make interesting contributions to this field by analyzing the importance of innovation on firm's success. With this objective in mind, we first review the concept of innovation from different points of view. Secondly, we analyze the determinant factors of new economic and social environments, placing special emphasis on the role of ICT on the new business situation. Finally, we focus on the study of the effects that ICT adoption has fostered in the business scene. The review of the relevant literature evidences how the intensive use of ICT by firms encourages innovation as well as cultural, organizational, strategic and tactical changes. The conclusions of this work provide interesting managerial implications for both product and brand managers in developing innovation processes.

**Key words:** Innovation, product development, ICT.

**JEL classification:** M13.

### **1. Introduction**

During the past decade, innovation activity has increased dramatically in modern economies. On the contrary to prior stages (see Table 1), the agents' behaviour has changed significantly. In particular, a great increase in the private initiative as well as a significant change in the investment pattern have been detected (Achrol and Kotler, 1999; Saw et al., 1999; Vilaseca and Torrent, 2005).

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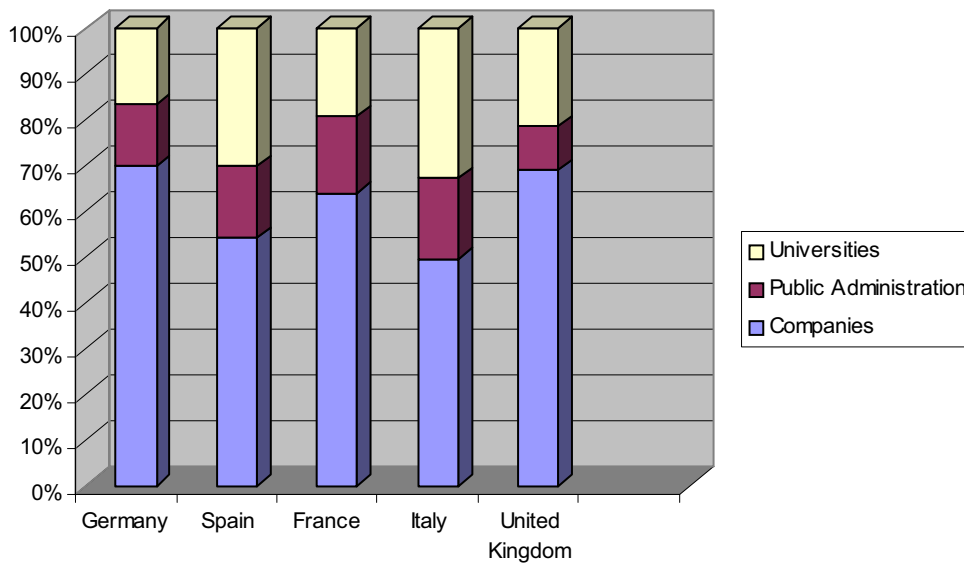
Table 1

R+D investment in OECD countries (2003)

	R+D investment (milliards, \$)	R+D investment as a percentage of the GNP	R+D investment/inhabitant
Germany	57,5	2,52	697,0
Spain	11,1	1,05	263,6
France	38,1	2,18	617,2
Italy	17,7	1,16	305,2
United Kingdom	33,7	1,88	566,0
EU-25	211,3	1,82	450,0
USA	292,4	2,68	1,004
Japan	112,7	3,15	883

Source: COTEC Report (2006).

Firms have become the most important innovation agents in these processes (Castells, 2001; Evangelista and Savona, 1998; Han et al., 1998) (see Figure 1). Thus, innovation initiatives and actions that are mostly oriented to innovation are directed, initiated, developed and/or financed by firms. Besides, innovation is not only oriented to the purchase of industrial equipment but also, a relevant part of it is used in the acquisition of technological goods or in the training of human resources (Barras, 1986). Definitely, the innovation investment is oriented to the generation and development of intangible goods, which are based on knowledge, strengthen the competitive advantage of the firm and improve its corporate image and positioning (Athuahene-Gima, 1996 a,b; Vorhies et al., 1999).



Source: COTEC Report (2006).

Fig. 2. Distribution of R+D investment in different economic sectors (% of the total) in the main European countries (2003)

For this reason, the study of business innovation has become a cornerstone for both researchers and academics during recent years. However, the research on this topic has become a complex task since it is very difficult to offer a precise definition of the innovation concept that fits to the business context accurately. Given the broad, abstract and multi-dimensional character of the innovation concept, the limits for its definition are fuzzy, generating considerable controversy among different researchers.

## 2. Innovation in a Business Context: Concept, Typology and Risks

Some contributions, especially those from the economic field, shed light on the above mentioned situation. Thus, the definition of innovation can be established in terms of generation, introduction or adoption of *something new*, e.g., a product, a production method, an organization formula, a supply source, a market, a way of doing things (Abernathy and Utterback, 1978; Barras, 1986). This approach opens an important debate in which several questions should be answered in order to analyze innovation from a business perspective (Adams et al., 1998; Cooper, 1996; Johnes and Storey, 1998).

Traditionally, the discussion on innovation has evolved along two main dimensions: the type of innovation to develop, and the risk associated to innovation processes (Storey and Easingwood, 1996; Oldenboom and Abratt, 2000; Langerak et al., 2004). Nevertheless, both aspects are intrinsically related since usually the risk intensity is highly related to the type of innovation developed and the perceived risk often impacts the type of innovation.

The innovation activity of the firm may have impact on three different fields: the organization, the processes and the products (Solow, 1956). First, the organizational innovation involves: (1) the introduction of changes in the organizational activities as well as in the management of the store, (2) changes in the organization and administration of the productive process, (3) the incorporation of corporate structures modified significantly, (4) the launch of strategies, and (5) the adoption of new or substantially modified strategic orientations (Johnston and Lawrence, 1988; Song et al., 1997). Second, the innovation in processes assumes the adoption of new or improved production methods. This innovation may have the aim of producing and/or delivering new or improved technological products which can not be produced nor delivered through conventional production methods, or either increasing the production efficiency or delivery of existing products (Athuahene-Gima, 1996 a; Bowers, 1989; Cooper, 1996). Third, the product innovation involves the market launch of a new or significantly improved technological product (Smith and Blanck, 2002; Tatikonda and Stock, 2003).

The consensus in the acceptance of the latter classification has not fostered the same level of interest and study on the different types of business innovation. Traditionally, the analysis of business innovation has been focused on the study of products and processes (Bowers, 1989; Han et al., 1998; Storey and Easingwood, 1996; Weerawardena, 2003). It means that it has not been paid much attention to the study of other influencing transformations affecting the structure, the culture and the organizational strategies. Given the great relevance of innovation on firm's competitiveness, it has not been until recently that the academic research has started to take into account organizational innovation. However, in most situations, the interest has been placed on measuring its importance and impact on new processes or products that the firm can develop (Langerak et al., 2004).

Another issue to be focused on is the consideration of innovation not only as a radical change, a rupture or the adoption of something completely new but also as a renovation or improvement (Adams et al., 1998; Ottun and Moore, 1997; Rotwell, 1994; Storey and Easingwood, 1996). Therefore, along with the previous classification, another categorization of types of innovation should be considered regarding the extent to which the process represents an innovation for the organization. Bearing this in mind, it is possible to distinguish between *radical innovation* – the adoption or development of something completely new – and *incremental innovation* – the renovation, modification or improvement of something existing. Finally, it should be mentioned that every innovation has a strong degree of risk in regard to the industry or the novelty degree (Olden-

boom and Abratt, 2000). Concerning the factors that may produce risk, three types of risks are generally reported in the relevant literature: the *market risk* or the *commercial risk*, the *technological risk* and the *strategic risk*. Table 1 offers a description of the mentioned risks (Athuahene-Gima, 1996 a; Bowers, 1989).

Table 2

Types of risk

TYPE OF RISK	FACTOR	DESCRIPTION
Market risk – commercial risk	New products	Market reaction to the degree of originality and novelty of the innovation
Technological risk	New processes	Firm ability to adapt to the adoption of a new process as well as the use of qualified employees
Strategic risk	New management practices	Risk derived from the previous risks

Source: Own elaboration.

During the last years the relevant economic and social transformations have fostered new interesting research streams on business innovation processes (Ahuja, 2000). Both academics and practitioners are focusing on the study of the innovation key issues as well as on the way those issues determine the extent to which firms innovate. In particular, the study of certain factors such as changes in demand, the market globalization and the development and intensive adoption of ICTs by firms has generated great interest (Achrol and Kotler, 1999; Gulati et al., 2000; Tuominen et al., 1997).

### 3. The Knowledge Economy: Changes in the Environment and Adoption of ICTs by Firms

Since the early 90s, a profound transformation in the aspects that define the social environment has been observed (Castells, 2001). Nowadays, the *knowledge society* is being developed in a context characterized by an economy based on knowledge. Several researchers such as Harley (1989), Urry (1990) or Vilaseca and Torrent (2005), have identified the change in the traditional pattern individuals behaviour, the development and use of ICTs and globalization, as the main reasons of the emergence of the new economy. However, among the latter factors, ICTs have an important role, given their ability to acquire, create and manage knowledge (Prassat et al., 2001; Moenaert and Souder, 1990; Sammut-Bonnici and McGee, 2002). In this new scenario, the economic activity is based on the intensive use of knowledge as well as on the development of all processes, actions and behaviours (Adams et al., 1998; Deeds et al., 2003). As an internal resource, used intensively, the knowledge can be understood not only as a productive factor but also as a strategic element able to constitute an important source of competitive advantage (Adams et al., 1998; Argyres, 1999; Vorhies et al., 1999).

In particular, the intensive use of ICTs in the economic activity is constant observed since the past decade in the developed countries. The implementation of ICTs in the production and consumption activities has encouraged two important situations. On the one hand, it has facilitated the development and use of a wide variety of innovations and improvements in processes and products, and consequently, has contributed to the transformation in the activity generated by several economic sectors (Sinkula, 1994; Saw et al., 1999; Thomke and Von Hippel, 2002). On the other hand, this situation has induced the emergence of new productive activities that contribute to the emergence of a new sector – the information industry (Li and Calentone, 1998; Nonaka, 1991).

Obviously, firms have been influenced by these changes. As main agents, firms have undergone an intense transformation process in order to adapt to the new social and competitive context (Tatikonda and Stock, 2003). However, the impact of the relevant change factors and the way to confront them have been different. While the market globalization and the change in the patterns of demand

have been perceived as great challenges, the development of ICTs has been considered as an opportunity, and the intensive use of ICTs has been perceived as a strength (Michael and Palandjian, 2004; Tuominen et al., 1997).

Traditionally, the literature suggests many different perspectives or aspects of ICTs that must be considered (Brady et al., 2002). From an economic and management point of view, ICTs have been analysed as: (1) a social construction, (2) an information provider, (3) an infrastructure – hardware and software, and (4) a business process and system. From a marketing viewpoint, ICTs have also been viewed as: (1) a variety of separate applications (Internet, databases, back office applications), (2) a marketing channel, (3) a communication/promotional media, (4) a marketing technique, and (5) a tool for relationship marketing.

ICTs are more than just computers or the Internet. Although there has been a tendency to focus on Internet technology, the study of technology effects on the economy and business fields should also be closely considered. Today, ICTs must be conceived in a wide way to encompass the information that businesses create and use, as well as the broad spectrum of increasingly convergent and linked technologies that process that information. Therefore, ICTs can be viewed as a collective term for a wide range of software, hardware, telecommunications and information management techniques, applications and devices (Brady et al., 2002; Porter and Millar, 1985).

Nowadays, the widespread use of ICTs is changing the way people and companies work (Roberts, 2000). In recent years, large number of people has acquired direct access to computers, or other types of digital technologies, primarily for individual task development. Yet now these computers are beginning to be connected to each other, and for the first time, there is an opportunity for a large amount of people and companies to use computing and communications capabilities to help coordinate their work. Specialized products have been successfully developed and commercialized, and to some observers these applications herald a paradigm shift in technology usage and implications

As internal strategic factors, ICTs provide notable opportunities to firms, since they can be considered not only as tools that facilitate the development of certain processes, but also, as elements that foster the generation, accumulation and diffusion of knowledge within the organization (Brady et al., 2002). Since the knowledge becomes an essential productive and strategic factor, the business activity begins to be focused on the use of this intangible asset. This situation has yielded, as a first consequence, a modification and a redefinition of the traditional inputs: job and capital. The massive incorporation of knowledge as a productive resource has made it necessary to redefine traditional factors to include knowledge as the third basic input in the business activity (Vilaseca and Torrent, 2005).

The second main transformation observed in the firm is generated by the massive incorporation of knowledge as a strategic resource (Adams et al., 1998). Rotwell (1994), Sammuth-Bonnice and McGee (2002), Trim (2002) and Webster (1992) show the dissemination of knowledge all over the organization and its use as a guide for the decision-making processes, having induced changes in the orientation and organizational structure, enabled the development of new processes – or the modification of the existing ones – and contributed to the emergence of new strategic management models: the network firm.

#### **4. The Adoption of ICTs in the Business Context: Innovation**

The intensive use of ICTs by firms has fostered a transformation in all their levels. The use of ICTs along with the adoption of a business culture oriented to the market, has encouraged the development of new organizational, productive and strategic management models (Song et al., 1997). This situation contributes to establish more flexible organizational structures, more efficient and effective productive processes and strategic models based on the generation and use of information and knowledge (Grönroos, 2000; Tzokas and Saren, 1997; Vorhies et al., 1999).

Changes in the environment lead the firm to be aware not only of its situation as a social agent but also of the importance of every environmental issue. As a result, organizational culture experiments a key change, and the organizational values, the mission and the strategic objectives are modified (Dyer and Nebeoka, 2000; Vorhies et al., 1999). The firm is, then, orientated to the market and to the organizational learning (Wei and Morgan, 2004), the organizational objectives are established in terms of survival and long-term growth, and the consumer, as one of the main issues, begins to take the core place in the organizational strategy (Grönroos, 2000; Lankgerak et al., 2004).

Understanding the environment and all their relevant elements becomes a priority for the organization. Anticipating and giving response to changes require the acquisition of a perfect knowledge of every agent integrated into the environment, especially in order to foresee the most adequate potential actions, strategies and behaviours regarding the new scenario (Ottum and Moore, 1997). From this perspective, the organization begins to develop processes and systems based on the use of ICTs orientated to obtain and generate knowledge (Rangaswamy and Lien, 1997). The use of certain ICTs in market research enables the quick and efficient acquisition, analysis and storage of a great deal of information regarding the environment. Besides this, the development of internal communication systems facilitates the quick recovery, diffusion and use of this kind of information (Dyer and Nebeoka, 2000; Leenders and Wierenga, 2002; Rotwell, 1994).

The use of knowledge is an essential issue in the decision-making processes. Since the business activity is performed along the overall value chain, all functional areas – and even external agents – must be involved in these processes. The coordination and cooperation among different agents within the value chain become a must (Kahn, 1996, 2001). The role of ICTs is essential since ICTs contribute to improve and increase the degree of internal and external collaboration, providing the organization with tools that enable the knowledge diffusion and strength of the communication and working in teams along the firm (Rotwell, 1994).

The previous changes have a significant impact on the organizational, productive, strategic and management models of firms. Organizations become more flexible, decentralized and specialized in the generation and management of a certain type of knowledge and activities progressively (Sammuth-Bonnice and McGee, 2002). Nevertheless, the generation of value does not exclusively depend on the organization. On the contrary, it is shared along the value chain, increasing the interdependencies among members and emerging new organizational networked structures (Dyer and Nebeoka, 2000). In these new structures, the formulation of the competitive strategy must be based on the specialization of every unit and its fundamental competencies.

Cooperation relationships and alliances with different environmental agents become essential, especially in innovation processes. Nowadays innovation can be characterized as a complex and uncertain process where speed is a key competitive element. Responsiveness to market needs in the form of a more rapid product development process, coupled with better design, increased quality, and low cost is of paramount importance to firms seeking to improve or maintain their competitive edge. Innovation processes also involve uncertainty about the potential market response and the use of new technology in product design and/or production. Moreover, added to this uncertainty is the increasing complexity associated with more innovativeness, the resultant high degree of sophistication of products and rapidly changing conditions in a dynamic competitive marketplace (Rangaswamy and Lilien, 1997).

In order to reduce innovation uncertainty and time dependence, and therefore improve their results, organizations value the establishment of cooperative relationships (Deeds and Rothaermel, 2003; Gummesson, 1987; Leenders and Wierenga, 2002). The type of established relationship varies, from a simple transaction or one-off exchange to total consolidation, with the integration of the members of a complete organisation or team making for an authentic alliance (Deeds and Rothaermel, 2003; Leenders and Wierenga, 2002; McDonough, 2000; Webster, 1992). The relationship partner may take the form of universities and research centres (Santoro, 2000), competitors (Ahuja, 2000) or distributors and consumers (Appleyard, 2003; Schulze et al., 2001; Von Hippel, 1986, 1988).

Empirical evidence shows the existence of a positive relationship between cooperation and a successful innovation process (Ahuja, 2000; Deeds and Rothaermel, 2003; Phua and Rowlinson, 2004; Rothaermel, 2001). Cooperation offers important benefits to the company, which can be summarized as follows:

- (1) The establishment of workteams made up of experts in different functional fields who adopt flat, highly adaptable structures, wherein decisions are taken in a decentralised way (Henke et al., 1993).
- (2) The transfer of information, experience and new technologies that help to identify, and resolve quickly and efficiently, any problem that might arise (Chakrabarti and Hauschild, 1989; Gulati et al., 2000; Tatikonda and Stock, 2003). Furthermore, cooperation guarantees the circulation of information among agents and its use in the innovation process, thereby improving the activities of investigation and NPD (Peterson et al., 2003).
- (3) The supply of economic, human and technological resources to reduce complexity, cost and duration of the process (Littler et al., 1995).
- (4) The improvement of communication and information exchange processes (Pitta and Franzak, 1997; Pita et al., 1996).
- (5) The improvement of relationships between agents in the environment, internalizing the project and promoting the development of working relationships in which members actively participate (Meyer, 1993; Neale and Corkindale, 1998; Webster, 1992).
- (6) Positive support for developed products that meet new needs and demands, and the development of a more efficient innovation process that incorporates the "voice of the customer" together with the experience and know-how of other agents (Bhattacharyar and Sen, 2003).
- (7) A reduction of the uncertainty surrounding the product's future (Wind and Majan, 1988), and its dependence on the timing of product launch (Hillebrand and Biemans, 2004; Littler, et al., 1995), while improving the results obtained, and ensuring a favourable response from the market (Dogson, 1993).

On the other hand, the value concept becomes the centre of the competitive strategy design (Grönroos, 2000). The mission focuses on offering clients the highest potential satisfaction continuously, to make clients loyal becomes the most important objective to which organization orientates its management. The organization, based on its resources and capabilities, seeks competitive strategies to overcome competitors in their level of services, adaptation, prices as well as in the generation and delivery of other social and psychological benefits, e.g., trust, confidence (Grönroos, 2000; Gurviez, 1997; Morgan and Hunt, 1994). This is the added value that the firm uses to achieve the higher satisfaction to its clients, which is fundamental in order to keep customers loyal.

Customization and adaptation to the individual requirements of the clients become a relevant way of increasing the offered value (Boulding et al., 2005; Jain, 2005). New productive and management systems are developed, new products are created, additional services are offered, certain elements – such as brands – are used in order to enhance the aesthetic and symbolic value of the products and services, and finally, new communication, exchange and relationship channels are established using ICTs intensively (Adams et al., 1998; Ansary and Mela, 2003; Keller, 2003).

However, as Grönroos (2000) and Sanchez et al. (2000) show, the efficient development of these activities presents several implications for the organization:

- (1) A change in the core value of the organizations. The core business must be understood as a set of elements – product attributes and added values – in order to satisfy needs and offer value.
- (2) The consumption act becomes the goal instead of the instrument. Apart from considering it as a simply rational act oriented to the acquisition of products and the satisfaction of needs and desires, new interpretations of the consumption act related with its social, cultural, ludic and symbolic dimension appear.



- (3) A redefinition in the relationship that the organization establishes with its clients. Apart from the punctual exchange based on the purchase-sale of a product, the firm will attempt to get a solid relationship with its clients. Through this relationship the firm can offer clients other psychological and sociological benefits (as well as the product benefits).
- (4) A modification in the traditional marketing concept, with the subsequent alteration in the management processes. Therefore, a new marketing orientation towards relationship has emerged. This marketing concept is based on the dialogue among agents and the generation of value. The emerging processes must be global and interactive and also must include all departments and functions developed in-and-out the organization. This new marketing concept must attempt to achieve the proper management of all firm's relationships.

In general, the use of ICTs – in particular the Internet – offers the organization significant opportunities for the development of strategies (Ahuja, 2000; Brady et al., 2002; Rangaswamy and Lilien, 1997). Nowadays, almost all firms carry out e-business activities, especially e-commerce activities. The awesome increase in the number of consumers using different facilities of ICTs in their purchase processes, has led several firms to use ICTs intensively for a wide variety of activities, ranging from the search and analysis of information to the efficient development of certain internal processes. Certainly, ICTs have provided firms with a tool to obtain information, developing a communication channel and establishing a dialogue between the firm and their clients (Arnott and Bridgewater, 2002).

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