

Preface

Role of Information Technology in Entrepreneurship

All authors agree that the firm creation phenomenon is important for growth and economic development, particularly since the work of Schumpeter (1942). Entrepreneurs are vital for economic growth and prosperity. Today, millions of men and women, young and not so young, of all ages and ethnic groups, are currently involved in entrepreneurial activities: starting up new businesses, buying failed businesses, revitalizing family firms, or innovating (Osborne, 1987). A reflection of the importance of the entrepreneurship phenomenon can be found in the GEM consortium,¹ which is made up of research teams from more than 30 countries dedicated to analyzing entrepreneurship at the national, and in some cases, regional level. A large number of works have studied the determinants of entrepreneurship. Many of these have investigated the characteristics of successful entrepreneurs. These studies have tried to explain firm creation by analyzing the characteristics of these individuals, including their personality, educational level, or ethnic origin (Storey, 1994), factors associated with new firm creation (Armington & Acs, 2002; Reynolds, Miller, & Maki, 1993), the geographic, industrial, and organizational factors associated with entrepreneurship (Reynolds et al., 1993; Saxenian, 1999), and the effect of new firm creation on regional growth and development (Kirchhoff, Armington, Hassa, & Newbert, 2002; Storey, 1994).

Others studies analyze the influence of competitive factors such as innovation or technology on the creation of new firms. Innovation and creativity are key ingredi-

ents for providing more and better products and services. One of the first writers to discuss entrepreneurs was Schumpeter (1942), who defined the entrepreneur as a person who introduces new technologies into the production process. Schumpeter argued that entrepreneurship boosts innovation, the introduction of new products, or processes (services were not considered goods at that time). These individuals are coordinators of innovation, engineers of imagination and ideas, and, at the same time, managers of ambiguity and uncertainty (Osborne, 1987).

This book focuses on information technology, since this is a factor that favors competitiveness, innovation, and, presently, the creation of new firms.

This preface describes the entrepreneurship process and stresses the important role of innovation in firm creation, the role of the technology entrepreneur, and the capacity of information technology to be a source of competitive advantage and value creation for the firm. This is followed by some practical recommendations on how to generate value. The section concludes by analyzing the changes that the adoption of these technologies is causing in the traditional structures of organizations.

Entrepreneurship Process

An analysis of the entrepreneurship phenomenon first requires an understanding of the characteristics of the entrepreneurship process. There is some consensus in the literature that the firm creation process consists of various stages (Reynolds, Bosma, Autio, Hunt, de Bono, & Servais et al., 2005; Veciana, 1988). These stages include gestation, creation, launch, and consolidation. Understanding each of these stages may shed light not only on the firm creation process itself but also on the entrepreneurs' characteristics and the problems they face.

In the gestation stage, various factors influence the decision to create a firm, among which the future entrepreneur's professional background is particularly important. Individuals who create technology-based firms normally have a technical university education. Although this type of entrepreneur also tends to have previous professional experience in the field, they usually have less experience than non-technical entrepreneurs. What seems to influence the decision to create a firm in this type of person is the business organization in which they work. These entrepreneurs tend to create firms using the technology or knowledge they have acquired previously, so although these are technology-based firms, they are not innovative firms. These entrepreneurs often create their firms after a trigger event (getting fired, failing to get promoted or recognized, etc.).

The creation stage begins with the entrepreneurs identifying a business opportunity in the market or in their environment. They must then produce a business plan detailing all the information relevant to the idea, the product or service, and the market. The plan must also include an economic-financial analysis with projected

earnings and profits for the first few years in the life of the firm. This stage ends with the firm's incorporation.

In the launch stage the entrepreneurs must find the right people to work in the organization, and obtain the resources they will need to operate. Technology has a very important role in this stage, since fewer people may be required to work in the organization if new technologies are used effectively. This might, on the other hand, require highly qualified technical personnel. In any case, the entrepreneur will have to assess the long-term profitability of any investment in technology very carefully. Choosing the wrong technologies (problems of incompatibility or standards, obsolescence, rejection by the market, the technology is untested, etc.), or not using technologies correctly (poor planning, inconsistency with the firm's overall plan, poor implementation, resistance and opposition to the technologies from organization members, no control over compliance with the proposed objectives, etc.), could lead to failure. But firms will inevitably suffer declines in short-term productivity due to their lack of experience, as they are in the first stage of a learning curve of how to use the technologies effectively. These negative short-term effects are related to the concept known as the technology productivity paradox (Bruque & Medina, 2002). According to the productivity paradox, greater investment in information technology is associated, unexpectedly, with lower productivity.

The final stage is the consolidation of the firm. Consolidation occurs if the market has accepted the firm's products or services and the entrepreneurs have overcome any difficulties they faced in the early stages of the process. Personal problems often arise between the partners and some may leave the project as a result. The entrepreneurs are then effectively starting afresh at this point, because this is when they start making decisions concerning the growth and expansion of the firm. Investments in IT are at a stage that is close to maturity. The organization has gained a certain experience, and this helps it use the technology more efficiently and rectify initial errors. The entrepreneurs begin to realize that there are new ways of exploiting the technology investment made and that new business opportunities are beginning to be more clearly discernible.

Technology-Based Entrepreneurs

Economists and politicians began to pay more attention to the creation of technology-based firms from the 1990s onward. These firms contribute to job creation, and fast-growing startups, particularly in high-tech sectors, play a crucial role in renewing the economic system. In the past quarter century, the computing industry has grown much more quickly than the economy in general, although with some ups and downs. These firms, particularly those from sectors of the so-called new economy, such as software, e-commerce, and communications equipment, have competitive advantages based on innovation. The Internet has become commonplace

in practically all firms, not just the new ones but also the already consolidated ones. New technology adoption began in firms in the United States, but quickly spread to Europe and the rest of the world.

The Internet is now regarded as a powerful tool that can help firms overcome physical and managerial barriers to internationalization. This is particularly important for the smallest entrepreneurial firms, given their well-known initial limitations in terms of financial and human resources, international experience, and knowledge of global markets (Sinkovics & Bell, 2006). Thus, small firms that use information and communications technologies (ICT) tend to be more involved in internationalization activities and tend to perform better (Nieto & Fernandez, 2006).

The tendency in the current century is for information and the information technologies to continue transforming our homes and businesses, changing the way companies compete and consumers behave. Products and services based on information will expand and will have a high level of innovation (Osborne, 1987). ICT has changed the fundamental principles of traditional trade, but if firms handle the technologies properly they can be a source of competitive advantage (Porter, 1985). Nieto and Fernandez (2006), in contrast, argue that ICT on its own is not necessarily a source of competitive advantage; the technologies are complementary with some of the firm's other strategic resources. ICT is modifying the processes in all the firm's functional areas. Specifically, the Internet's impact can be seen in all the organizational areas: marketing, distribution, business processes, and so forth (Loane, 2006). With regard to the impact of ICT on firm creation, when a new technology appears, a large number of business opportunities are frequently seen shortly after.

Information technologies have proved to be innovative and are constantly being reinvented, creating shorter product life cycles, a higher level of automation, and faster obsolescence, in both products and services (Osborne, 1987). For entrepreneurs and the entrepreneurial process, the information era is a magnificent opportunity. The early 21st century is a time of considerable expectations for the technology entrepreneur, due to the excellent business opportunities available to technology-based firms and the fact that the ICT sector is still maturing.

In this context, the concept of e-entrepreneurship arises. This is rather more than simply applying technologies to the firm. In fact, it is the interaction between technology, business strategy, and business processes. E-entrepreneurship involves the application of ICT by entrepreneurs to create value from the entire value chain of business processes by acquiring, sustaining, and enhancing business competitiveness (Mahmood & Yu, 2005).

Researchers have examined whether entrepreneurs starting up technology-based firms have different profiles from other entrepreneurs. In general, Osborne (1987) finds that entrepreneurs are well-educated people, knowledgeable and experienced, and excellent students of human behavior and observers of consumer habits. Entrepreneurs starting technology-based firms tend to be younger than other entrepreneurs and tend to have a higher educational level in the case of high-tech manufacturing

startups (Autio, Kanerva, Kaila, & Kauranen, 1989; Donckels, 1989; Jo & Lee, 1996; Licht, Nerlinger, & Berger, 1985; Westhead & Storey, 1994), but a lower educational level in the case of startups directly or indirectly involving the Internet (Colombo & Delmastro, 2001). For many entrepreneurs, starting up technology-based firms is their first professional experience. But this usually depends on the type of technology firm involved. High-tech start-ups strongly depend on the founder's knowledge and skills, so these entrepreneurs are likely to have considerable previous experience from working in technology and experience of the market relevant to their firm (Colombo & Delmastro). This is even more the case when the firm is from the ICT manufacturing sector. Nevertheless, technology entrepreneurs starting up firms offering Internet services very often have less experience.

Two complementary explanations may explain why entrepreneurs have different characteristics in function of their activity in the high-tech sector (Colombo & Delmastro, 2001): first, the advent of the new Internet paradigm and the consequent appearance of new markets opening up new business opportunities and giving rise to many new enterprises; second, the technological and managerial knowledge and skills associated with previous work experiences quickly become obsolete, and repeating consolidated knowledge patterns may endanger the success of the business. This is why the founders of firms providing Internet services generally have lower educational levels and less previous experience than entrepreneurs from the ICT manufacturing sector. These latter firms are in the maturity stage of their life cycle and are consequently subject to less market turbulence. The competencies acquired during their education and previous work are consequently critical to the entrepreneurs with these firms.

Another characteristic of IT-intensive firms is that they tend to employ fewer people than firms from other sectors. Thus, their entrepreneurs typically need fewer financial resources to start their firms than entrepreneurs from other sectors.

Entrepreneurs who use IT undoubtedly have a different profile from other entrepreneurs. But technology entrepreneurs also have specific characteristics that influence their decision to start a business. The decision to start a business is conditioned to a greater or lesser extent by three factors. The first factor is the motivation to start a business. Technology entrepreneurs are more motivated to start out projects and put their innovative ideas into practice than other entrepreneurs. They tend to be driven by the need for achievement and self-realization and the desire to implement their projects; their motive is not purely economic.

The second factor is the entrepreneur's capacity or ability to create a business in the chosen sector. The competencies required to start up a firm come within the so-called managerial capacities. These are as necessary for entrepreneurs starting up a technology-based firm as they are for other entrepreneurs. But if the new firm needs to use information technologies intensively, either in its processes or in its products, the entrepreneur must possess technical competencies. Entrepreneurs can hardly apply IT efficiently if they lack knowledge or experience in the area.

The third factor that strongly conditions the decision to start a business is the entrepreneur's perception that there are business opportunities that they can exploit. Clearly, whether there are more or less business opportunities is important, but more important still is the entrepreneur's ability to see them. Technology entrepreneurs tend to have a refined analytical capacity developed during their technical education. Moreover, the constant evolution of these technologies and the possibility of applying them to various unforeseen uses provide fertile ground for the proliferation of opportunities.

Information Technology as a Source of Competitive Advantage

The motivation to start a business, possessing the competencies required to do this, and the perception that there are business opportunities all encourage firm creation, but they cannot guarantee success. The interest in studying the creation of firms that use IT in their products or processes lies in the fact that the technologies are frequently a source of competitive advantage for the firm.

Many researchers mention ICT as a source of competitive advantage (Barney, 1991; Clemons & Row, 1991a; Feeny & Ives, 1990; Mata, Fuerst, & Barney, 1995; Porter & Millar, 1986; Powell & Dent-Micallef, 1997), and this section now discusses this question.

One of the most important possibilities offered by ICT, from an internal perspective, is the impact of these technologies on the firm's processes, products, and services. For example, ICT can favor the creation of products with a greater informational content, or of services added to the product, for example, via the Internet.

With regard to improving the firm's processes, ICT can help create, modify, or destroy activities and links in the value chain (Porter & Millar, 1986), or restructure current business processes (Hammer & Champy, 1993). In fact, ICT allows firms to apply many of the principles of business process engineering. For example, firms can use the technologies to control or self-control the results of processes and transmit the results to management and to the workers concerned; workers carrying out tasks can simultaneously process the information that they generate, thereby lightening the workload of the administrative structure; information can be made available directly to whoever needs it in their work; and the firm no longer captures information more than once, so anyone who needs certain information can access the database that stores it, regardless of which company unit produced the database. In this way, the firm integrates independent systems with the consequent benefits in terms of synergies and scale economies (no redundancy of data or information, consistency of information, minimum cost of updating data, savings in data storage, and quality of data).

Many contributions in the literature examine the advantages obtained by the increased switching costs that ICT can generate (Clemons, 1986; Clemons & Row, 1991b; Feeny & Ives, 1990; McFarlan, 1985).

According to Mata et al. (1995), the literature recognizes five attributes of ICT as potential sources of sustainable competitive advantages: customers' switching costs, capital requirements, ownership of the technology, technical skills in ICT, and ability to manage the ICT. Their analysis, which is carried out under the resource-based perspective, concludes that only the last attribute is a likely source of sustainable competitive advantages. The generation of switching costs may dissuade future customers, who will prefer to use alternative standards that avoid investment in specialist technologies (and their concomitant switching costs). Capital requirements may exclude some firms if substantial investments in technology are required, but a large number of firms have enough capital to make such investments. Reverse engineering and the high level of obsolescence in information technologies make basing the firm's competitive advantage on its ownership of technologies alone unwise. And technical skills in the use of ICT are accessible on the market, either by employing qualified people or through training courses. With all this, the ability to manage the ICT is the only attribute that can give rise to sustainable competitive advantage. This will require a continuing evolution and learning for a more efficient and dynamic use of the ICT, for the firm's processes, and for the products and services it offers. It will mean that the firm needs to adapt continuously and proactively to the needs of its customers, suppliers, partners, and, indeed, to its own needs. These management skills imply that the technology firm is first and foremost a firm; the fact that it uses technologies is secondary. In fact, more than one technology firm has failed as a result of giving too much weight to the technology side and not enough to its essential nature as a firm. In the particular case of e-business, concentrating too much on technology aspects has blinded many firms to the fact that as businesses they must generate value, in other words, profits. Earle and Keen (2000) refer to this phenomenon using an inspiring phrase: firms must "pass from .com to .profit."

Some work in the ICT literature has focused on the role of these technologies in knowledge management. It is important to note that when the environment and the organization are highly complex, information systems and knowledge management become more important (Nonaka & Takeuchi, 1995). ICT, which supports the information system, plays a decisive role in this context (Davenport, De Long, & Beers, 1998; Lowendahl & Revang, 1998).

According to Garud and Nayyar (1994), the creation, maintenance, and development of a mass of technological knowledge will form the basis of future competencies.

From an external perspective, Porter and Millar (1986) argue that information has acquired a strategic value, since it can modify the structure of a sector, create new competitive advantages, and even lead to the creation of new businesses that were not feasible before. Cash and Konsynski (1985) and Porter and Millar (1986) stress

that firms can use ICT to develop generic cost-leadership, differentiation, and segmentation strategies. Rackoff, Wiseman, and Ullrich (1985) add innovation, growth, and external alliances to these strategies.

Nolan and Gibson (1974) and Nolan (1981) write that investments in ICT are dynamic in nature. Applying the product life-cycle philosophy to the introduction and development of ICT in the firm, these authors develop a six-stage model relating ICT investment with its organizational and strategic impact using a standard model of development and learning. The final stages of the model (information management and maturity) correspond to situations where the information system is evolving and it has a strategic role for the firm, but for which it has been necessary to evolve initially from previous stages facilitating learning.

McFarlan (1985) also stresses the strategic role of the systems and of the ICT, but arguing, from a more contingent perspective, that the role of these may differ from one company to the next. Thus, this author differentiates between firms whose current systems and systems in development depend to a great extent on ICT, and firms where they do not. It is therefore necessary to analyze whether ignoring the importance of a future technological development could leave the firm at a competitive disadvantage. Firms in this situation need to be aware of the strategic importance of ICT in the firm's planning. A serious error in the organization's information system plan can threaten its very survival.

ICT can undoubtedly represent a source of competitive advantage for the firm. But for this to happen, the company needs people who know how to manage it correctly (Mata et al., 1995). This management capacity is useful both to improve the processes and products of already existing companies and for the creation of new firms. The technology entrepreneur's role is critical here. As mentioned above, being a technology entrepreneur is more than just applying technologies to the firm. This type of entrepreneur is able to apply ICT efficiently at all steps in the value chain of the business processes, improving the firm's competitiveness (Mahmood & Yu, 2005) both in its internal operations and in its relationships with other organizations.

ICT offers entrepreneurs an enormous number of business opportunities in sectors like ICT infrastructure, Internet infrastructure, Internet intermediation, and e-commerce (Mahmood & Yu, 2005).

Activities relating to the ICT infrastructure include, for example, the supply of products and services involving software, hardware, communications, network support, and Internet services.

With regard to the Internet infrastructure, this includes services and programs such as Internet consultancy, e-commerce applications, multimedia programs, Web site development software, search engine software, online education, consultation of online databases, Web site support and hosting services, and transaction processing services.

Internet intermediation gets around the limitations of physical intermediation in the old economy in which firms achieved an efficient distribution by cutting transaction

costs, in turn achieved by locating goods and services close to the customers. The need for intermediaries on the Internet arises from the information asymmetries that exist between suppliers and customers, and also to aggregate supply or demand. But Internet intermediation can fail if the activity is limited to the traditional concept of bringing together the supply of some parties with the demand of others. Internet intermediaries need to generate value added for the providers, the buyers, or both. There is an important potential to start up new firms offering intermediation services in areas such as online travel agencies, online brokerages, content aggregators, portal content providers, Internet advertising brokers, and virtual malls.

Finally, e-commerce involves the commercialization, via the Internet or other networks, of products and services delivered either off-line or online (for purely digital products). E-commerce opens up business opportunities throughout the entire commercial process: marketing, promotion, distribution and logistics, procurement and purchasing, supply-chain management, sales, customer-relationship management, customer service, and provision of complementary information with products.

Practical Guidelines to Create Value

Nowadays, the technology firm par excellence is one that uses technologies to carry out its operations, to generate or offer its products and services, or to communicate with its customers and other firms. This type of firm is commonly known as an e-business.

Amit and Zott (2001) conclude, after their empirical study, that an e-business must create value if it is to be successful. The authors identify four interdependent dimensions that can potentially generate value in this type of business: efficiency, complementarities, lock-in (of customers and partners), and novelty.

Firms can become more efficient by cutting the cost of transacting with other firms and their production or service-delivery costs. Information technologies have contributed to reducing transaction costs between firms. On one hand, firms can use the technologies to quickly search for available providers and the supply becomes more transparent. On the other, after selecting the providers, or when transacting with customers, the technologies improve both formal and informal communication, and tools such as electronic data processing, electronic data interchange, and electronic fund transfer help automate the transactions. Similarly, systems such as computer-aided manufacturing, flexible manufacturing systems, computer-aided design, and computer-aided engineering help reduce production costs. The technologies also improve service delivery by facilitating an efficient and quick access to global markets through the Internet, cell phones, satellite communications, and so forth.

Complementarity means that a set of resources or capabilities provides more value working together than working separately. In this respect, individual information

technologies have no value in isolation. If a firm could buy all the technological assets of a successful firm but lacked the complementary resources and capabilities required to make them work properly, it would inevitably fail. In this sense, Powell and Dent-Micallef (1997) ask why some companies encounter difficulties while others prosper when using the same IT, and why IT-based advantages dissipate so quickly. They suggest that IT and complementary human resources and business capabilities must be integrated. Thus, IT requires complementary human resources, such as open organization and communication, consensus, top management commitment, flexibility, and experience in strategic-IT integration. In addition, with regard to complementary business capabilities, IT requires a close relationship and IT connections with suppliers, suitable IT training and planning, redesigning processes, orientation towards teamwork, and benchmarking capabilities (see Table 1).

With regard to the recommendation to lock in the customers, a valuable strategy commonly adopted by e-businesses is to encourage customers to make repeat transactions rather than occasional ones. On one hand, trapping customers in the relationship generates value. On the other, firms want to dissuade their partners from opportunistic behaviors that go against the spirit of the alliance. Firms can achieve both these objectives when switching providers or partners generates costs that dissuade such a decision. Nevertheless, this “captivity” should ideally be the result of a relationship that has value for the customer or partner, rather than due to the existence of switching costs. The threat of embarking on a transaction when switching the provider or partner is costly may dissuade them from entering the relationship in the first place. In this respect, adding value to the relationship, offering the customers or partners resources and capabilities that are complementary to their own, developing trust by tightening the links in the relationship, and consolidating the reputation that an honest and non-opportunistic behavior can be expected from the firm, are all potentially ways of attracting customers and partners. Moreover, the fact that the relationship maintained with these is stable and lasting means that routines can develop over time, and the information technologies used by the

Table 1. Complementary human resources and business capabilities (Source: Adapted from Powell and Dent-Micallef, 1997)

Human resources	Business capabilities
<ul style="list-style-type: none"> • Open organization • Open communication • Consensus • Commitment of top management • Flexibility • Strategic integration/IT 	<ul style="list-style-type: none"> • Relationship with suppliers • Connect IT with suppliers • IT training • Redesigning processes • Orientation towards teamwork • Benchmarking • IT planning

two organizations can become more integrated and coordinated. This discourages customers and partners from terminating the relationship, since they would have to learn new routines and adapt to new technologies with other firms. Moreover, a positive and valuable experience with the current relationship creates obstacles to terminating it in favor of another relationship that is full of uncertainties.

Novelty, in other words continuous innovation, also generates value in e-businesses. In fact, e-businesses usually obtain advantages if they are the first mover. Technologies can help in the most traditional continuous innovation—innovation in the firm's internal processes, and innovation in products and services. In fact, technologies are increasingly making products and services more ubiquitous and more virtual. But technologies are also enabling another type of innovation—creating new ways of carrying out transactions. Thus, they are innovating the way sellers and buyers are brought together, or innovating the way the purchase process takes place (e.g., Internet auction sites, or reverse markets), or integrating all the agents of the same sector (e.g., buyers, sellers, finance companies, and insurance companies). These are just some examples of how transactions can be restructured in novel ways.

If an e-business cannot generate value with its strategy, it will not be rewarded with improved earnings or a stronger competitive position. The firm must build a strong position in at least one of the four value creation formulas discussed above. But as was mentioned above, the four dimensions are all highly interdependent.

E-businesses must develop strategies to generate value if they are to be successful. This contrasts with the generalized belief that it is enough to be on the Internet, and that being on the Internet is just to support the traditional physical business. Many firms that think like this have Web sites that simply direct customers to their traditional sales channels.

Other firms do exploit the digital economy, but they are lost in a sea of .coms that only work because they are linked to popular portals or search engines. But in this last case achieving a transaction is costly, and does not necessarily guarantee customer loyalty after a sale. Thus, each new transaction incurs the same customer acquisition costs.

The challenge is to go from being present on the Internet to being profitable. For this, firms must turn occasional commercial transactions into stable customer-firm relationships by giving the customers value and being profitable at the same time. When Internet businesses are managed only from the perspective of the technology infrastructure, they end up being run by technical people. In short, it is essential that entrepreneurs run their e-businesses as the businesses that they are, and that the managers manage the firm from a business, and not just a technical, perspective.

On the other hand, going it alone is unwise in both business and technology. The firm should work with customers, product and service providers, technology providers, and even competitors. But it must not forget that it is only as strong as its weakest partner. Badly chosen, inefficient partners that do not add differentiation to the firm's products or services do not add value—quite the opposite.

Some authors offer practical guidelines to create value in e-businesses (Earle & Keen, 2000; Shapiro & Varian, 1999). There follows some recommendations on how to run firms as businesses rather than as technological infrastructures:

- Cultivate stable relationships with your customers. By building a critical mass of loyal customers firms can avoid customer acquisition costs for each transaction. The idea is to build a solid relationship with a strong bond. With this in mind, some firms offer free services in their Web sites, such as specialized information (grants, congresses, trips, etc.), discussion forums, e-mail accounts, space on their server, and so forth.
- Build a powerful brand. On the Internet, the brand concept becomes redefined. It is a relationship brand, rather than a product brand. Customers cannot see the product physically, as they would do in a supermarket, or leaf through the book that is of interest, as they would do in a bookshop. Thus, firms wishing to commercialize products or services on the Internet have no option but to establish a brand, a reputation (Shapiro & Varian, 1999). This reputation takes a long time and is costly to build, but it can be acquired rapidly by partnering with an organization that has one already.
- Improve your logistics. Firms that distribute physical products need to have first-rate logistics. In fact, many Internet start-ups fail because of logistics problems. Getting the logistics right creates synergies with many of the firm's other processes and allows the firm to increase its marketing actions, reduce prices, or improve its services. At the same time, it puts the firm in a good position to exploit other e-commerce opportunities, by using its now developed logistics capabilities. The evidence is clear: firms that have superior logistics perform better than their competitors.
- Harmonize your channels in the name of the customer. Customers choose the communications channel that offers them the most advantages. Firms must give their customers the option that best builds and maintains the relationship, and this choice is for the customer to make, not the firm. In this respect, some firms with an Internet presence operate a myriad of communication channels (Web forms, e-mail, telephone, fax, ordinary mail, combination of physical and virtual branches, etc.).
- Become an intermediary that adds value, or use one that does. In spite of all the evidence suggesting that the Internet would lead to an increasing disintermediation of markets, the coming era of business on the Internet will be dominated by hubs, which some authors call cyberintermediaries, such as portals with powerful brands and other intermediaries bringing together the supply and demand. These intermediaries will control the interaction between providers and customers by virtue of their role as coordinators of information, and they will advise customers where to go on the Internet to find the products or services they are looking for. Only those intermediaries that provide value

to consumers and firms will thrive. If a firm does not provide value as an intermediary, it must use an intermediary that does if it wants to be profitable.

- Information has the special characteristic that obtaining and processing it is costly, while it can then be copied indefinitely at practically zero cost, and subsequently be distributed quickly and with no logistical problems in an electronic market. At the same time, consumers do not consume information when they buy it. This is a more attractive opportunity on the Internet than manufacturing and selling physical products. It is important to analyze how much is invested in producing and selling the information. The electronic trade of data allows firms to distribute information globally enjoying scale economies, which reduce unit costs and so make the product cheaper. This last aspect also boosts the demand for such information services.
- Finally, scale, flexibility, and speed of entry and exit are all critical when competing in a commodities market. In this type of market, firms must:
 - o Enter at the right time. The firm must weigh the advantages of being a pioneer. It is not always worthwhile (e.g., before a price or standards war).
 - o Seek substantial market share and exploit scale economies to produce at low cost.
 - o Exit at the right time or change activities, before the business becomes unprofitable.

Information Technology as a Factor of Organizational Change

Nowadays, entrepreneurs are finding that ICT helps them create and manage their firms. Nevertheless, ICT's role in the firm has evolved over time along with developments in the technology. Firms' incorporation of ICT can be divided into three stages (Arjonilla & Medina, 2002), characterized by the technological advances and organizational changes experienced. The first stage runs from the 1960s to the mid-1970s. This stage saw the introduction of centralized computer systems and database systems in firms. The only objective was to automate and organize basic internal administrative tasks. The application of ICT in this stage had practically no influence on how work was done or the organization was structured.

The second stage began in the 1980s, with the advent of personal computers and local area networks. This is the stage when information technology began to modify the nature of the work and the structure of the organization. ICT allowed managers to flatten their organizations, which required fewer levels of managers responsible for transmitting information, instructions, and control reports. An effective use of

databases required a reorganization of the functional barriers between departments. Cooperative software (groupware tools) produced important changes in how the organization's members interacted with each other.

The expansion of the Internet in the 1990s marks the third stage. ICT accelerated the transformation of organizations by eliminating the organizational barriers between companies. Internal and external activities became integrated, and firms connected better with their customers, suppliers, and other firms (Antonelli, 1992; Bradelley, Hausman & Nolan, 1993; Jarvenpaa & Ives, 1994; Kambil & Short, 1994; Lucas & Baroudi, 1994; Malone & Rockart, 1991).

The advances in ICT have been widely recognized as having a substantial impact on the organizational structure. But firms' use of the technologies has evolved over time. ICT's role ranges from passively supporting the firms' operations to a more active role redesigning organizational structures. Initially, the rudimentary systems of index cards and memos between offices allowed bureaucracies to develop, making it possible to coordinate and control the components of the organization (Yates, 1989; Yates & Orlikowski, 1992). Later, the telephone, telegraph, and mail systems enabled distributed organizational forms and interorganizational communications (Chandler, 1977; Pool, 1983). Organizational forms were designed to adapt to the needs of communication. For example, self-contained units were created to reduce environmental uncertainty (Galbraith, 1973; Thompson, 1967; Tushman & Nadler, 1978). Conversely, ICT was designed to adapt to the organizational forms in place. For example, workflow systems were developed to support the matrix organization (Fulk & DeSanctis, 1995).

Beniger (1986, 1990) argues that ICT and the organization are equivalent forms. ICT creates new options for organizational design; and the new organizational forms, in exchange, offer new opportunities for the design of technology. This is consequently a more active vision of ICT's role in organizational design. In fact, designing ICT and designing the organization have become the same task (Lucas & Baroudi, 1994).

In 1958, Leavit and Whistler (1958) wrote a controversial article predicting that the combination of management science and ICT would lead to a reduction in the number of middle managers and an increased decentralization of the organization. Since the publication of their article, numerous authors have studied the relation between ICT and organizational structure. Some support the thesis that firms should use ICT to centralize the decision-making process and consequently cut the number of middle managers (Whistler, 1970). Other researchers see the possibility of increased decentralization. They argue that ICT provides timely and relevant information that could enable decentralized decision-making and the delegation of power (Arjonilla & Medina, 2002). Nevertheless, there is general recognition that ICT is changing the way people work, the structure of their organizations, and indeed the structure of entire sectors (Neumann, 1994; Zuboff, 1988).

There is also consensus that ICT is improving the control and self-control of workers, which reduces the number of hierarchical levels needed and makes organizations less formalized (Daft, 1995; Drucker, 1990; García, 1998).

Firms can also use ICT to establish either a greater centralization or a greater decentralization, depending on management's preferences, improving coordination with offices, warehouses, and plants distributed around the world (García, 1998).

ICT influences the organizational structure via the firm's organizational design parameters, which, according to Mintzberg (1979), are: job design, design of the superstructure, design of the lateral linkages, and design of the decision-making system. With regard to job design, ICT can be used to reduce the vertical and horizontal specialization of jobs. Workers can then assume more self-control and their jobs become more creative, motivating, and multifunctional, making organizations more organic. All this occurs because ICT can assume the routine tasks that traditionally dictated a horizontal specialization of the jobs, a formalization of the task, and more bureaucratized structures. This new way of looking at the division of labor favors team work over the traditional individualist work typical in highly specialized jobs.

ICT also influences the design of the superstructure, in other words, the authority that defines the criteria for grouping the units. The reduced vertical specialization, together with the teamwork, cuts the number of managers required as well as the number of hierarchical levels. Another reason why fewer managers are required is that ICT can take on many of their communication, coordination, and control functions, as well as widening their span of control. All this leads to flatter organizations.

With regard to unit size, enriched jobs mean that fewer people are required for a given set of functions, so the units will be smaller.

According to Mintzberg (1979), organizations use lateral linkages to coordinate themselves. These elements are planning and control, which standardize the outputs, and linking mechanisms, which facilitate the necessary mutual adaptation when direct supervision and standardization are insufficient. ICT affects each and every one of these lateral linkages. In the case of planning, ICT improves analytical and design capacities, and increases access to information, making it easier to capture, prepare and handle information in flexible formats that are easy for the decision-makers to use (Arjonilla & Medina, 2002). With regard to control, ICT makes it easier to access the results being controlled, calculate more sophisticated indicators, detect the reasons for deviations from the expected results, conduct ad hoc control as continuously as is necessary, and control by exception. The new technologies also improve coordination and mutual adaptation by providing more effective communication systems.

Finally, the design of the decision-making system defines the level of centralization or decentralization in the decision-making. ICT can support centralization processes, by providing enhanced organizational transparency and giving top managers greater

control capacity. But equally, it can also support decentralization processes, or at least selective decentralization, since information becomes rapidly accessible at any point in the organization. Thus, ICT allows organizations simultaneously to exploit the advantages of both centralization and decentralization. According to Daft (1995), ICT leads either to increased centralization or increased decentralization, depending on what management decides to do.

Organization of This Book

This book describes 14 real cases of firm creation involving information technologies.

The cases presented in this book are grouped in two parts: entrepreneurs and corporate entrepreneurship. The first section includes cases 1 to 10. These are firms created by physical people, either one individual or a group of partners, who began an entrepreneurial process after a particular trigger event, and this process eventually culminated in the creation of a new firm.

The second section runs from cases 11 to 14, which involved the creation of firms or development of projects by already existing firms. This type of entrepreneurial behavior is known as corporate entrepreneurship. This entrepreneurial behavior does not always end in the creation of a new firm. It often generates an innovative process that leads to new projects and entrepreneurial initiatives that remain in the organization. In other cases this entrepreneurial initiative does in fact end in the creation of a new firm that is distinctive from the original one.

A brief description of each of these cases follows:

Chapter I looks at the revolution created by FON. Its objective is to create a universal and unified Wi-Fi network that allows the members of its community to share not only bandwidth, but also experiences and ideas. FON is a virtual community of Wi-Fi users worldwide making use of spare bandwidth from customers' broadband connections. This enormous Wi-Fi network, practically free of charge, is a new project from Martin Varsavsky, an entrepreneur who has created seven innovative businesses in the past 20 years, nearly all in the high-tech sector.

Chapter II explains the creation process of Remote Internet-Based Supervision Systems, S.L. (RISS), a spin-off of the University of Figueres. It describes all the phases, from its creation to the present day, and the problems and challenges faced by the entrepreneurial team composed of academics and industry professionals. Starting in a lab shared by two computer engineers finishing their PhDs, their friendship later turned into a new science-based venture.

Chapter III analyzes the case of BookingFax. This firm acts as an intermediary between wholesalers of tourism offers and retailers, in other words, the travel agencies. The main objective of this case is to examine how information technologies have provided the basis for this firm-creation idea in the tourism sector. BookingFax has used information technologies to enter a market that had no apparent room for more intermediaries. The key to its success is that it creates value and offers cost savings to all the parties involved. Increasing the critical mass of users of its information systems will be crucial to reduce the threat of new entrants and imitation by the sector's wholesalers.

Chapter IV examines the case of ShiftMarket, an example of IT entrepreneurship in the health care sector. ShiftMarket is a startup company developing and promoting technology-driven solutions for staffing hard-to-fill hospital shifts. Started without angel or venture-capital funding, ShiftMarket negotiated a strong beginning by pursuing technology transfer in collaboration with a U.S. hospital rather than building from scratch. At the time of this case study, ShiftMarket is facing some key changes in the market, including new entrants and new alliances, and has begun evaluating what strategic adjustments may be warranted.

Chapter V analyzes different factors in the entrepreneurship process in a company that exploits the business opportunities offered by open-source software. Blobject connects opportunities for local development, use of open-source technologies, and new social trends in many consumers. The case shows the integration process of the different technologies, which connect through a digital infrastructure.

Chapter VI illustrates, in a holistic way, the different components that affect recognition of the technological venture opportunity—the environment, attributes that characterize technology-based entrepreneurs, the type of organization created, and the type of technology used to build the venture—and the interactions that take place between those components, which ultimately result in the market innovation. NTC, an emerging business, offers a clear example of how the entrepreneur, technology, and the accumulation of experience and knowledge interact to give rise to a technology-based venture.

Chapter VII focuses on the case of Waleli. Waleli is a high-tech company that uses the latest technological developments in wireless communication to bring innovations to the market. The firm aims to develop wireless communications to solve simple communication needs, both between people and between machines.

Chapter VIII is about Workcenter SGD. This company was born on the basis of following the same idea and services that Kinko's® created successfully in the United States, with nearly 1,300 retail stores devoted to reprographic services. Nevertheless, in 4 years the company went far ahead of the original idea, developing new technologies that helped manage its growth, control its operations, and reduce its costs.

Chapter IX describes the entrepreneurial process in the case of Europrint, a manufacturer of Printed Circuit Boards (PCBs), from 1991 until 2006. It offers an entrepre-

neurial perspective on the European PCB landscape, highlights the manufacturer's successful launch of a dot.com in the highly competitive B2B environment, and illustrates the manufacturer's transition to an e-business to break the product commodity cycle. As a final point, the case also reveals how the manufacturer's off-line and online business activities were consolidated and leveraged for maximum impact across Belgium, Hungary, and India.

Chapter X is about Cember.net. This online business networking start-up based in Turkey provides a platform through which its members can locate potential economic exchange partners. Cember.net differentiates its business model from those of major online competitors by incorporating ways of fostering social interactions and exchanges. Cember.net, with its continually growing membership base, presents networking opportunities to its members by advancing not only the quantity but also the quality of the relationships.

Chapter XI, which examines the firm Comitas Comunicaciones, is a clear example of corporate entrepreneurship in the telecommunications sector. This firm was created to offer telecommunications services in general, and telecommunications services applied to telemedicine in particular. Comitas Comunicaciones exploits the business opportunities opened up by market demands not currently being adequately attended to by other firms. The role of the incubator firm is particularly important in this case, since it provides the company with resources, capabilities, and technological knowledge.

The purpose of Chapter XII is to describe a real story where key issues related to the business expansion process of a young IT-based applied research center (ARC) are discussed. The start-up ARC develops visual and interactive communication technologies in the field of computer-aided graphics. The expansion of this IT-based organization was original—it involved the creation of two spin-offs during its infancy period. This chapter highlights the general concerns associated with knowledge management and the capacity of innovation that emerged during the business expansion process. These concerns can be classified in three main theoretical areas: entrepreneurship, interpreneurship, and intrapreneurship.

Chapter XIII analyzes how various stakeholders—a university, an innovation and technology transfer institute, and private and public client organizations—acting in concert, create multiple opportunities for the application of technology to real-world problems, and how some of those projects originate spin-offs. This chapter presents a real-life example of one such company, which develops software for mobile applications. It spun off from a project with a big cell-phone service provider 5 years ago, incubated for 3 years at the institute, and moved out in 2004. The authors draw on their experience in assisting the creation of 70 technology-based start-ups to provide practical recommendations and point out key success factors.

Chapter XIV concludes and focuses on a pharmaceutical distribution firm. This case explains the process of discovering and applying new information technology-based

opportunities. It is a mature firm, which, during the course of the last few years, has been able to adopt information technologies in innovative ways thanks to the intrapreneurial spirit of its managers.

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Endnote

- ¹ For more information on the GEM project, see www.gem-consortium.org.