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Abstract: Under conditions of rapid change, companies compete intensely to achieve competitive advantages. Through technology, they differentiate themselves from other companies to obtain a better market position. Decisions concerning technological variables are thus essential to a firm's overall competitive strategy, positioning and emplacement. Our research analyses how top management support for technology and technology skills enables technology acquisition, integration and infrastructure in firms, influencing organizational performance through corporate entrepreneurship. The analysis is performed using Structural Equation Model with a sample of 201 Spanish technological firms. The results show that awareness of technological issues enables entrepreneurship in the firm.

Keywords: Top Management Support, Technology Skills, Technology Acquisition, Technology Integration, Technology Infrastructure, Corporate Entrepreneurship.

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1 INTRODUCTION

One of the most important strategic decisions facing management in today's globally competitive environment involves technology development (Jones et al., 2001). To face these technological changes, companies innovate using a process of continuous learning through which they generate new technological knowledge and competencies (Nonaka and Takeuchi, 1995). Organizations are aware that factors change with increasing speed, technological advances cause more rapid innovation, etc. When organizations face such circumstances, it is quite difficult for them to maintain a competitive advantage achieved some time ago unless they adapt to the changes (Akgün et al., 2014). In this sense, the theory of capabilities which complements the Resource-Based View (RBV) (Barney, 1991) by arguing that only firms capable of developing dynamic capabilities will be able to survive (Han and McKelvey, 2008) and generate sustainable competitive advantage (Cruz González et al., 2009; Teece et al., 1997). This study thus focuses on technological capabilities as one of the most dynamic capabilities and as one capable of strengthening the entrepreneurial organization (Antoncic and Hisrich, 2001; Kuratko and Audretsch, 2013; Nonaka and Takeuchi 1995; Zaltman et al., 1973).

Technology allows introduction of some systems to reduce costs and increase organizational success (Ross et al., 1996). Decisions concerning technology variables are essential for a firm's competitive strategy and must be supported by top management (Zahra, 1996). Top management support for technology (TMS) is one of the most often-cited concepts in the technology literature (Ghosh et al., 2001). It "reflects, in many ways, the importance that top management executives place on technology" (Byrd and Davidson, 2003, p. 246). TMS is a "perceived powerful source" (Leonard-Barton and Deschamps, 1988, p. 1254). With society's recent increase in technology skills, companies' awareness of the need to outdo their competitors has risen dramatically, rendering companies dependent on top management to face the challenge of training a new workforce. This task involves identifying the skills shortages to satisfy the demands of a range of new professions by identifying the learners and educators acquainted with the new technology (Ahsan and Malik, 2015; Bustamante, 2004; Herrera and Nieto, 2015).

Leonard-Barton (1992, p. 113) defines skills as a dimension "that distinguishes and provides the knowledge set needed to enable a core capability. This dimension of skills encompasses both firm-specific techniques and scientific understanding." It provides the basis for a firm's competitive capacities and sustainable advantage in a particular business (Teece, 1986). Applying this understanding to technological issues, Leonard-Barton (1992) emphasizes that technology skills constitute the entire technical system, which can usually be traced back to the firm's first products. Technology skills define the roots of a firm's sustainable competitive advantage, since the capabilities comprise patents protected by law, technological knowledge, and production skills that are valuable and difficult for competitors to imitate (Lee et al., 2001).

These striking technology skills have brought further technological breakthroughs. Only after developing their own technology and competing in the current turbulent environment do companies realize that they must still acquire expertise and external technology from other sources, such as social networks, and that top managers perform this task (Dodds et al., 2003; Haro-Domínguez et al., 2010; Kramer et al., 2011; Srivastava et al., 2015). Once firms have developed their initial innovative technology, they struggle to integrate new technology to remain competitive. Strategic advice from managers or technology experts is thus needed for ongoing outcomes (Ahsan and Malik, 2015). Having achieved full integration of technology in the firm, the company needs a basic, stable technological framework to maintain, transfer and communicate its new technological knowledge more effectively (Ahsan and Malik, 2015; Kamal et al., 2015; Srivastava et al., 2015; Yin, 1992). And soon as the framework is constructed, it must be funded by top managers (Bolton and Foxon, 2015).

Recent technological developments that heighten awareness of the impact of technology have led to reconsideration of its links with development of technology acquisition, technology integration (change), and technology infrastructure (Byrd and Turner, 2001; Larsen et al., 1991; Zahra and George, 2002). Such a technological framework is possible thanks to top managers' support for technology (Byrd and Davidson, 2003; Stone, 2006).

One of the most important strategic decisions management faces in today's globally competitive environment involves technology acquisition, integration (change) and development. Technology acquisitions indicate "the firm's capability to identify and acquire externally (technological) generated knowledge that is critical to its operations" (Zahra and George, 2002, p. 189). Similarly, technology integration consists of "the set of knowledge building activities through which novel concepts are explored, evaluated and refined to provide the foundation for product development" (Iansiti, 1995, p. 521–522). This technology integration process provides a critical road map to guide technology design and development activities (Iansiti, 1995). Finally, technology infrastructure is defined as "the enabling foundation of shared technology capabilities upon which the entire business depends" (Byrd and Turner, 2001, p. 42). Infrastructure is a set of shared, tangible technology resources that form the foundation for business applications (Duncan, 1995). Because this part of the organization's capacity is intended to be shared, a flexible technology infrastructure is a new

weapon crucial to developing sustained competitive advantage (Byrd and Turner, 2001), one that many researchers cite as an extremely valuable resource (Rockart et al., 1996).

Technology acquisition, integration and infrastructure create opportunities for corporate entrepreneurship strategies as knowledge and technologies are integrated to develop entrepreneurial competences (Barreyre, 1988). The entrepreneurial dimension is enhanced by acquisition and integration of technology and knowledge into the technology infrastructure, since all three activities provide incentives for systems that establish a structure for science and innovation by having acquired technology and integrated it into the firm (Akgün et al., 2014; Burger-Helmchen, 2008; Soh and Subramanian, 2014). Technology acquisition, integration and infrastructure create an environment for investments in scientific and technological endeavours, develop innovation capabilities, and ensure the sustainable growth of corporate entrepreneurship (Koh, 2006; Soh and Subramanian, 2014), defined as "the process by which firms notice opportunities and act to creatively organize transactions between factors of production so as to create surplus value" (Jones and Butler, 1992, p. 735).

Firms combine entrepreneurial actions to create new opportunities through strategic processes and to generate competitive advantage (Hitt et al., 2002). Corporate entrepreneurship thus identifies knowledge spillovers as a key mechanism underlying new venture formation, organizational innovation, proactiveness and self-renewal within the company, leading to the economic growth of companies (Antoncic and Hisrich, 2001; Martin-Rojas et al., 2011, 2013; Zahra, 1993).

All the previous literature suggests that there is every likelihood that some technological assets influencing on entrepreneurship (Alvarez and Barney, 2007; Antoncic and Hisrich, 2001; Antoncic and Prodan, 2008; Martin-Rojas et al., 2013; Simsek and Heavey, 2011; Woolley, 2010; Zahra, 1996) or performance (Byrd and Davidson, 2003; Byrd and Turner, 2001; Capuano et al., 2008; Jones and Butler, 1992; Leonard-Barton, 1992; Park and Ghauri, 2011; Teece, 1986; Van de Ven, 1993) have been previously studied. However, not only there is scarce literature focused on these specific concepts such as technology integration (from an organizational view point) within technological companies, but also no one has studied all of these concepts combined as a step by step complementary process. Furthermore, this study tries to shed some light on literature by finding how key widely studied technological assets (technology skills and top management support to technology) impact on second order technological assets into the firm (technology acquisition, integration and infrastructure) from an organizational point of view; and, only after the organization have developed a complex technology infrastructure motivated by all the previous assets, these complementary technological assets combined will influence on organizational performance through corporate entrepreneurship (entrepreneurial spirit throughout the company).

To develop these relationships, we structure this study as follows. Section 2 analyses the hypotheses theoretically. Section 3 presents the study's data analysis and methodology. Section 4 discusses the results obtained. Finally, Section 5 presents the study's conclusions, theoretical and practical implications, and limitations and lines for future research.

2 THEORETICAL BACKGROUND AND HYPOTHESES

2.1 The influence of TMS on technology skills, acquisition, integration, and infrastructure

In discussing the relationship between TMS and technology skills, Stone (2006) affirms that TMS is an important core value used to demonstrate commitment and enhance potential for employee participation. Managers should understand company culture and values; they should also maintain beneficial aspects of this culture and promote technology skill creation through an organizational learning process. This result can be achieved if the manager is willing to observe and talk to employees; recognize obstacles, problems and successes; and train employees in technology skills (Leonard-Barton, 1992; Stone, 2006). In analysing management support for technology, Omerzel and Antoncic (2008) conclude that main managers are the people who provide employees with technological ability through an organizational learning process and thus facilitate technology transfer throughout the firm. Personal commitment from top managers is thus a key factor for a successful business. Top management requires different technological knowledge and skills in different growth periods of the firm, and develops its organizational learning process continuously to obtain those technology skills and knowledge (Omerzel and Antoncic, 2008).

Liberatore and O'Neill (1985) confirm this assertion in the field of robotic technology implementation, where only after having being helped by managers financially and technically did operators and managers develop their technology skills to control the robots' performance. Firm personnel with high technology skills may be rewarded with assignments that use the new technology they have learnt through the support of the Board and managers.

Zahra et al. (2009) affirm that Boards may even help managers to pursue new skills and capabilities by reducing cognitive rigidity among firms' senior managers. The authors analyse a specific case in which the support of CEOs and managers allowed highly-skilled technology employees to disseminate their knowledge to stimulate innovation, allowing the company to identify opportunities for growth and thus promoting corporate entrepreneurship and other wealth-creating activities that generate economic profits (Zahra et al., 2009).

In the education sector, Markman et al. (2005) find that extraordinary support from managers at the university in the field of technology (AUTM, Association of University Technology Managers) allowed university professors and students to utilize their technology skills to skyrocket economic opportunities through business incubation. Thus, the higher the level of support managers offer employees, the greater the development of technology skills achieved, and subsequently the higher the performance. Based on these arguments, we formulate the following hypothesis:

Hypothesis 1. Top management support is positively related to technology skills.

Top managers' choice to invest in technology and knowledge acquisition must be the result of a deliberate and conscious strategic decision (McLoughlin et al., 1985). Top managerial strategies for introducing new technologies in the company may be the outcome of a process of social choice and political negotiation (Cohen and Levinthal, 1989; Haro-Domínguez et al., 2010; Narayanan, 1998). In the field of space technology, Jason et al. (2010) demonstrate a positive relation between TMS and technology acquisition. Technology acquisition is analysed as a mechanism to underpin economic growth and development.

This support is not only financial but also includes development of technological skills and knowledge. A study of DaimlerChrysler finds that companies need internal development but that managerial support must also include knowledge and technology acquisition, which make the company more dynamic and competitive in the current environment of crisis (Göker and Roth-Berghofer, 1999; Soh and Subramanian, 2014). Based on the study of innovation capabilities, Petroni and Panciroli (2002) find that TMS strengthens technology acquisition in companies. According to their investigation, financial and strategic TMS improve technology acquisition and knowledge to bring about product or process development.

Park and Ghauri (2011) provide solid arguments that TMS is absolutely necessary to promote foreign technology and know-how, since technology and knowledge acquisition are highly dependent on managerial support as well as communication, appreciation and mutual reliance among employees (Park and Ghauri, 2011). Organizations with TMS promote technology acquisition and diffusion of ideas, solutions and know-how throughout innovative systems (Akgün et al., 2014; Ancarani et al., 2016; Doloreux and Melançon, 2009). TMS promotes learning by doing and R&D investments, which are indispensable to changing outdated production methodology and acquiring new technology to enable firms to advance to a different technology frontier, improving the firm's competitiveness and market share (Narayanan, 1998). In other words, companies that invest in R&D also develop and maintain broader capabilities to acquire, assimilate and exploit technology. Many scholars also find that managerial efforts are one of the most important ways of acquiring technology (Cohen and Levinthal, 1989; Narayanan, 1998; Soh and Subramanian, 2014). Based on the foregoing arguments, we propose the following hypothesis:

Hypothesis 2. Top management support is positively related to technology acquisition.

The technology integration process is determined by TMS. TMS is not only a function of effective planning at the strategic level but ensures appropriate technology integration to provide the right foundation for product development activities (Iansiti, 1995). Top managers achieve excellence in technology integration by undertaking activities such as providing information about potential international collaborators (e.g., technology donors); brokering transactions between two or more parties; acting as mediators; and helping to obtain advice, funding and support for the innovation outcomes of such collaborations. Implementation of technology integration is thus often affected by managerial issues such as social capability and key institutions' hindrance of the technology integration process (Ahsan and Malik, 2015). Furthermore, TMS is required to obtain successful technology integration, which may promote development of new products or processes (Smith and Offodile, 2008).

On the other hand, Ancarani et al. (2016) and Kamal et al. (2015) find that absence of support from top managers prevents full integration of technology in the company, preventing companies from achieving effective solutions for technology-related problems, as much research in technology sectors is extremely complicated and unmanageable for the firm.

Finding appropriate solutions relies heavily on top management's attitudes and behaviour toward adoption of successful technology integration (Kamal et al., 2015), which permit implementation of knowledge and competencies to manage recognition of demands in the marketplace, understand the business in depth, and obtain the skills to develop rapport with customers. In technology-intensive sectors, top managers are responsible for providing more services to their clients by delivering a more comprehensive type of service that improves technology integration and comes closer to the technology recipients via more direct knowledge transfer and communication (Ahsan and Malik, 2015). That is, top management support for technology, accompanied by greater allocation of resources and improvement of existing competencies, fosters better communication and coordination, encouraging technology integration (Zhao et al., 2010). Taking the foregoing literature into account, we formulate the following hypothesis:

Hypothesis 3. Top management support is positively related to technology integration.

Following Kamal et al. (2015), lack of support to achieve full technology integration inhibits development of a collaborative, organization-wide technology infrastructure. Absence of such a structure leads to inefficient decision-making aptitude and behaviour, problems that in turn generate unsophisticated technology activities inadequate to developing the firm. The right TMS will, in contrast, drive optimal use of skill-based resources to reduce the downside risk of inflexibility traps that might otherwise damage or confine agility, whereas a flexible technology infrastructure (Fink and Neumann, 2009; Srivastava et al., 2015) can be created, configured, and rearranged rapidly to attend external business needs and facilitate superior time to market for new business initiatives (Agostinho, 2015).

Creating and managing an integrated technology infrastructure with seamless interoperability thus requires foresight, comprehensive technological knowledge, adequate time, managerial and financial commitments, and qualified resources (Irani et al., 2007). TMS, as well as other top managerial tasks such as the need for trust, open and effective communication, and conflict resolution structure and skills, are core elements guaranteeing a successful technology infrastructure (Barlow et al., 1997; Cheng et al., 2000).

In the field of education, analysis of technology infrastructure shows that managerial support creates an institutional infrastructure for technology transfer associated with positive outcomes, increasing university research capabilities and improved ability to attract world-class research faculty and openness to high-tech entrepreneurial activities (Plummer and Gilbert, 2015).

The impact of TMS is especially relevant in the field of technology. In cell phone advertising, for example, top managers are very likely to support appropriate promotional techniques to achieve a broad technology infrastructure that permits short-term evolution of consumer acceptance. In other words, given the growing sophistication of mobile communication technology, top managers who provide sufficient technology infrastructure for high-speed Internet connections will gain market share rapidly (Okazaki and Taylor, 2008). Horwitch (1990) reaches the same conclusions about the aerospace and automotive sectors, where top managers are especially involved in generating technology infrastructure because they find the endowments required for this infrastructure.

TMS thus influences technology infrastructure development, since technology infrastructure demands strong and committed top management to guide the initiative and develop a working environment that supports technology (Ghosh et al., 2001). TMS aims to create a technology infrastructure with ever-improving software modules developed and shared by all concerned with company (Overeem et al., 2013). Based on these arguments, we propose the following hypothesis:

Hypothesis 4. Top management support is positively related to technology infrastructure.

2.2 The influence of technology skills on technology acquisition, integration and infrastructure

The decision whether to develop technology and innovative capabilities internally or to acquire them via external means is a central component of any technology strategy (Zahra et al., 1994). Much recent evidence shows that firms do not trust exclusively in their internal resources to maintain technological competitiveness (Narula, 2001).

Rapid technology development, the complexity of products and services, and their high costs are making firms increasingly conscious of the limitations of exclusive internal development of their technology. Acquiring technology through external sources can facilitate rapid development and deployment of commercial technologies and products, while providing access to state-of-the-art technology, but it can also undermine the need to maintain and upgrade internal capabilities.

Firms must weigh carefully the advantages and disadvantages of acquiring technology internally or externally to ensure their ability to compete effectively in today's market (Haro-Domínguez et al., 2010). The technology management literature views external technology sourcing strategies as a means of complementing and leveraging internal skills (Jones et al., 2001; Zahra and George, 2002). This observation is especially important for firms with high levels of technological skill, as they must react rapidly to changes, and it can justify high-tech firm managers' preference for external acquisition of technology to maintain a high level of technology and innovation in the firm (Eisenhardt and Schoonhoven, 1996). The intensity and speed of firm technology skill in identifying and gathering knowledge can determine technology acquisition. The greater the firm's technology capabilities, the more quickly the firm will acquire technology (Zahra and George, 2002). Since firms with technology skills can benefit from combining their technology with other complementary assets from external technology acquisition, technology skills are important to providing firms with the high levels of internal variety needed to address external technology acquisition (Giarratana and Torrisi, 2010).

Based on these arguments, we propose the following hypothesis:

Hypothesis 5. Technology skills are positively related to technology acquisition.

Effective technology integration is not only a function of effective planning at the strategic level and strong project management; success is also linked to technology skills, which ensure an organization's knowledge base (Iansiti, 1995). Having the depth of knowledge needed to understand technology skills will produce stronger technology integration in the company, enabling a competitive advantage that is difficult to imitate. Research shows that the most effective organizations dedicate substantial resources to the execution of distinct and explicit technology integration activities, which are based on the broad impact of the novel technology skills of employees and managers (Iansiti, 1995). If managers have better technology skills, their meaningful participation will enable the technology integration needed to overcome the adverse effects of uncertainty and promote employee participation in any technological change process that arises, reducing uncertainty (Larsen et al., 1991). Furthermore, the technology integration process affects all members of an organization but may have special relevance for managerial personnel, who carry particular responsibility for introducing and implementing new technological developments (Larsen et al., 1991). Technology skills thus facilitate technology integration in the training process, which promotes increased interaction across disciplines and improves the way that the organization's personnel use technology in their subject-specific areas of specialization (Aburime and Uhomoibhi, 2010).

The EMBLEMA project at Salermo University finds that optimization of business technology integration processes involves technology skills, among other capabilities. The advantage obtained was attributed to the technology integration processes transmitted through the technology skills, knowledge and competencies that managers possessed.

Technology skills thus facilitate technology integration processes that produce a more appropriate, personalized advantage (Capuano et al., 2008). Likewise, Ertmer et al. (2012) find that managers engaged in exemplary, innovative, or best-practice skills achieve greater technology integration. They also find that technological attitude, beliefs, knowledge and skills are the strongest factors contributing to managers' ability to integrate technology. Managers who possess specific technology skills design a technology integration process more easily than managers who lack these skills (Larsen et al., 1991). In other areas, such as education, lack of technology skills in teachers is a significant barrier to technology integration in schools (Ertmer et al., 2012). Consequently, the greater the teachers' technology skills, the greater the technology integration the institution can achieve (Capuano et al., 2008; Ertmer et al., 2012). Based on this prior literature, we formulate the following hypothesis:

Hypothesis 6. Technology skills are positively related to technology integration.

Technology infrastructure is developed by factors such as data transparency, compatibility, application, connectivity, boundary skills, functional skills, technology management and technology skills (Churchill, 1979). Analysis by Byrd and Turner (2001) shows technology skills to be a structural capability that seems to make a difference in the technology platform or infrastructure. Consequently, higher technology skills produce strong employee motivation to obtain a consistent, significant foundation of technological knowledge and a stronger technology infrastructure (Churchill, 1979; Mayorova, 2011).

Van de Ven's (1993) study provides evidence of how different skills contribute to the infrastructure variables. This argument is not only typical of technology firms; hospitals with skills based on technology have also been shown to achieve better management of technology infrastructure (Wainwright and Waring, 2000). Similarly, at the university, students' higher technology skills require development and improvement of technology infrastructure (Mayorova, 2011). Universities' greater appreciation of technology skills, competencies, and knowledge permit a well-built infrastructure with advantages and benefits in this competitive global technology environment (Byrd and Turner, 2001; Capuano et al., 2008). In the tourism sector, technology skills are clearly needed to develop technology infrastructure and outdo competitors (Bordoni, 2011). Greater availability of general technology skills creates a broader technology infrastructure (Byrd and Turner, 2001; Mayorova, 2011; Wainwright and Waring, 2000), whereas a low level of technology skills in the company translates into weaknesses for technological knowledge and infrastructure (Azzone and Maccarrone, 1997). We thus formulate the following hypothesis:

Hypothesis 7. Technology skills are positively related to technology infrastructure.

2.3 The influence of technology acquisition, integration and infrastructure on corporate entrepreneurship

Corporate entrepreneurship is important for organizational survival, profitability, growth and renewal (Zahra, 1996). Attracting resources from external providers is critical to the survival and growth of an entrepreneurial venture (Shane, 2003). The decision whether to develop technology and innovative capabilities internally or acquire them via external means applies to both corporate-sponsored venturing efforts and new venture efforts undertaken by independent entrepreneurs (Zahra, 1996). Firms must consider the trade-offs and risks associated with this decision. Developing technology internally ensures greater control over its distribution and maintains viable technical capability for the firm, but it may require more resources than the firm is willing or able to commit. Acquiring technology through external sources may, in contrast, facilitate rapid development and deployment of commercial technologies and products while providing access to state-of-the-art technology, but it can also undermine the need to maintain and upgrade internal capabilities. Firms must weigh carefully the advantages and disadvantages of acquiring technology internally or externally to ensure the ability to compete effectively in today's market (Haro-Domínguez et al., 2010; Jones et al., 2001).

Entrepreneurs can take existing knowledge through technology acquisition that allows firms to identify potential market opportunities and act upon them (Woolley, 2010). Technology acquisition thus opens a space of opportunity for new entrants to develop a nascent technology. Technology acquisitions also provide opportunities for entrepreneurs to exploit nascent innovations. Entrepreneurs identify such opportunities through the discovery and creation of knowledge, technology and ideas (Alvarez and Barney, 2007). Without identification of opportunities, entrepreneurship is “fruitless” (Dean and Meyer, 1996, p. 110). While opportunity recognition may be subjective, an entrepreneur identifies the opportunity and its potential value (Shane and Venkataraman, 2000) or creates an opportunity and exploits it. Thus, opportunities must be recognized not only as viable for market business but also as attractive. Firms benefit from using their internal and external sources in pursuit of competitive advantage by engaging in entrepreneurial activities (Zahra, 2008). Thus:

Hypothesis 8. Technology acquisition is positively related to corporate entrepreneurship.

Technology integration is currently a necessity (Lyytinen and Fomin, 2002), as it enables design and development of architecture, which enables technology innovation and corporate entrepreneurship (Antoncic and Hisrich, 2001; Zhao et al., 2010). Technology integration creates organizational areas that entrepreneurs may develop to achieve both technological and social challenges (Lyytinen and Fomin, 2002). Technology integration has been widely studied in the field of education and widely shown to be central in preparing young people for

the knowledge society, where competent use of technologies to acquire and process information is very important (Drent and Meelissen, 2008).

In fact, lack of technological competence is often cited as an obstacle to entrepreneurial behaviour (Martin-Rojas et al., 2013). Technology integration in education enables students to use innovative technology (Drent and Meelissen, 2008; Herrera and Nieto, 2015) that requires greater coordination and encourages entrepreneurship in competitive markets by connecting education and/or previously accumulated knowledge and skills (Zikic and Ezzedeen, 2015).

In technology-intensive sectors such as filmmaking, biotechnology or telecommunications, technology integration joined to complementary assets is especially relevant to undertaking corporate entrepreneurship in firms (Gans and Stern, 2003; He et al., 2006). In these markets, entrepreneurial firms rely extensively on the best external technology and knowledge spillovers available from universities or companies, which possess their society's technological “crown jewels” (Teece, 1986). These spillovers enable them to create novel, valuable inventions that can be patented and defended (He et al., 2006), and thus to excel over competitors. That is to say, once technology acquisition has been achieve, technology integration must be developed by the own company.

In analysing nanotechnology firms in the Netherlands, Robinson et al. (2007) reflect that technology infrastructures and technology integration are absolutely essential for becoming an entrepreneurial organization. This relationship is even easier to see in dynamic industries, which have a high degree of technology integration, increasing the opportunities available to new venture formations and corporate entrepreneurship (Antoncic and Hisrich, 2001; De Carolis et al., 2009).

Technology integration takes into account the different technological changes, promoting the existence of an organizational culture and climate that encourage corporate entrepreneurship by rewarding creativity and risk-taking, as well as the capacity to assimilate new processes and procedures (Antoncic and Hisrich, 2001; Drent and Meelissen, 2008; Larsen et al., 1991). Furthermore, firms need technology integration to accommodate innovative patented technology successfully (Akgün et al., 2014) and exploit it commercially, processes that constitute a core element of corporate entrepreneurship (Burger-Helmchen, 2008). Based on the foregoing literature, we propose that:

Hypothesis 9. Technology integration is positively related to corporate entrepreneurship.

Organizations with a well-established technology infrastructure and knowledge (Van de Ven, 1993) have an easier time achieving new entrepreneurial ventures and gain competitive advantage (Antoncic and Hisrich, 2001; Byrd and Turner, 2001; Van de Ven et al., 2007). Technology infrastructure is a key component in obtaining more corporate entrepreneurship (Van de Ven, 1993). Technology-based infrastructure not only shapes the firm's technological competencies but is also effective in incorporating them into the firm's organizational context, making them apparent on all organizational levels and giving meaning both to all learning processes and to corporate entrepreneurship (Byrd and Turner, 2001; Leonard-Barton, 1992; Martin-Rojas et al., 2011).

Many studies confirm this direct relationship between technology infrastructure and corporate entrepreneurship (Burg et al., 2008; Haug and Ness, 1992; Koh, 2006; Van de Ven et al., 2007; Venkataraman, 2004). Burg et al. (2008) support the idea that infrastructure is a good developer of spin-off ventures, which reinforce corporate entrepreneurship by providing venturing skills and new entrepreneurial knowledge. In comparing some regions of the United States, Venkataraman (2004) observes that Silicon Valley is more successful than Central Virginia or Albany in corporate entrepreneurship because of its relative presence of technology infrastructure, among other intangible factors. This research demonstrates that intangible assets of technological infrastructure, such as advanced telecommunications and transportation systems, are a necessary prerequisite for corporate entrepreneurship in technology. A favourable technology infrastructure is certainly important in ensuring the success of corporate entrepreneurship (Venkataraman, 2004).

Technology infrastructure enables development of corporate entrepreneurship to facilitate access to capital and rapid productivity improvements. A firm's technological infrastructure thus enables development of innovation capabilities and encourages corporate entrepreneurship, since it motivates systems that establish a structure for science and innovation (Koh, 2006). Based on this literature, we formulate the following hypothesis:

Hypothesis 10. Technology infrastructure is positively related to corporate entrepreneurship.

2.4 The influence of corporate entrepreneurship on organizational performance

Various studies present evidence for a relationship between corporate entrepreneurship and organizational growth and profitability (Antoncic and Hisrich, 2001; Covin and Slevin, 1991; Kim et al., 2010; Zahra, 2008; Zahra and Covin, 1995). Zahra and Covin (1995) examine the longitudinal impact of corporate entrepreneurship on a financial performance index composed of both growth and profitability indicators, and find a strong positive relationship between corporate entrepreneurship and performance. Similarly, Antoncic and Hisrich (2001) demonstrate that corporate entrepreneurship makes a difference in the company's performance, measured as growth and profitability.

Research by Zahra and Garvis (2000) shows that even international entrepreneurial efforts can enhance the growth and profitability of a company's performance. Consequently, corporate entrepreneurship is a strategic variable in successful organizations (Antoncic and Prodan, 2008; Zahra, 1996), as it influences organizational survival, growth and performance (Antoncic and Hisrich, 2001). Entrepreneurs who identify their firms' positions in the industry's competitive network can strengthen and engage opportunities accurately and neutralize the negative implications of threats and weaknesses, obtaining higher performance. Companies that institute corporate entrepreneurship as a process that spreads throughout the entire organization thus tend to achieve positive results over time in the form of improved internal efficiencies, higher employee morale and major improvements in performance (Antoncic and Prodan, 2008; Martin-Rojas et al., 2011).

Corporate entrepreneurship is also positively related to organizational performance in large firms (Covin and Slevin, 1991; Zahra, 1996; Zahra and Covin, 1995) as well as small and medium-sized firms (Simsek and Heavey, 2011). Antoncic and Hisrich (2001) find a relationship between corporate entrepreneurship and performance for small, medium-sized and large firms from various industries in Slovenia, but not in the USA. Zahra and Garvis (2000) show that entrepreneurship in international corporate US companies is positively associated with the firm's overall intensity as well as its foreign profitability and growth. Finally, for technological organizations, various current studies indicate a positive relationship between corporate entrepreneurship and organizational performance (Audretsch et al., 2008; De Carolis et al., 2009; Martin-Rojas et al., 2011). These studies show that positive economic performance in high-tech or information and communication technology companies depends on entrepreneurship capital and a region's capacity to support entrepreneurs (Audretsch et al., 2008). Alternately, companies may license use of their technology to other companies in the industry to create new business and enhance their revenue and profits (De Carolis et al., 2009). Since technological opportunities in an industry are positively associated with increased corporate entrepreneurship (Zahra, 2008), we can expect a positive relationship between corporate entrepreneurship and performance in terms of profitability and growth, as the following hypothesis proposes:

Hypothesis 11. Corporate entrepreneurship is positively related to organizational performance.

3 METHODOLOGY

3.1 Sample and procedure

The population for this study consisted of Spanish technology organizations. Technology organizations are firms that emphasize orientation toward R&D, innovativeness and entrepreneurship, and maintain a special pattern of work relations (a corporate culture of technology). These elements describe shared values, beliefs and symbols, and the way things are done in the firm (Grinstein and Goldman, 2006). The sample was selected by means of stratified sampling with proportional allocation (size and geographical location) from the Dun & Bradstreet Spain Database. Choosing a sample of firms located in a relatively homogeneous geographical, cultural, legal and political space enables us to minimize the impact of the variables that cannot be controlled in the empirical research. The Spanish market is relatively well developed and wholly integrated in the European Union. However, Spain is in a geographical area that has received relatively little attention from organizational researchers in the field of technological competencies.

Drawing on our knowledge of key dimensions of this investigation, previous contacts with interested managers and scholars, and new interviews with managers and academics interested in these strategic variables (the questionnaire was pre-tested through personal interviews with CEOs, and the interviewers specifically asked the CEOs to consider ambiguities, interesting issues, inapplicable questions, etc.), we developed a structured questionnaire to investigate how organizations face these issues. CEOs were our main informants, since they manage a great deal of information in all departments in the company and evaluate and mould the different variables under study throughout the organization by determining the types of behaviour that are expected and supported (Baer and Frese, 2003).

Surveys were mailed to the 1000 selected organizations along with a cover letter. We used this method because it enabled us to reach a greater number of organizations at lower cost, to exert less pressure for immediate reply, and to provide the interviewees with a greater sense of autonomy. The cover letter explained the goal of the study and offered recipients the option of receiving the results once the study was completed. It also explained that all responses obtained in the questionnaires would be used on an aggregate level to prevent identification of any organization in order to reduce desirability bias.

We mailed each manager who had not yet responded two reminders. 226 valid questionnaires were returned, but because of missing values only 201 questionnaires were included in the research. The response rate was 20.1% (Table 1) without significant difference between early and late respondents. Characteristics of the responding businesses were compared to those of the non-responding businesses to reduce the possibility of non-response bias. The results for return on assets, return on equity, return on sales and number of employees indicated that there was no significant difference among respondents and non-respondents. Nor did we find significant differences due to geographical location or size in the variables studied in the different tests, such as the chi-square and t-tests. We tested the possible effects of common method variance for the variables using Harman's one factor test. If common method variance is a serious problem, we expect a single factor to emerge from a factor analysis or one general factor to account for most of the covariance in the independent and dependent variables (Podsakoff and Organ, 1986). All items used, a total of 30, were factor-analysed using principal axis factoring, where the unrotated factor solution was examined, as recommended by Podsakoff et al. (2003). Kaiser's criterion for retention of factors was followed. The sample size seems to be large enough for factor analysis according to the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO=0.919). Factor-analytic results indicate the existence of six factors with eigenvalues>1.0. The six factors explained 74.14% of the variance. Since several factors, as opposed to one single factor, were identified and since the first factor did not account for the majority of the variance, a substantial amount of common method variance does not appear to be present (Friedrich et al., 2009; Podsakoff et al., 2003). We thus conclude that common method variance bias is not a threat to validity of the results.

Table 1. Technical details of the research

Sectors	High-tech firms
Geographical location	Spain
Methodology	Structured questionnaire
Universe of population	50,000 firms
Sample size (response size)	1000 firms (201 firms, 20.1%)
Sample error	6.9%
Confidence level	95 %, *p-q*=0.50; *Z*=1.96

3.2 Measures

3.2.1. Top management support

Using scales established by Byrd and Davidson (2003) and Ray et al. (2005), we drew up a four-item scale (Appendix) to reflect TMS. We performed confirmatory factor analysis to validate our scales (χ^2_2=3.68; Normed Fit Index, NFI=0.99; Non-Normed Fit Index, NNFI=0.99; Goodness of Fit Index, GFI=0.99; Comparative Fit Index, CFI=0.99). The scale was one-dimensional and showed high reliability (α=0.926).

3.2.2. Technology skills

We used the scales designed by Byrd and Davidson (2003) and established a scale of four items (Appendix) to reflect technology skills. Using a confirmatory factor analysis, we validated our scales and then verified each scale's one-dimensionality and high validity and reliability (α=0.817).

3.2.3. Technology acquisition

We used four-item scale developed by Jones et al. (2001) to measure technology acquisition (Appendix). These items have been duly adapted to the present study. We performed a confirmatory factor analysis to validate the scales (χ^2_2=2.68, NFI=0.99, NNFI=0.99, GFI=0.99, CFI=0.99) and showed that the scale was one-dimensional and had adequate validity and reliability (α=0.909).

3.2.4. Technology integration

We used the four-item scale developed by Ross et al. (1996) to measure technology integration (Appendix). These items have been duly adapted to the present study. We performed confirmatory factor analysis to validate the scales (χ^2_5=4.32, NFI=0.99, NNFI=0.99, GFI=0.99, CFI=0.99) and showed that the scale was one-dimensional and had adequate validity and reliability (α=0.930).

3.2.5. Technology infrastructure

Using scales established by Ravichandran and Lertwongsatein (2005), we drew up a five-item scale (Appendix) to reflect technology infrastructure. We performed a confirmatory factor analysis to validate our scales (χ^2_5=9.84; nfi=0.98; nnfi=0.98; gfi=0.99; cfi=0.99). The scale was one-dimensional and showed high reliability (α=0.908). A seven-point likert scale (1 'totally disagree', 7 'totally agree') for this and all prior variables allowed managers to express agreement or disagreement.

3.2.6. Corporate entrepreneurship

We used six items developed by Zahra (1993) to measure organizational innovation, five items developed by Zahra (1993) to measure new business venturing, five items developed by Knight (1997) to measure proactiveness, and eight items developed by Zahra (1993) to measure self-renewal. These items have been duly adapted to the present study (Appendix). A seven-point Likert scale (1 'totally disagree', 7 'totally agree') for these variables allowed managers to express agreement or disagreement. We calculated the arithmetical mean of these items (a high score indicates a good level of each entrepreneur's variable) and obtained a four-item scale of corporate entrepreneurship. We developed a confirmatory factor analysis to validate this scale (χ^2_2=10.03, NFI=0.98, NNFI=0.96, GFI=0.99, CFI=0.99) and showed that the scale was one-dimensional and had adequate validity and reliability (α=0.867).

3.2.7. Organizational performance

We used the five-item scale developed by Murray and Kotabe (1999). Many researchers use managers' subjective perceptions to measure beneficial outcomes for firms. Others prefer objective data, such as return on assets. The literature has widely established a high correlation and concurrent validity between objective and subjective data on performance, which implies that both are valid when calculating a firm's performance (Homburg et al., 1999). We included both types of questions, but the CEOs were more open to offering their general views than precise quantitative data. When possible, we calculated the correlation between objective and subjective data, and these were high and significant. We developed a confirmatory factor analysis to validate the scales (χ^2_5=10.43, NFI=0.99, NNFI=0.99, GFI=0.99, CFI=0.997) and showed that the scale was one-dimensional and had high reliability (α=0.899). We used a seven-point Likert-type scale (1 “Much worse than my competitors,” 7 “Much better than my competitors”) to ask about the organization's performance as compared to that of its most direct competitors.

3.3. Model and analysis

Data were analysed through a structural equation model (LISREL 8.80 program) to determine the existence of the exogenous latent variable (TMS [ξ1]), first-grade endogenous latent variable (technology skills [η1]) and second-grade endogenous latent variables (technology acquisition [η2], technology integration [η3], technology infrastructure [η4], corporate entrepreneurship [η5] and organizational performance [η6]) and to establish the causal relationships among these variables. This process allowed us to translate the theoretical constructs into mathematical models to be estimated and evaluated empirically (Jöreskog and Sörbom, 1996). The hypotheses of a recursive non-saturated model are plotted in the theoretical model presented in Fig. 1.

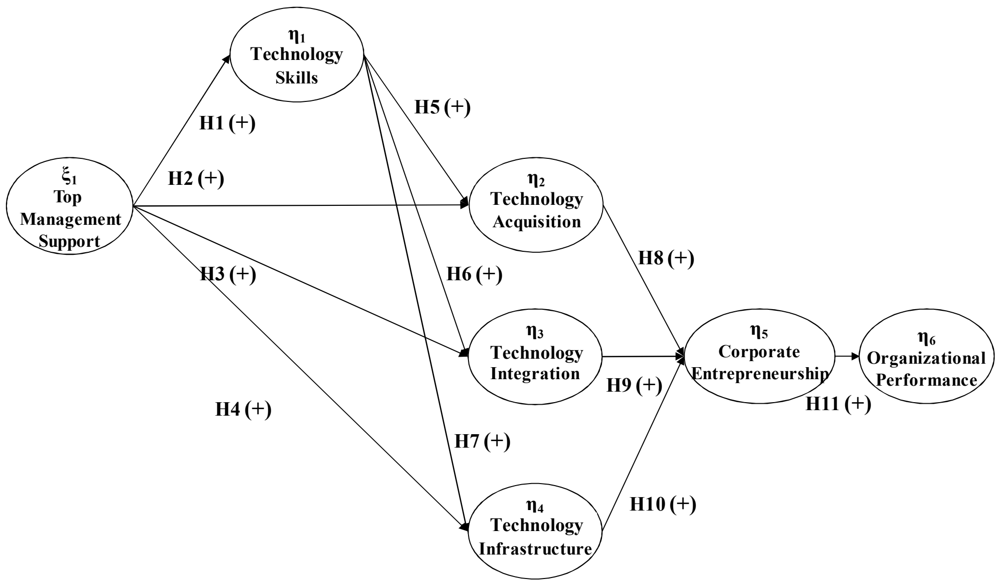

Figure 1. Hypothesized Model

4 RESULTS

This section presents the research results. First, Table 2 shows the means and standard deviations, as well as the inter-factor correlation matrix for the study variables. There are significant and positive correlations among TMS, technology skills, technology acquisition, technology integration, technology infrastructure, corporate entrepreneurship and organizational performance. Consistent with the two-step approach advocated by Anderson and Gerbing (1988), we estimated a measurement model before examining structural model relationships.

Table 2. Means, standard deviations and correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7
1. TMS	4.706	1.438	1.000						
2. Technology Skills	4.880	1.271	0.445***	1.000					
3. Technology Acquisition	4.078	1.679	0.606***	0.469***	1.000				
4. Technology Integration	4.909	1.450	0.679***	0.558***	0.487***	1.000			
5. Technology Infrastructure	5.305	1.307	0.460***	0.469***	0.404***	0.526***	1.000		
6. Corporate Entrepreneurship	4.358	1.161	0.630***	0.466***	0.593***	0.542***	0.440***	1.000	
4. Organizational Performance	5.530	1.051	0.380***	0.300***	0.410***	0.315***	0.387***	0.465***	1.000

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$ n = 201

Table 3 shows that all indexes show very good fit with the model. The constructs display satisfactory levels of reliability, indicated by composite reliabilities ranging from 0.85 to 0.93 and average variance extracted coefficients from 0.62 to 0.76. Convergent validity can be assessed by examining the significance of the factor loadings and the average variance extracted (> 0.50). All multi-item constructs meet this criterion, with loading (λ) significantly related to its underlying factor (t-values > 2.45) in support of convergent validity. Discriminant validity was established between each pair of latent variables by constraining the estimated correlation parameter between them to 1.0 and performing a chi-square difference test on the values obtained for the constrained and unconstrained models. The resulting significant differences in chi-square indicate that the constructs do not correlate perfectly and that discriminate validity is achieved among all constructs (Anderson and Gerbing, 1988).

Table 3. Measurement model results

Variables	Items	λ*	R^2	C.R.	AVE	Goodness of Fit Statistics
Top Management Support for technology (TMS)	TMS1	0.86***(4.10)	0.74	0.929	0.765	χ^2_{384}=515.14 (*P*>0.01) ECVI=3.39 AIC=677.14 CAIC=1025.71 NFI=0.97 NNFI=0.99 IFI=0.99 PGFI=0.61 PNFI=0.86 NCP=131.14 RFI=0.97 CFI=0.99 RMSEA=0.04
	TMS2	0.86***(5.30)	0.75			
	TMS3	0.89***(4.26)	0.79			
	TMS4	0.89***(4.57)	0.79			
Technology Skills (TS)	TSKILL1	0.77***(3.46)	0.59	0.851	0.657	
	TSKILL2	0.86***(3.87)	0.74			
	TSKILL3	0.80***(3.41)	0.63			
Technology Acquisition (TA)	TACQU1	0.89***(6.99)	0.79	0.915	0.731	
	TACQU2	0.82***(6.37)	0.67			
	TACQU3	0.85***(6.59)	0.72			
	TACQU4	0.86***(8.06)	0.75			
Technology Integration (TINT)	TINTEG1	0.87***(4.41)	0.75	0.933	0.737	
	TINTEG2	0.82***(4.03)	0.68			
	TINTEG3	0.80***(5.05)	0.64			
	TINTEG4	0.90***(4.87)	0.81			
	TINTEG5	0.90***(4.56)	0.81			
Technology Infrastructure (TINF)	TINFRA1	0.87***(3.77)	0.75	0.920	0.700	
	TINFRA2	0.82***(4.04)	0.68			
	TINFRA3	0.91***(3.76)	0.83			
	TINFRA4	0.86***(3.42)	0.74			
	TINFRA5	0.71**(2.69)	0.51			
Corporate Entrepreneurship (CE)	ENTR1	0.87***(8.17)	0.75	0.866	0.620	
	ENTR2	0.73***(4.69)	0.54			
	ENTR3	0.71***(5.64)	0.50			
	ENTR4	0.83***(5.12)	0.69			
Organizational Performance (OP)	PERF1	0.85***(3.57)	0.73	0.919	0.697	
	PERF2	0.93***(5.02)	0.87			
	PERF3	0.88***(4.32)	0.78			
	PERF4	0.77*(2.55)	0.59			
	PERF5	0.73*(2.45)	0.53			

Notes: λ* = Standardized Structural Coefficient (t-students are shown in parentheses); R^2=Reliability; C.R.= Composite Reliability; AVE=Average Variance Extracted; *** $p < 0.001$ (two-tailed).

Table 4 presents the results for the structural model in Fig. 2. The relative importance of the variables is reflected by the magnitude of the coefficients. Structural equation modelling was performed to estimate direct and indirect effects using Lisrel with the covariance matrix and asymptotic covariance matrix as input. The overall fit of the structural model is good, and the fully standardized path estimates indicate significant relationships among the constructs.

If we examine the standardized parameter estimates, we see that TMS directly affects technology skills (γ11=0.53, $p < .05$), technology acquisition (γ21=0.52, $p < .001$), technology integration (γ31=0.56, $p < .001$) and technology infrastructure (γ41=0.31, $p < .05$). Further, TMS has an indirect effect on technology acquisition (0.15, $p < .05$), technology integration (0.19, $p < .10$) and technology infrastructure (0.24, $p < .10$), due to technology skills (.53×.29 for technology acquisition; .53×.36 for technology integration; .53×.45 for technology infrastructure; see Bollen, 1989 for calculation rules). The global influence of TMS on technology skills (0.53, $p < .05$), technology acquisition (0.67, $p < .001$), technology integration (0.75, $p < .001$) and technology infrastructure (0.55, $p < .05$) supports Hypotheses 1, 2, 3 and 4, respectively. Technology skills affect technology acquisition (β221=0.29, $p < .05$), technology integration (β31=0.36, $p < .01$) and technology infrastructure (β41=0.45, p <

.01), supporting Hypotheses 5, 6 and 7, respectively. Comparing the magnitudes of these effects indicates that the total effect of TMS on technology acquisition, technology integration and technology infrastructure is larger than the effect of technology skills on each of these variables (technology acquisition, technology integration and technology infrastructure).

Likewise, the total effect of TMS on technology integration is larger than the effect of TMS on technology acquisition or technology infrastructure. On the other hand, the effect of technology skills on technology infrastructure is larger than the effect of technology skills on technology acquisition or technology integration. Globally, technology skills ($R2=0.28$), technology acquisition ($R2=0.51$), technology integration ($R2=0.66$) and technology infrastructure ($R2=0.44$) are explained well by the model. Corporate entrepreneurship is influenced by technology acquisition ($\beta52=0.50$, $p < .001$), technology integration ($\beta53=0.19$, $p < .05$) and technology infrastructure ($\beta54=0.23$, $p < .05$), supporting Hypothesis 8, 9 and 10, respectively. Comparing the magnitudes of these effects indicates that the effect of technology acquisition on corporate entrepreneurship is larger than the effect of technology integration or technology infrastructure on corporate entrepreneurship. Globally, corporate entrepreneurship is explained well by the model ($R2=0.61$). Corporate entrepreneurship affects organizational performance ($\beta65=0.51$, $p < .05$), supporting Hypothesis 11. Globally, organizational performance is also explained well by the model ($R2=0.26$). In addition to these effects, we have demonstrated other indirect effects (Table 4).

Finally, evaluation of the model was completed by comparing the proposed model to a series of competing models acting as alternative explanations for the proposed model. The acceptability of the proposed model can thus be determined by establishing whether better fit can be achieved with any other similarly formulated model (Anderson and Gerbing, 1988; Friedrich et al., 2009; Hair et al., 2010). We propose different models (Table 5) and compare quality of fit measures for the different models. The results show that the proposed model obtains better fit indices for the various fit measures (of absolute, incremental and parsimonious fit). For example, if we compare the proposed model (Model 1) to a model that does not consider the relationship between TMS and technology integration (Model 3), we can see that the latter has a worse Root Mean Square Error of Approximation (> RMSEA=0.006), Expected Cross-Validation Index (> ECVI=0.15), Akaike Information Criterion (> AIC=30.63) and Estimated Non-Centrality Parameter (> NCP=31.63). The results thus show that TMS affects technology integration and that Model 1 was preferred to Model 5 ($\Delta\chi2=32.63$, $\Delta df=1$). The proposed model is accepted in the light of these results, which strengthen both the empirical and theoretical basis of this investigation.

Table 4. Structural model results (direct, indirect and total effects)

Effect from		To	Direct Effects	*t*	Indirect Effects	*t*	Total Effects	*t*
TMS	→	Technology Skills	0.53*	2.39			0.53*	2.39
TMS	→	Technology Acquisition	0.52***	5.26	0.15*	2.05	0.67***	5.27
TMS	→	Technology Integration	0.56***	4.17	0.19†	1.89	0.75***	4.65
TMS	→	Technology Infrastructure	0.31*	2.21	0.24†	1.67	0.55*	2.55
TMS	→	Corporate Entrepreneurship			0.61***	5.31	0.61***	5.31
TMS	→	Organizational Performance			0.31†	1.80	0.31†	1.80
Technology Skills	→	Technology Acquisition	0.29*	2.13			0.29*	2.13
Technology Skills	→	Technology Integration	0.36**	2.69			0.36**	2.69
Technology Skills	→	Technology Infrastructure	0.45**	2.87			0.45**	2.87
Technology Skills	→	Corporate Entrepreneurship			0.32**	3.23	0.32**	3.23
Technology Skills	→	Organizational Performance			0.16†	1.84	0.16†	1.84
Technology Acquisition	→	Corporate Entrepreneurship	0.50***	4.86			0.50***	4.86
Technology Acquisition	→	Organizational Performance			0.26*	2.11	0.26*	2.11
Technology Integration	→	Corporate Entrepreneurship	0.19*	2.02			0.19*	2.02
Technology Integration	→	Organizational Performance			0.10	1.52	0.10	1.52
Technology Infrastructure	→	Corporate Entrepreneurship	0.23*	2.00			0.23*	2.00
Technology Infrastructure	→	Organizational Performance			0.12	1.44	0.12	1.44
Corporate Entrepreneurship	→	Organizational Performance	0.51*	2.01			0.51*	2.01
Goodness of Fit Statistics		χ^2_{394}=513.82 (*P*=0.01) ECVI=3.28 AIC=655.82 CAIC=961.35 NFI=0.97 NNFI=0.99 IFI=0.99 PGFI=0.62 PNFI=0.88 NCP=119.82 RFI=0.97 CFI=0.99 RMSEA=0.03						

Notes: Standardized Structural Coefficients; †$p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

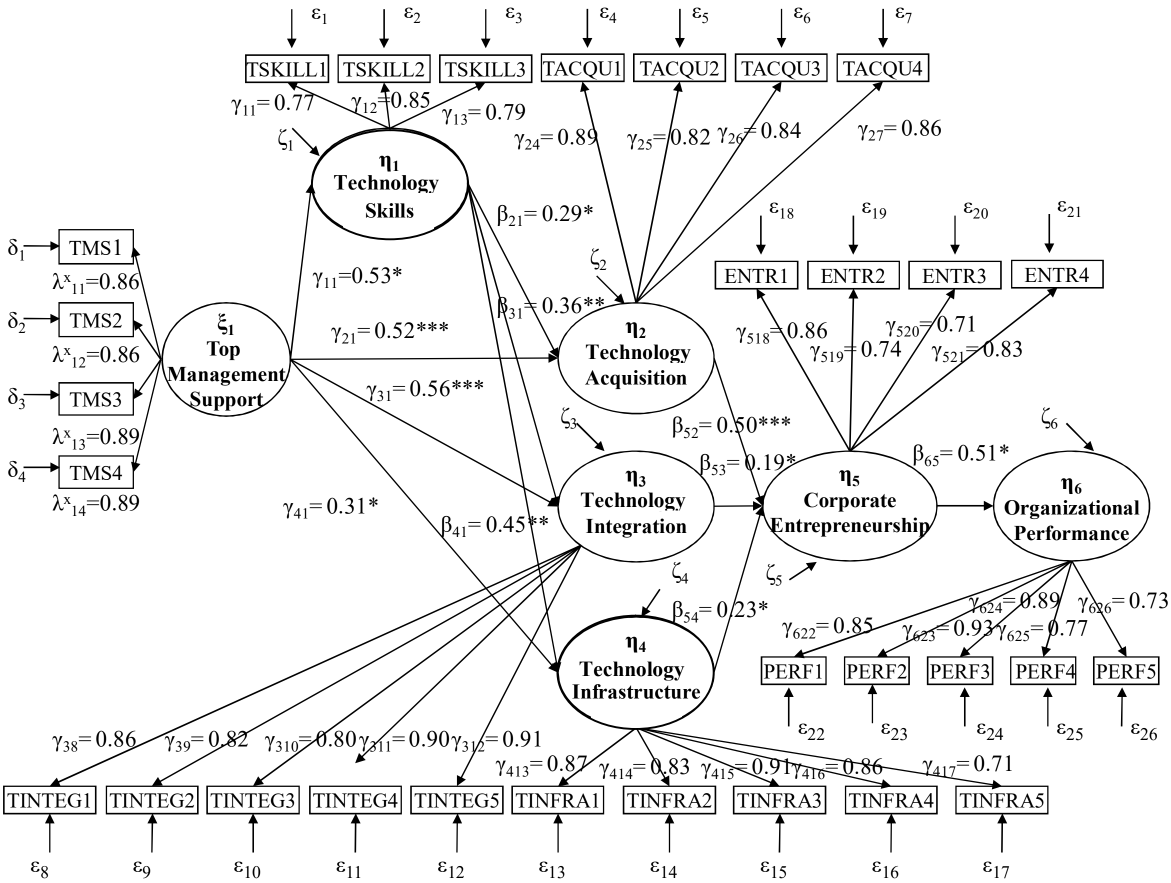

Figure 2. Results of Structural Equation Model.

Table 5. Model statistics against theoretical model

Model	Description	χ^2	$\Delta \chi^2$	RMSEA	NFI	NNFI	ECVI	AIC	NCP
1	Theoretical	513.82		0.038	0.97	0.99	3.28	655.82	119.82
2	W.R. TMS to Technology Acquisition	535.15	21.33	0.042	0.97	0.99	3.38	675.15	140.15
3	W.R. TMS to Technology Integration	546.45	32.63	0.044	0.97	0.99	3.43	686.45	151.45
4	W.R. Technology Skills to Technology Acquisition	518.01	4.19	0.039	0.97	0.99	3.29	658.01	123.01
5	W.R. Technology Acquisition to CE	530.22	16.4	0.041	0.97	0.99	3.35	670.22	135.22
6	W.R. Technology Integration to CE	519.80	5.98	0.040	0.97	0.99	3.30	659.80	124.80
7	W.R. CE to Organizational Performance	524.80	10.98	0.041	0.97	0.99	3.33	666.80	130.80

Notes: W.R. = Without Relationship; n = 201.

5 CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

5.1 Conclusions

Technology companies compete intensely to achieve a competitive advantage that differentiates them from each other and to obtain a good position or higher performance (Byrd and Turner, 2001; Ross et al., 1996). The results of this research underscore that exploiting the advantage of TMS will impact their firm's access to the technologically skilled research personnel and knowledge streams from which the firm will develop its specific dynamic capabilities (Leonard-Barton, 1987, 1992).

Firms' top managers invest in R&D not only directly to pursue new process and product innovation, but also to increase imported technology and accomplish trajectory shifts (Cohen and Levinthal, 1989). Top managers may promote corporate entrepreneurship through external technology acquisition, because they try to grow beyond the limits set by the resources they currently control, in order to acquire more technology investment in their firm. Organizations with TMS for technology promote technology acquisition and diffusion of ideas, solutions and know-how throughout innovation systems (Doloreux and Melançon, 2009). In addition to acquiring technology from external sources, top managers support technology integration as a strategy to develop personnel and enhance experiential learning (Capuano et al., 2008). Such a strategy enables the firm to combine the various systems for integrated business operations that are difficult to change and renew (Kamal et al., 2015). Finally, TMS supports the technology infrastructure that the established rules of precedence to establish the order and hierarchy of business processes (Agostinho, 2015), enables competitive technological advantage and supports the design, development and implementation of entrepreneurial business applications (Byrd and Turner, 2001).

This study also finds that TMS enhances new technology skills and capabilities by reducing rigidity among a firm's senior managers to promote corporate entrepreneurship activities and encourage revitalizing performance for the company (Zahra et al., 2009) through technology acquisition, integration and infrastructure processes, which are essential to making the firm a technology-focused entrepreneurial organization.

Employees who possess a variety of technology background experiences and understanding help to facilitate better and faster acquisition of technology via improved technical skills training (Bustamante, 2004; Herrera and Nieto, 2015; Jones et al., 2001). Various studies also confirm that integration of technologies requires specific technology skills, such as reception and installation of technology, exhibition and maintenance (Ahsan and Malik, 2015; Ancarani et al., 2016; Kamal et al., 2015). Finally, these technology skills also impact the foundation of a technology infrastructure that renders other plans viable and stable (strategic or financial), and that consequently ensures the solidity of the organizational framework (Agostinho, 2015; Olsson and Espling, 2004).

All of these technological issues enhance creation and strengthening of corporate entrepreneurship because they can improve intelligent access to specific local cultural information to attract potential entrepreneurs (Bordoni, 2011). These entrepreneurs compete and cooperate among themselves to exploit technology acquisition, integration and infrastructure (Van de Ven et al., 2007). Finally, corporate entrepreneurship engages opportunities and neutralizes the negative implications of threats and weaknesses, thus obtaining higher performance (Antoncic and Prodan, 2008; Martin-Rojas et al., 2011; Simsek and Heavey, 2011). Moreover, with the knowledge acquired and the organizational innovation developed in the company with technology, entrepreneurs should be able to engage in more entrepreneurial activities and obtain higher levels of growth and profitability than organizations that do not (Antoncic and Hisrich, 2001; Martin-Rojas et al., 2011, 2013), thereby obtaining improved internal efficiencies and major improvements in performance (Antoncic and Prodan, 2008). This issue is especially relevant in high-tech industries (Robinson et al., 2007), where talented individuals look into rosy opportunities that ordinary people would otherwise be unable to find (Woolley, 2010). To sum up, technological and entrepreneurial behaviour in firms is especially significant to undertaking activities and predicting and ensuring sustainable growth in the firm (Akgün et al., 2014; Herrera and Nieto, 2015; Kim et al., 2010; Koh, 2006).

To sum up, all the evidence suggests that the combined process of exploiting technological skills from employees in the firm thanks to the financial and strategic support from managers, let strengthen step by step second order technological assets -acquire new technology, integrate successfully it and finally develop a complex and sustainable infrastructure within the company-. Then, they will allow to undertake an entrepreneurial spirit throughout the company so as to improve organizational performance.

5.2 Limitations and future research

This study has several limitations that should be considered. Firstly, survey data based on self-reports may be subject to social desirability bias (Podsakoff and Organ, 1986). However, assurance of anonymity can reduce such bias even when responses relate to sensitive topics (Konrad and Linnehan, 1995). The low risk of social desirability bias in this study was indicated by several managers who commented that it made no sense at all for their companies to go beyond regulatory compliance. Still, the responses are subject to interpretation by individual managers.

Second, although Harman's one-factor test and other method tests did not identify common method variance as a problem, it still might have been (Konrad and Linnehan, 1995; Podsakoff and Organ, 1986). Although Spector (2006) has argued that it is incorrect to assume that the use of a single method automatically introduces systematic bias, we recommend that future research gather measures of independent and dependent variables from different data sources to minimize the effects of any response bias (Podsakoff et al., 2003). Third, our data are cross-sectional, making it difficult to examine the evolution of the different variables in our study. This aspect is of particular interest when considering the dynamic nature of some of our variables. Although we tested the most plausible directions for the pathways in our model, longitudinal research is needed to assess the direction of causality in each relationship and to detect possible reciprocal processes. We have tried to temper this limitation through attention to theoretical arguments by rationalizing the relationships analysed and integrating temporal considerations into measurement of the variables (Hair et al., 2010).

Fourth, future studies should be based on a larger sample, preferably in more than one country and in other sectors. As this study focuses only on Spanish firms, an empirical research paper could study the same relationship in Europe in order to generalize the results throughout the European economy, and subsequently throughout the world. Finally, hypotheses indicate relationships of some technological assets and corporate entrepreneurship to organizational performance. Other technological assets could be analysed, such as technology organizational slack or technology distinctive competencies (Danneels, 2012; Martin-Rojas et al., 2011; Real et al., 2006; Simsek and Heavey, 2011).

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APPENDIX

❖ Top Management Support for technology

Indicate the degree to which you agree or disagree with the following statements about top management support for technology.

1. Top management cultivates technology project champions.
2. Top management ensures adequate funding of technology research and development.
3. Top management restructures work processes to leverage technology opportunities in the organization.
4. Top management facilitates technology transfer throughout the organization.

❖ Technology Skills

Indicate the degree to which you agree or disagree with the following statements about technology skills. The skills of the people in the department/unit for technology:

1. Are highly superior to our closest competitors in hardware and operating systems performance.

2. Are highly superior to our closest competitors in communications services efficiency.

3. Are highly superior to our closest competitors in the generation of programming languages.

- **Technology Acquisition**

1. My business unit develops the product technology it requires through its own research (RC).

2. My business unit spends more on developing its own product technology than
on purchasing it from other companies (RC).

3. My business unit's products are based primarily on product technology we developed (RC).

4. A large number of new product/process ideas have been made possible through process technology breakthroughs in our industry (RC).

- **Technology Integration**

1. Do information technology and business executives share a vision for how information technology will support the business?

2. Do information technology and business managers have overlapping, frequently used, formal and informal channels of communication at many levels of the firm?

3. Do information technology and business managers consult with each other regularly on business and technical decisions?

4. Do information technology and business managers have a mutual understanding of each other's responsibilities for planning, developing and supporting systems?

5. Do information technology and business partners negotiate priorities for cycle time, cost and flexibility?

- **Technology Infrastructure**

Indicate the degree to which you agree or disagree with the following statements about technology infrastructure:

1. The organization has the technology infrastructure needed to link our business units electronically.

2. The organization has the technology infrastructure needed to link our firm electronically to external business partners (i.e., key customers, suppliers, alliances).

3. The organization has the technology infrastructure needed for current business operations.

4. The capacity of our network infrastructure meets our current business needs.

5. Corporate data are currently shareable across business units and organizational boundaries.

❖ Corporate Entrepreneurship

1. Organizational innovation

The organization has significantly increased:

1.1. The emphasis on developing new products/services.

1.2. The rate of introducing new products/services into the market.

1.3. The spending on new product/service development activities.

1.4. The number of products/services added by the organization and already existing in the market.

1.5. The number of new products/services that the organization has introduced in the market for first time.

1.6. Percentage of revenue generated from new businesses/services that did not exist three years ago.

2. New business venturing

2.1. The organization has stimulated new demands on the existing products/services in currents markets through aggressive advertising and marketing.

2.2. The organization has broadened the business lines in current industries.

2.3. The organization has pursued new businesses in new industries related to current business.

2.4. The organization has found new niches for its products/services in current markets.

2.5. The organization has entered new businesses by offering new lines and products/services.

3. Proactiveness

3.1. In dealing with competitors, the organization is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc.

3.2. In dealing with competitors, our organization typically adopts a very competitive, undo-the-competitors posture.

3.3. In general, the top managers at our firm have a strong inclination toward high-risk projects (with chances of very high returns).

3.4. In general, the top managers at our firm believe that, owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives.

3.5. When confronted with decision-making situations involving uncertainty, our organization typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities.

4. Self-renewal

4.1. The organization has revised the business concept.

4.2. The organization has redefined the industries in which the company will compete.

4.3. The organization has reorganized units and divisions to increase organizational innovation.

4.4. The organization has coordinated activities among units to enhance organizational innovation.

4.5. The organization has increased the autonomy (independence) of different units to enhance their innovation.

4.6. The organization has adopted flexible organizational structures to increase innovation.

4.7. The organization has rewarded employees for creativity and innovation.

4.8. The organization has trained and encouraged employees to be creative and innovative.

- **Organizational Performance**

Relative to your main competitors, what is your firm's performance in the following areas?

1. Organizational performance measured by return on assets (ROA).
2. Organizational performance measured by return on equity (ROE).
3. Organizational performance measured by return on sales.
4. Organization's market share in its main products and markets.
5. Growth of sales in its main products and markets.