“Social media technologies: a waste of time or a good way to learn and improve technological competences?”

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Abstract

Purpose – *The purpose of this study is to deepen understanding of the effects of using social media technologies to acquire technological knowledge and organizational learning competences, of technological knowledge competences on organizational learning and finally of organizational learning on organizational performance.*

Design/methodology/approach – *The study was performed by analyzing data from a sample of 197 technology firms located in Spain. The hypotheses were tested using a structural equations model with the program LISREL 8.80.*

Findings – *This study’s conceptual framework is grounded in complexity theory – along with dynamic capabilities theory, which complements the resource-based view. The study contributes to the literature by proposing a model that reflects empirically how business ecosystems that use social media technologies enable the development of interorganizational and social collaboration networks that encourage learning and development of technological knowledge competences.*

Research limitations/implications – *It would be interesting for future studies to consider other elements to conceptualize and measure social media technologies, including (among others) significance of the various tools used and strategic integration. The model might also analyze other sectors and another combination of variables.*

Practical implications – *The results of this study have several managerial implications: developing social media technologies and interorganizational social collaboration networks not only enables the organizational learning process but also encourages technological knowledge competences. Through innovation processes, use of social media technologies also contributes to strengthening companies’ strategic positioning, which ultimately helps to improve firms’ organizational performance.*

Social implications – *Since social media technologies drive information systems in contemporary society (because they enable interaction with numerous agents), the authors highlight the use of complexity theory to develop a conceptual framework.*

Originality/value – *The study also deepens understanding of the connections by which new experiential learning contributes to the generation of coevolutionary adaptive business ecosystems and digital strategies that enable development of interorganizational and social collaborative networks through technological knowledge competences. Only after examining the impact of social media technologies on organizational performance in prior literature, did the authors underscore that both quantity and frequency of social media technology use are positively related to improvement in knowledge processes that lead to employees’ creation and acquisition of new metaknowledge.*

Keywords *Social media technologies, Organizational learning, Technological knowledge competences, Organizational performance*

Paper type *Research paper*

1. Introduction

When *Social Media Technologies* (hereafter, SMTs) were still an incipient phenomenon, a pioneering study of technology and learning in companies observed that organizations were beginning to connect in formerly unexpected ways. They were suddenly able to share information they had never been able to share before; the study argued that "we are drowning in information, but we are starving for knowledge" (Carayannis, 1998, p. 698). Today, we can affirm this observation: the increase in technology has changed the way we communicate, interact and conduct commercial transactions. Much more important, however, is the way our abilities are developing (Jennings and Wargnier, 2010). Technologies provide us with vast amounts of information and knowledge resources that can enable us to learn better and more quickly, but they also bring the risk of "cognitive overload that exhausts limited resources such as intellectual bandwidth and time available" (Carayannis, 1998, p. 698). We must develop agile minds that select precise information properly to act since knowledge is a strategic resource that enables organizations to acquire competitive advantage (Barney, 1991; Hitt *et al.*, 2000).

Eric Kandel – who received the Nobel Prize in Medicine for his study of synaptic plasticity, and learning and memory processes – defines learning as "the ability to acquire new ideas from experience and retain them over time as memories" (Kandel, 2001, p. 1030). In the case of companies, learning must currently focus more on technology, action and production while adopting models inspired by "experiential learning" (Jennings and Wargnier, 2010). Such learning is based on virtual learning environments and facilitates the acquisition of capabilities since it not only obtains information but motivates action. According to these authors, the experiential learning process:

> Combines four basic elements: the experiences we have, the opportunity to practice and integrate these experiences into our long-term memory, the conversations and interaction we have with others, and reflection (Jennings and Wargnier, 2010, p.14).

This way of acquiring knowledge – by developing the capabilities to search, interpret and communicate, as well as to transform knowledge into action – is what defines key differences and greater effectiveness (Aral *et al.*, 2013; Senadheera *et al.*, 2016) due to use of new technologies, especially social media.

"Social media are not about websites. They are about experiences" (Hanna *et al.*, 2011, p. 268); they share the possibility of "connecting users in ways that shorten distance, time, and other traditional barriers" (García-Morales *et al.*, 2018, p. 346). This change is a clear transformation of the impact of technology on businesses, both inside and outside the boundaries of the firm (Aral *et al.*, 2013). This process of rapid change in business due to digitalization creates new opportunities while also destroying existing commercial models that have been successful for a long time. Such a situation constitutes both a threat and an opportunity for firms by creating a future more connected to the possibilities that digital ecosystems provide (De Reuver *et al.*, 2018; Weill and Woerner, 2015). SMTs thus become very valuable tools for increasing knowledge-related competences, as they enable information exchange and interaction among users, decoupling learning from the mere imparting or exchange of content and linking experience to what is discussed or shared through technological applications. The disruptive crossings that occur in digital environments shift the axis around which firms' competitive advantage revolves, from control of the value chain to attraction of generative activities associated with digital platforms or ecosystems. In this shift, dynamic capabilities are important not only to create value – as research on capabilities proposes – but also to capture value (Helfat and Raubitschek, 2018). These platforms work as mediating transactions between groups of actors (De Reuver *et al.*, 2018; Teece, 2018).

The scholarly literature on knowledge and knowledge management increased considerably in 2009 and was a trending topic by 2012, achieving the highest citation rates ever seen (Akhavan *et al.*, 2016). Some authors, such as Michaelidou *et al.* (2011), propose that SMTs research, in general, is in the embryonic stages since little is known about the dynamic capabilities in digital ecosystems (Helfat and Raubitschek, 2018). Although we can draw on notions and concepts from the prior literature, new research challenges are opening research paths on the use of digital platforms and ecosystems, requiring us to consider the specific characteristics of digitalization – among others, the potentially disruptive nature of digital platforms, which increases the complexity of research (digital infrastructures are ever larger) and the need for better understanding of ecosystems and platforms (De Reuver *et al.*, 2018; Weill and Woerner, 2015).

Moreover, since the pandemic, disruption managers have drawn more attention to SMTs and intensified their use to connect with more agents and capture business-oriented knowledge (Yu *et al.*, 2021). These tools are also fostering the development of entrepreneurial processes within firms, as they promote collaboration, business networking, cocreation and business innovation (Olanrewaju *et al.*, 2020). Such development must lead us to tackle research not from the perspective of the nondigital world – as previously done – but from how best to operate firms in these ecosystems based on a view of the digital world. The strategic and operations management literature currently focuses on the connection between information captures through social media use and organizational management (Bharati *et al.*, 2015; Crammond *et al.*, 2018; Garrido-Moreno *et al.*, 2015; Gomezelj Omerzel *et al.*, 2011; Vuori and Okkonen, 2012). Recent studies have demonstrated the positive influence of digital technologies in the economy (Chaudhuri *et al.*, 2022; Kristoffersen *et al.*, 2020; Nandi *et al.*, 2020). Hardly any of these studies focuses, however, on the effect of SMTs on organizational performance (hereafter, OP) in digital ecosystems. Moreover, some authors observe that few studies have analyzed the contribution of SMTs to improving organizational knowledge (hereafter, OK) (Bharati *et al.*, 2015; Yu *et al.*, 2021) or to determining how dynamic capabilities and complexity make firms create and capture value when operating in digital ecosystems (Dominguez Gonzalez, 2022; Helfat and Raubitschek, 2018).

This study contributes to prior research by analyzing the relationship of SMTs to other strategic elements, such as development of *Technological Knowledge Competences* (hereafter TKCs) and *Organizational Learning* (hereafter, OL), as both elements can be strengthened through SMTs use to improve organizational results. This study thus aims:

- to analyze empirically the influence of SMTs use on TKCs development;
- to examine the influence of SMTs use on OL;
- to analyze the influence of TKCs on improvement in OL; and
- to study the relationship between OK and OP.

Although the variables will be explained in the following section, we would highlight that TKCs are a first firm-level issue of interest, as levels of technological knowledge are embedded in routines and operations – i.e. intangible assets that provide the foundations for these organizations to develop novel technologies that enable firm growth (Fischer *et al.*, 2022).

The article is structured as follows: Section 2 develops the theoretical framework and research hypotheses. Section 3 presents the methodology, structural model and data analysis. Section 4 explains the results, and Section 5 presents the discussion, conclusions and implications of the research.

2. Theoretical framework and research hypotheses

Social media's value proposal stems primarily from the potential it gives firms to interact with their customers (Blanchard, 2011) and other agents, create awareness, increase sales and generate loyalty (Castronovo and Huang, 2012) while also increasing attention to the company itself (Owyang, 2007). Other aspects of digital business strategies in SMTs use for firms include e-commerce, marketing, use of commercial networks for customer relations management and knowledge management, among others (Aral *et al.*, 2013). Because these tools were initially seen as merely digital technology (Elia *et al.*, 2020; Montes *et al.*, 2021), the idea of using SMTs as a resource for learning or competence development to bring value or new resources was once viewed with skepticism. Such activity was even judged a waste of time based on the idea that "firms must justify the time and effort their employees invest in social media" (Sigala and Chalkiti, 2015, p. 45). Today, however, we know that SMTs use has improved the efficiency of organizational processes (Aral *et al.*, 2013) and that the acquisition of new knowledge inevitably involves technological components (Hansen *et al.*, 1999; Joshi *et al.*, 2010).

Starting from these premises, we develop the conceptual framework for our study based on complexity theory, as well as dynamic capabilities theory, which complements the resource-based view (hereafter, RBV). Focusing on the RBV and on dynamic capabilities theory, which argues that only firms that develop dynamic capabilities will be able to generate competitive advantage (Barney, 1991; Teece *et al.*, 1997), we argue that SMTs use helps firms to face the current chaotic environment by driving the development of TKCs and OL, contributing to improved performance. The dynamic capabilities of learning and technological capabilities are crucial elements in this respect (Garzón, 2015; Jiménez-Jiménez and Sanz-Valle, 2011; Martín-Rojas *et al.*, 2013; Schilke *et al.*, 2018; Zahra *et al.*, 2006). They are strategic assets that connect the turbulent environmental changes and ongoing knowledge acquisition promoted by SMTs to the values espoused by OL and thus strengthen the relevance of TKCs to OL. Furthermore, SMTs can enable organizations to achieve a competitive advantage.

We also know that the RBV of the firm (Barney, 1991; Wernerfelt, 1984) is valuable for our study, as this theory holds that valuable, rare, difficult to imitate and nonsubstitutable resources lead to sustainable competitive advantage. Many firms are convinced that knowledge can become the resource that combines these characteristics (Grant, 1996; Teece, 1998). They thus expect to improve their performance by improving their learning and knowledge management processes, deriving maximum advantage from what information technologies can offer (Bharati *et al.*, 2015). The RBV is contextualized as the firm's capability to integrate, build and reconfigure internal and external competences to respond quickly to external changes (Dominguez Gonzalez, 2022; Teece *et al.*, 1997). On the other hand, the RBV is complemented and improved by the notion of dynamic capabilities (Eisenhardt and Martin, 2000), a theory that captures the evolutionary nature of resources and capabilities as intrinsically linked to dynamism of the market and as driving firms "continually to adapt, renovate, reconfigure and recreate their resources and capabilities in line with the competitive environment" (Wang and Ahmed, 2007, p. 31). In fact, dynamic capabilities enable firms both to create and to capture value by focusing on digital ecosystems and continually innovating and redesigning their business models. Dynamic capabilities refer to a subset of capabilities directed toward strategic change at both organizational and individual levels (Helfat and Raubitschek, 2018).

Although this article follows both the RBV and dynamic capabilities theory, we should indicate that individual knowledge often fails to generate the benefits expected when is imperfectly distributed and shared in the organization (Dominguez Gonzalez, 2022). Because the role of SMTs as digital technologies may encourage the collaboration of employees and managers in the organization, organizational structure is an element capable of integrating individuals and their knowledge to develop complex innovative activity (Dominguez Gonzalez, 2022) through collaboration between individuals who share their skills and capabilities. A productive theoretical approach to apply, given the role of SMTs as digital technologies (Elia *et al.*, 2020; Montes *et al.*, 2021), is complexity theory.

Numerous organizational and emerging studies on strategic domain have been grounded in complexity theory (Chiva *et al.*, 2010; Gnyawali *et al.*, 2010; Jonsson *et al.*, 2018; McElroy, 2000; McKelvey, 2016; Ransbotham *et al.*, 2016; Salmador and Bueno, 2005).

These studies have confirmed the significance of complexity theory for deepening knowledge of digital strategies in increasingly complex coevolutionary adaptive business ecosystems. Complexity theory is the study of emergent order in what are otherwise very disorderly systems. Understanding these systems' influence on the organization's performance could lead to major gains in businesses. We specifically explore the presence of elements of Kauffman's (1993) "spontaneous order creation," which argues that complex systems produce their most inventive displays in the area of behavior he calls "the edge of chaos." Complex systems innovate by producing spontaneous, systemic bouts of novelty out of which new patterns of behavior emerge. That is, complex adaptive systems learn through a self-organizing process as patterns that enhance a system's ability to adapt successfully to its environment are stabilized and repeated (Chiva *et al.*, 2010; McElroy, 2000).

Following Chiva *et al.* (2010), the OL process may generate a new or improved organizational explicate order to be developed through the study of adaptive or generative learning. This means that using complexity theory involves a holistic understanding of any interaction and thus the possibility of improvement or development of the explicate order through a process of self-organization. Such change can generate complex ecosystems by impacting self-organized criticality processes, digital platform-based ecosystems and dissipative structures, thereby influencing innovation (McKelvey *et al.*, 2013; Nesij Huvaj and Johnson, 2019; Roundy *et al.*, 2018; Tanriverdi *et al.*, 2010; Usai *et al.*, 2018) and OP.

Growing complexity thus changes the dynamics of behavior in complex ecosystems, and the information obtained from SMTs use can contribute to facing the new challenges proposed by growing digital complexity. Moreover, organizations are aware that their surrounding conditions are immersed in the turbulence of the environments in which they operate, caused by faster organizational innovation and strong competition (García-Sánchez *et al.*, 2018). In these circumstances, only firms that can develop dynamic capabilities – such as TKCs – can generate sustainable competitive advantage (Martín-Rojas *et al.*, 2011). This article, therefore, combines complexity theory, the RBV and dynamic capabilities theory. The independent variables it uses to test these theories are defined as follows:

SMTs are defined as:

> A set of online tools open to public membership that support the exchange of ideas, creation and editing of content, and development of relationships through interaction and collaboration (Dutot and Bergeron, 2016, p. 1168).

These tools typically constitute a set of internet-based applications that can improve development of content provided by the participants and provide a forum for interaction among users (O'Leary, 2011). These technologies include wikis, blogs, microblogs, virtual worlds, social media sites and video-sharing sites, among others (Kaplan and Haenlein, 2010), as well as the so-called Web 2.0 – technological support tools that enable interaction and development of virtual relationships (O'Reilly, 2005).

Following previous studies (Aragón-Correa *et al.*, 2007), we define OL as "a collective capability based on experiential and cognitive processes and involving knowledge acquisition, knowledge sharing, and knowledge utilization" (Aragón-Correa *et al.*, 2007, p. 350). Other authors formulate similar definitions. They insist that through this process, the firm develops new knowledge and perspectives on people's common experiences in the organization, producing cognitive and behavioral changes. That is, the process has the potential to influence individuals' behavior (modifying routines and beliefs) and to improve the firm's capabilities through experimentation via trial and error (Fiol and Lyles, 1985; Huber, 1991; Jiménez-Jiménez and Sanz-Valle, 2011; Levitt and March, 1988).

Although the literature uses different terms for this OL process, we use the term TKCs to indicate:

> The organization's expertise in mobilizing various scientific and technical resources through a series of routines and procedures which allow new products and/or production processes to be developed and designed (Real *et al.*, 2006, p. 508).

That is, TKCs drive the process by which the organization mobilizes scientific and technological resources, converting activities into routines by means of procedures that facilitate rapid adaptation to new opportunities, as well as the design and development of new products and/or processes (García-Morales *et al.*, 2018). TKCs require a learning process that generates a new flow of technological knowledge or distinctive technological competences (Nieto, 2004).

Taking all the foregoing into account, OL may be seen as a learning process that involves knowledge acquisition (development or creation of abilities, knowledge and relationships), knowledge exchange (diffusion to others of what some have acquired) and knowledge use (integration of learning so that it is assimilated and widely available and can be generalized to new situations). TKCs may, in turn, be seen as the competences the organization needs to develop its technological knowledge, focusing on knowledge as their core element. Following dynamic capabilities theory, both OL and TKCs then belong to a different group of capabilities, termed learning capability for OL processes and technological capability for TKCs.

2.1 Influence of social media technologies use on technological knowledge competences

Habitual SMTs use not only facilitates knowledge management and OL development but also enables the organization to evolve with this information (Dalkir, 2013; Tsimonis and Dimitriadis, 2014; Sigala and Chalkiti, 2015). Such organizations develop TKCs, as "social media use enables people to become involved in conversational and collaborative knowledge, which in turn enriches their cognitive and creative processes" (Sigala and Chalkiti, 2015, p. 44), and thus, the organization's generative learning (García-Morales *et al.*, 2012). The effectiveness and value of SMTs use lie in its quantitative and qualitative improvement of communication and interaction among people who make creation and exchange of information possible since these processes have been transformed into "open, informal, autonomous processes that are networked and occurring constantly" (Sigala and Chalkiti, 2015, p. 45). "Organizations run on conversations" (Ogunseye *et al.*, 2011, p. 253) and the "conversations" generated by SMTs clearly facilitate information, knowledge, experiential learning, contact with specialists from the same area or complementary areas and very extensive networks of relationships. All these activities contribute to the firm's development of a form of technological knowledge that we call TKCs. TKCs consist of a unique combination of knowledge and abilities that can generate profitable innovations (Chiesa and Barbeschi, 1994; Real *et al.*, 2006) and create baggage in the firm – "routinization," or institutionalization over a long period of time. These innovations become part of the firm's knowledge creation system (Leonard-Barton, 1992), enabling it to face proactively the strategic modifications necessary to adapt to changing environments.

Very few empirical studies have examined the impact of SMTs use on the development of dynamic capabilities. Garrido-Moreno *et al.* (2015, p. 406) propose the need to "better conceptualize and measure social media use, developing more sophisticated measures that include frequency of use, relevance of the different tools implemented, and strategic integration." Similarly, since using more diverse contacts improves the quality of knowledge acquired and ideas generated (Parise *et al.*, 2015), Sigala and Chalkiti (2015) propose analyzing the impact of the density, centricity and variability of social media used by a firm's employees.

Employing SMTs means being able to:

> Add, share, store, and synthesize knowledge from diverse sources to create new metaknowledge; identify oneself and join social media to stay informed professionally and participate in processes of collective knowledge generation through exchange of experience; critique theories and occurrences within various communities of practice; and manage their processes for the creation of meaning (Sigala and Chalkiti, 2015, p. 45).

The activities listed here generate the knowledge resources that drive:

> The organization's experience in mobilization of diverse scientific and technical resources through a series of routines and procedures that enable it to develop and design new products and/or production processes (Real *et al.*, 2006, p. 507; Teece *et al.*, 1994).

Such mobilization of resources – acquired through SMTs use – triggers the learning processes through which new technological knowledge flows, what we term TKCs (Nieto, 2004). The firm's acquisition of TKCs is thus motivated by the use and quantity of different technologies and the frequency of SMTs use. Based on the foregoing, we propose that:

H1. SMTs use is positively related to TKCs.

2.2 Influence of social media technologies use on organizational learning

Firms currently operate in markets that are subject to rapid change (Hitt *et al.*, 2000). Product and service life cycles are short and competition and risk intense; the root of sustainable competitive advantage lies in continuous OL, knowledge management and creativity (Nonaka and Takeuchi, 1995). Various studies have thus examined OL and knowledge management (Crammond *et al.*, 2018; García-Morales *et al.*, 2018; López-Nicolás and Soto-Acosta, 2010; Papa *et al.*, 2018; Real *et al.*, 2006; Scuotto *et al.*, 2017; Sigala and Chalkiti, 2015).

SMTs foster connectivity among people – and among firms – creating a complex, dynamic ecosystem that encourages innovation and growth (Fischer *et al.*, 2022; Gnyawali *et al.*, 2010). For this ecosystem to focus on innovation and organizational results, it must be aligned with the strategic goals of the firm, which must connect the strategic value provided by SMTs use to business performance (Bereznoy *et al.*, 2021; Venkatraman, 1989). The firm must thus motivate new learning processes so that its employees can exploit these SMTs to produce better performance (García-Morales *et al.*, 2018; Martín-Rojas *et al.*, 2013). Neither SMTs nor other technologies in themselves can develop new modes of behavior, but they do enable workers to contribute to and receive knowledge from online ecosystems (Gomes *et al.*, 2021; Papa *et al.*, 2018). In so doing, workers modify the way they communicate, learn or design strategies, multiplying exponentially the possibilities for contact and interaction, in terms not only of speed – even instantaneity – but also of potential to connect people and disseminate news worldwide. Social media can thus be considered as the core of networked resources (Adler and Kwon, 2002), and the firm's participation in a social media platform can be a strategic decision of either defensive reaction to an environment of change (Dutot and Bergeron, 2016) or proactive reaction and reconfiguration of resources to improve its performance (Senge *et al.*, 1994).

The literature states that "social media can have a positive, though indirect, influence on the general quality of organizational knowledge" (Bharati *et al.*, 2015, p. 470). SMTs use can thus involve initiatives for knowledge acquisition and management as part of its strategic movements (Kearns and Sabherwal, 2006). To achieve this goal, however, the firm's employees must learn to use and manage this knowledge for the organization's benefit (García-Morales *et al.*, 2018; Martín-Rojas *et al.*, 2013) to ensure that SMTs use encourages the development of learning throughout the entire organization.

Recent studies have shown that the quality of knowledge acquired is more important than volume because higher-quality knowledge is more likely to be transferred and reused successfully (Kane *et al.*, 2005; Zhang and Watts, 2008), making firms that acquire higher-quality knowledge more innovative and financially better off (Soo *et al.*, 2003). The firm's knowledge acquisition and management initiatives must thus lead not only to more but to better knowledge, working in a concerted way with SMTs instead of merely depending on them (Bharati *et al.*, 2015).

SMTs facilitate practically unlimited information and knowledge exchange in terms of people and diversity of knowledge. They drive the essentials of OL – a prerequisite to develop business aptitudes, examine situations of success and failure, learn of market changes and identify previously unexplored opportunities (Martín-Rojas *et al.*, 2013). SMTs can also encourage the most advanced form of OL – generative learning – since they give the organization resources that can lead it to "question assumptions from big data on its mission, customers, capabilities, and strategy, and to generate changes in its practices, strategies, and values" (García-Morales *et al.*, 2012, p. 1041).

Sheer volume of knowledge is not enough to guarantee better knowledge management. One can construct "digital junk heaps" full of knowledge that no one is interested in using (McDermott, 1999). Nor does more frequent SMTs use or use involving a larger number of networks guarantee a better contribution to OL. Sigala and Chalkiti (2015) have demonstrated the positive relationship between SMTs use, increased creativity and learning in the organization. The quantity of social media used to collect or discuss information and the frequency of their use can enrich people's cognitive processes and support conversational and collaborative knowledge management processes – dynamic processes that facilitate the continuous learning and new knowledge creation that comprise OL. Based on the foregoing, we propose that:

H2. SMTs use is positively related to OL.

2.3 Organizational learning as determining factor of technological knowledge competences

In any firm, survival on the market is linked to the challenge of constantly developing new products, processes or services. Firms must respond – and ever faster and better – to these demands from turbulent and uncertain environments (Lynn *et al.*, 2003). Firms can meet this challenge if they can develop TKCs. Some authors propose that TKCs foster processes and are positively related to OL (Andreu and Ciborra, 1996; Martín-Rojas *et al.*, 2013; Real *et al.*, 2006) in the firms that develop them. Knowledge acquisition in a firm must contribute to modifying behavior and developing new ideas, practices and processes. That is, OL is an essential element for managing technological knowledge properly in the firm by improving its employees' technological competences (Evanschitsky *et al.*, 2007; Grant, 1996; Martín-Rojas *et al.*, 2013). A relationship thus exists between OL and development of new TKCs.

On the other hand, routinization – institutionalization over a long period of time – integrates TKCs into the firm's knowledge creation system (Leonard-Barton, 1992), and through such routinization, TKCs influence OL (Huber, 1991). Similarly, García-Morales *et al.* (2012) show that development of new abilities and knowledge and increase in organizational capability enable OL. Since this relationship exists because TKCs drive OL, we propose that:

H3. TKCs positively influence the process of acquiring new OL.

2.4 Influence of organizational learning on organizational performance

The learning that leads to continuous innovation enables firms to manage turbulence in the external environment properly in very dynamic markets (Jiménez-Jiménez and Sanz-Valle, 2011). This ability is one of the key factors to achieving sustainable competitive advantages

(Chen and Jaw, 2009), improving OP (Thornhill, 2006; Weerawardena *et al.*, 2006) and thus guaranteeing survival as an organization (Damanpour and Evan, 1984; Hurley and Hult, 1998). The concepts of learning and knowledge creation are often used synonymously to describe the innovation process (Nonaka and Takeuchi, 1995). However, OL generally precedes the innovation process. Scholars have recognized the close link between OL and innovation. They suggest that OL and its results – OK – are antecedents of innovation (Hurley and Hult, 1998; Jiménez-Jiménez and Sanz-Valle, 2011), and thus cause improvement in the OP produced by innovation. That is, technological firms must first have a high degree of effective OL to make innovation a strategic priority (García-Morales *et al.*, 2007). OL:

> Supports creativity, inspires new knowledge and ideas, and increases the potential for understanding and applying them, encouraging organizational intelligence and (with culture) forming a background for orientation to organizational innovation (García-Morales *et al.*, 2007, p. 535).

Some authors (Lei *et al.*, 1999; McGill and Slocum, 1993) advise firms to promote OL to adapt to changes in changing environments and uncertain times, making this learning not a choice but a necessity for firms (Senge *et al.*, 1994).

Other studies propose that the positive effect of OL on OP is mediated by innovation (García-Morales *et al.*, 2012), positing a double path to a positive relationship between OL and OP: the relationship occurs both directly and mediated by the contribution of organizational innovation since OL enables the firm to develop capabilities that improve innovation and innovation influences OP positively (Aragón-Correa *et al.*, 2007; Baker and Sinkula, 1999; Han *et al.*, 1998; Hurley and Hult, 1998). One study has shown that the effect of OL on innovation is stronger than its effect on OP (Jiménez-Jiménez and Sanz-Valle, 2011), but no research to date has analyzed the relationship between OL and OP in conjunction with TKCs development. Orientation to learning has a direct effect on OP (Baker and Sinkula, 1999), and many studies demonstrate a positive relationship between OL and improvement of the firm’s OP (Baker and Sinkula, 1999; Martín-Rojas *et al.*, 2011; Carayannis *et al.*, 2006; Leonard-Barton, 1992; Tippins and Sohi, 2003). Since OL has positive effects on OP, we propose that:

H4. OL is positively related to OP.

3. Methodology

3.1 Data collection and procedure

The study population consisted of firms in the high/medium-high technology sectors in Spain. We chose high/medium-high tech firms due to the inherent interest of studying organizations with a substantial technological component. The technology sector acts as a strategic element for knowledge transfer from academics to the production sector (Martín-Rojas *et al.*, 2013).

Choosing a geographical, legal, political and cultural space enables us to reduce the impact of variables that are not controlled for empirically (Fernández-Pérez *et al.*, 2014). We used Chief Executive Officer (CEOs) as key informants because they are ultimately responsible for designing the organization’s leadership and planning and for guiding the actions carried out to achieve them (Westphal and Fredickson, 2001). CEOs manage a large amount of information from all departments of the firms analyzed. These individuals are a valuable source for evaluating and modifying the different variables studied throughout the organization, as they determine and foresee the type of behavior expected (Baer and Frese, 2003).

Initially, several interviews were conducted with directors, academics, consultants and technological institutions to contrast the comprehensibility of the questionnaire items, phrasing and content. Based on the recommendations from this pretest, we refined the questionnaire and developed a pilot test with 12 general managers. Based on the responses from this random sample, the pilot questionnaire was then compiled and the recommended changes were incorporated to produce a structured questionnaire enabling us to investigate how organizations face these strategic questions.

The population was composed of high/medium-high tech firms obtained from the SABI and Amadeus databases and for which we also had information on the CEOs. We created this database by compiling a reliable list of CEOs in these firms in Spain. The list was compiled in collaboration with public institutions and with the help of partial funding from Spain's Ministry of Science and Research and the Local Council of Economy, Innovation and Science of the Andalusian Regional Government. The research used stratified random sampling, as this technique ensures that each subgroup of a given population is adequately represented within the whole sample population of a research study. We selected 850 high/medium-high tech firms. The structured questionnaire was analyzed with the CEOs via telephone contact and e-mails, and the companies selected were given the option of receiving the results of the investigation. To increase the response rate (23.17%, 197 valid answers, Table 1) and reduce possible desirability bias, participants were guaranteed that the analysis would be performed at aggregate level and that their responses would be kept confidential. We offered to send each CEO a comparative study specific to their firm of the variables analyzed. We also hired technicians to help us obtain a target percentage of responses, although this assistance increased the cost of the study. T-statistics and the chi-square showed no significant differences between characteristics of responding and nonresponding firms (annual sales, number of employees, etc.) or between early and late respondents, reducing the possibility of nonresponse bias (Armstrong and Overton, 1977).

3.2 Measures

The use of constructs played an important role in the design of a survey instrument for managing the research. In any research on elements of behavior, no mechanism has a metric unit that can measure behavior precisely and researchers usually use two or more measures to evaluate a construct or scale. Since developing new constructs or measurement scales is a complex task, constructs from prior empirical studies are used whenever possible to guarantee their validity and reliability. Various multiitem scales with seven-point Likert choices were used to measure the study constructs. The scales were adapted to this study (Table 2).

3.2.1 Social media technologies. We used frequency of use of different SMTs, such as Facebook, Twitter, YouTube, LinkedIn, Blogs, Wikis and Discussion Forums (1 "Very infrequently" 7 "Very frequently") based on prior scales (Choudhury and Harrigan, 2014; Garrido-Moreno *et al.*, 2018; Sigala, 2011). We performed confirmatory factor analysis (χ^2_{14} = 49.64, normed fit index [NFI] = 0.97, nonnormed fit index [NNFI] = 0.97, comparative fit index [CFI] = 0.98, goodness of fit index [GFI] = 0.82), validated our scale, and then verified its one-dimensionality, validity and reliability (α = 0.922).

3.2.2 Technological knowledge competences. We used the scale from Real *et al.* (2006) and established a nine-item scale to reflect TKCs in the organization. We performed confirmatory factor analysis to validate our scales (χ^2_{27} = 175.38; NFI = 0.97; NNFI = 0.96; GFI = 0.58; CFI = 0.97). The scale was one-dimensional and showed high reliability (α = 0.977).

3.2.3 Organizational learning. We used a four-item scale from Aragón-Correa *et al.* (2007) and García-Morales *et al.* (2006) to measure OL. The items were specifically adapted to this study. We performed confirmatory factor analysis to validate our scales (χ^2_2 = 4.42; NFI = 0.99; NNFI = 0.99; GFI = 0.94; CFI = 0.99). The scale was one-dimensional and showed good validity and reliability (α = 0.959).

3.2.4 Organizational performance. After examining how performance is measured in different strategic research studies, we prepared a scale that included seven points for measuring OP

Table 1 Technical details of the research

Variable	*Data*	*No. response*	*Turnover (thousand €)*	*Added Value (thousand €)*
Sectors	*High-tech manufactures sectors*			
	Manufacture of basic pharmaceutical products	13	14,135,747	4,985,156
	Manufacture of computer, electronic and optical products	18	5,675,202	1,898,360
	Manufacture of air and spacecraft and related machinery	4	11,034,453	3,011,001
	Medium-high tech manufacture sectors			
	Manufacture of chemicals and chemical products	22	41,354,641	8,851,231
	Manufacture of weapons and ammunition	2	682,132	169,700
	Manufacture of electrical equipment; manufacture of machinery and equipment n.e.c.; manufacture of motor vehicles, trailers and semitrailers	32	113,354,432	24,900,322
	Manufacture of other transport equipment except the manufacture of ships, air and spacecraft and related machinery	5	4,100,212	1,323,234
	Manufacture of medical and dental instruments and supplies	28	2,260,123	1,005,123
	High-tech Services			
	Motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities; telecommunications; computer programming, consultancy and related activities; information service activities	45	85,280,204	34,693,242
	Scientific research and development	28	2,727,135	2,645,123
Geographic location	Spain			
Methodology	Stratified random sampling			
Universe of population	2,023 firms	197		
Sample size (% response)	850 (23.17%) firms			
Sampling error	6.6%			
Data collection period	January to March 2020			

Table 2 Research items

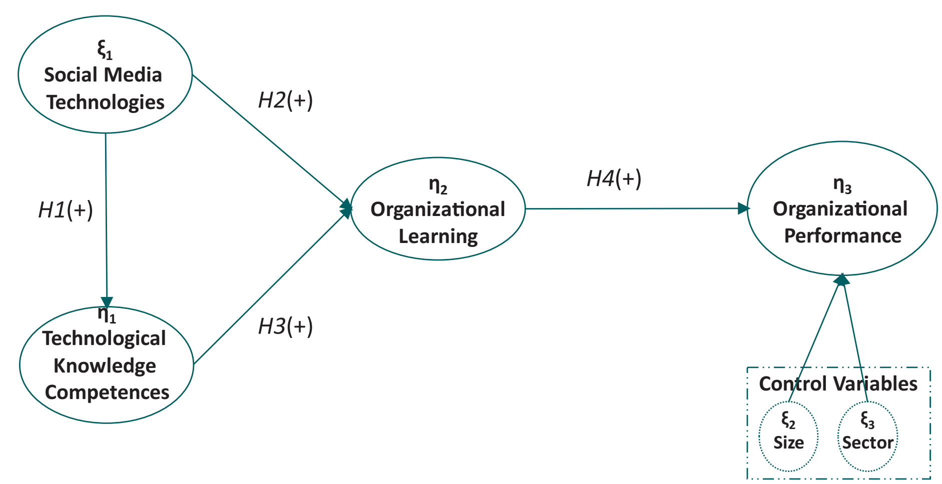
Variable	*Items*	*Description*	*Authors*
Social Media Technologies (SMTs)	SMT1	Facebook	Garrido-Moreno *et al.* (2018)
	SMT2	Twitter	Choudhury and Harrigan (2014), Garrido-Moreno *et al.* (2018)
	SMT3	YouTube	Choudhury and Harrigan (2014), Garrido-Moreno *et al.* (2018), Sigala (2011)
	SMT4	LinkedIn	Choudhury and Harrigan (2014)
	SMT5	Blogs	Choudhury and Harrigan (2014)
	SMT6	Wiki	Sigala (2011)
	SMT7	Discussion forums	Choudhury and Harrigan (2014), Garrido-Moreno *et al.* (2018), Sigala (2011)
TechnologicalKnowledge Competences (TKCs)	TKC1	Capability to obtain information about the status and the progress of relevant social media	Real *et al.* (2006)
	TKC2	Capability to generate advanced social media	
	TKC3	Capability to assimilate new and useful social media or social media with proven potential	
	TKC4	Capability to attract and retain qualified technical staff with knowledge in social media	
	TKC5	Capability to dominate, generate or absorb basic and key knowledge in social media	
	TKC6	Effectiveness in setting up programs oriented to internal development of technological or technological competences to use and improve social media in the organization	
	TKC7	Capability to achieve an effective collaboration with other department/unit in social media	
	TKC8	Effectiveness in definition of monitoring and revising instruments of social media	
	TKC9	Effectiveness in the development of appropriate training programs to enable the technological knowledge base of social media	
Organizational Learning (OL)	OL1	The organization has learned or acquired much new and relevant knowledge over the last three years	Aragón-Correa *et al.* (2007), García-Morales *et al.* (2006)
	OL2	Organizational members have acquired some critical capacities and skills over the last three years	
	OL3	The organization’s performance has been influenced by new learning it has acquired over the past three years	
	OL4	The organization is a learning organization	

(*continued*)

Table 2

Variable	*Items*	*Description*	*Authors*
Organizational Performance (OP)	OP1	Return on investment (ROI)	Murray and Kotabe (1999), Venkatraman and Ramanujam (1986)
	OP2	Return on equity (ROE)	Murray and Kotabe (1999), Venkatraman and Ramanujam (1986)
	OP3	Return on sales (ROS)	Murray and Kotabe (1999)
	OP4	Return on assets (ROA)	Venkatraman and Ramanujam (1986)
	OP5	Recovery of investment	Venkatraman and Ramanujam (1986)
	OP6	Market share growth	Murray and Kotabe (1999), Venkatraman and Ramanujam (1986)
	OP7	Sales growth in its main products and/or services	Murray and Kotabe (1999)
Size	SIZE	Number of employees	García-Morales *et al.* (2006)
Sector	SECTOR	Manufacture of basic pharmaceutical products/ manufacture of computer, electronic and optical products/manufacture of air and spacecraft and related machinery/manufacture of chemicals and chemical products/manufacture of weapons and ammunition/manufacture of electrical equipment; manufacture of machinery and equipment n.e.c.; manufacture of motor vehicles, trailers and semitrailers/manufacture of other transport equipment except manufacture of ships, air and spacecraft and related machinery/manufacture of medical and dental instruments and supplies/ motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities; telecommunications; computer programming, consultancy and related activities; information service activities/scientific research and development	Martín-Rojas *et al.* (2021)

Figure 1 Hypothetical model



Source: Own elaboration

developed by Murray and Kotabe (1999). Since performance is not a one-dimensional construct, many researchers argue that it is important to use multiple indicators (Venkatraman and Ramanujam, 1986). All these indicators must, however, share characteristics of giving an advantage that differentiates the firm from its competitors. The use of scales to evaluate performance compared to main competitors is one of the most common practices in recent studies (García-Morales *et al.*, 2014; Martín-Rojas *et al.*, 2019, 2021). Many researchers have used subjective perception of managers to measure beneficial results for firms. In the interviews, we included questions on participation that used both types of evaluation. When possible, we calculated the correlation between objective and subjective data, and the correlations were high and significant. We performed confirmatory factor analysis to validate our scale (χ^2_9 = 33.32, NFI = 0.99, NNFI = 0.99, GFI = 0.70, CFI = 0.99). The results showed that the scale was one-dimensional, valid and reliable (α = 0.981). 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 compared to that of its most direct competitors.

3.2.5 Control variables. Size has been used as a control variable to reflect other factors that could influence the research results. However, the results obtained were not significant. By size, firms were classified as large (250 workers or more) and small- and medium-sized enterprises (fewer than 250 workers). The research also used sector as a control variable. Since competitors vary in different markets or industries, OP can be influenced by the sector in which the firm operates (Martín-Rojas *et al.*, 2021).

4. Results

This research uses structural equation modeling (LISREL 8.8 software) to analyze the proposed research model. In the first stage, the quality of the measurement model was evaluated. In the second stage, the hypotheses were tested through the structural model (Anderson and Gerbing, 1988).

4.1 Measurement model

Initially, we analyzed the psychometric properties of the measures. First, we conducted factor analysis of the various research items (Table 3). This analysis of the proposed measures revealed that the 27 items, grouped into four factors through the principal component analysis and varimax rotation method, accounted for 82.94% of the variance. The minimum loading for each item on a factor was 0.649. The four factors are TKCs (this first factor accounted for 56.96% of the variance), OP (second factor, 12.67%), SMTs (third factor, 8.82%) and OL (fourth factor, 4.48%).

Table 4 presents the means, standard deviations and correlation matrix between factors for the study variables. We find positive and significant correlations between all variables.

From Table 5, we see that all indicators fit well with the model. The constructs show satisfactory levels of reliability, indicated by the composite reliabilities ranging from 0.93 to 0.98 (the composite reliabilities are also above the recommended minimums, >0.70), average variance extracted (AVE) from 0.68 to 0.87 (amount of variance captured by a construct is

Table 3 Rotated component matrix for strategic measures

Items	*1*	*2*	*3*	*4*
SMT1	0.285	0.261	*0.649*	0.120
SMT2	0.416	0.247	*0.655*	0.091
SMT3	0.224	0.200	*0.800*	0.065
SMT4	0.253	0.266	*0.746*	0.141
SMT5	0.297	0.210	*0.821*	0.108
SMT6	0.086	0.065	*0.767*	0.159
SMT7	0.156	0.200	*0.811*	0.164
TKC1	*0.824*	0.235	0.218	0.206
TKC2	*0.819*	0.224	0.241	0.229
TKC3	*0.859*	0.217	0.240	0.245
TKC4	*0.823*	0.176	0.203	0.316
TKC5	*0.852*	0.173	0.226	0.252
TKC6	*0.844*	0.170	0.263	0.250
TKC7	*0.857*	0.229	0.173	0.114
TKC8	*0.858*	0.182	0.227	0.101
TKC9	*0.860*	0.195	0.226	0.124
OL1	0.406	0.329	0.270	*0.728*
OL2	0.366	0.403	0.185	*0.750*
OL3	0.415	0.346	0.191	*0.766*
OL4	0.429	0.287	0.272	*0.731*
OP1	0.238	*0.858*	0.258	0.185
OP2	0.234	*0.883*	0.219	0.211
OP3	0.210	*0.881*	0.211	0.190
OP4	0.206	*0.907*	0.209	0.169
OP5	0.201	*0.869*	0.234	0.225
OP6	0.196	*0.883*	0.159	0.117
OP7	0.189	*0.877*	0.190	0.162

Notes: Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization. A rotation converged in six iterations; Italic = factor loadings for each item on their factor after rotation (partial correlation between the item and their rotated factor)

Table 4 Means, standard deviations, correlations and confidence intervals

Variable	*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*
1. Social Media Technologies	2.99	1.51	1.000	0.51–0.71	0.48–0.70	0.44–0.67	0.10–0.56	–0.22–0.09
2. Technolog. Knowledge Competences	3.80	1.50	0.58***	1.000	0.65–0.80	0.38–0.63	0.06–0.38	–0.21–0.08
3. Organizational Learning	3.90	1.71	0.55***	0.70***	1.000	0.57–0.76	0.11–0.53	–0.22–0.07
4. Organizational Performance	4.25	1.49	0.53***	0.50***	0.63***	1.000	0.01–0.48	–0.21–0.09
5. Size	1.14	0.34	0.20**	0.14*	0.19**	0.14*	1.000	–0.01–0.49
6. Sector	6.57	2.89	–0.03	–0.08	–0.09	–0.07	0.13	1.000

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; n = 197; numbers above the diagonal represent the confidence interval between each pair of constructs (95%)

greater than the amount of measurement error, AVE > 0.50), and Cronbach's alphas, with values from 0.85 to 0.94 [above the 0.707 minimum recommended; all loadings (λ) are significantly related to the corresponding factor (*t*-values > 10.74)]. Composite reliability, AVE and Cronbach's alpha thus support the scales' reliability and internal consistency (Fornell and Larcker, 1981; Hair *et al.*, 2016). Convergent validity is supported for all multiitem constructs.

To assess discriminant validity, different chi-square difference tests were performed between the values obtained for a restricted model (a model that restricts the estimated correlation parameter between each pair of latent constructs to 1.0) and an unrestricted model. The constructs did not correlate perfectly [discriminant validity (Anderson and Gerbing, 1988)]. Similarly, discriminant validity was verified through confidence intervals, reflecting that no confidence interval in estimation of the correlations between each pair of factors contained the value 1 for the key constructs (Table 4). Each construct thus differs from the others (Anderson and Gerbing, 1988; Fornell and Larcker, 1981). The statistical values indicate good measurement model fit (χ^2_{364} = 715.52 ($p > 0.01$); NFI = 0.97; NNFI = 0.98; GFI = 0.59; CFI = 0.98, incremental fit index [IFI] = 0.98, estimated noncentrality parameter [NCP] = 387.52, relative fit index [RFI] = 0.97, root mean square error of approximation [RMSEA] = 0.07, expected cross-validation index [ECVI] = 4.56, Akaike information criterion [AIC] = 893.52, consistent Akaike information criterion [CAIC] = 1,197.63). All beta pathway modification rates among the main variables were small, and additional routes would not significantly improve the fit.

To reduce common method bias in the study, we guaranteed anonymity of the surveys, used previously validated scales, established a random order of the items and communicated the

Table 5 Results of the measurement model

Variable	*Items*	λ*	R^2	*A.M.*
Social Media Technologies	SMT1	0.74*** (15.06)	0.55	α = 0.922; C.R. = 0.938; AVE = 0.687
	SMT2	0.80*** (19.53)	0.64	
	SMT3	0.84*** (27.10)	0.70	
	SMT4	0.85*** (22.78)	0.71	
	SMT5	0.93*** (51.31)	0.87	
	SMT6	0.77*** (16.54)	0.59	
	SMT7	0.86*** (27.00)	0.75	
Technological Knowledge Competences	TKC1	0.92*** (47.05)	0.84	α = 0.977; C.R. = 0.979; AVE = 0.844
	TKC2	0.94*** (61.30)	0.88	
	TKC3	0.97*** (116.72)	0.94	
	TKC4	0.94*** (52.00)	0.88	
	TKC5	0.95*** (81.22)	0.91	
	TKC6	0.96*** (91.40)	0.92	
	TKC7	0.85*** (25.87)	0.72	
	TKC8	0.86*** (32.64)	0.74	
	TKC9	0.87*** (34.54)	0.76	
Organizational Learning	OL1	0.93*** (58.53)	0.87	α = 0.959; C.R. = 0.966; AVE = 0.879
	OL2	0.94*** (80.88)	0.89	
	OL3	0.96*** (70.06)	0.91	
	OL4	0.92*** (49.36)	0.84	
Organizational Performance	OP1	0.96*** (77.92)	0.92	α = 0.981; C.R. = 0.980; AVE = 0.878
	OP2	0.98*** (109.51)	0.95	
	OP3	0.97*** (115.79)	0.94	
	OP4	0.99*** (116.68)	0.98	
	OP5	0.95*** (52.79)	0.89	
	OP6	0.84*** (10.74)	0.71	
	OP7	0.86*** (11.78)	0.74	
Goodness of Fit Statistics	χ^2_{364} = 715.52 ($P > 0.01$); NFI = 0.97; NNFI = 0.98; GFI = 0.59; CFI = 0.98; IFI = 0.98; NCP = 387.52; RFI = 0.97; RMSEA = 0.07; ECVI = 4.56; AIC = 893.52; CAIC = 1,197.63			

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

study objectives to the respondents (Podsakoff *et al.*, 2003; Podsakoff and Organ, 1986). Harman's one-factor test was performed (a single component did not explain most of the variance and several components took eigenvalues > 1.0), and fit was worse for one-dimensional model than for the measurement model (we compared the one-factor model to the measurement model). Further, when a common latent factor (first-order factor) was added to the researchers' theoretical model with all measures as indicators, the differences between the indicator with the common latent factor and the previous indicator were less than 0.200. Based on the above, we conclude that common method bias is not a serious problem in this investigation (Bou-Llusar *et al.*, 2009).

4.2 Measurement model

To test the research hypotheses, the study used a recursive nonsaturated model, considering SMTs (ξ_1) as an exogenous latent variable; TKCs (η_1) as a first-degree endogenous latent variable; and OL (η_2) and OP (η_3) as second-degree endogenous latent variables. Size and sector were control variables. The covariance and asymptotic covariance matrices were used as input in SEM estimations of direct, indirect and total effects (Table 6). The standardized path coefficients of the structural model (Figure 2) provided evidence of the hypothesized relationships and indicated good overall fit of the structural model (χ^2_{370} = 763.08 ($p > 0.01$); NFI = 0.97; NNFI = 0.98; IFI = 0.98; PGFI = 0.50; NCP = 393.08; RFI = 0.97; CFI = 0.98; RMSEA = 0.07).

The general fit of the structural model was good, and the path analysis estimators indicate significant relationships among the constructs. If we examine the standardized parameters, we observe that SMTs use strongly affects TKCs (γ_{11} = 0.61, $p < 0.001$), supporting *H1*. SMTs use affects OL directly (γ_{21} = 0.25, $p < 0.001$) and indirectly (0.35, $p < 0.001$) through TKCs (0.61 $\times$ 0.58; see Bollen (1989) for calculation rules). The overall influence of SMTs use on OL is.60 ($p < 0.001$), supporting *H2*. In comparing the magnitudes of these effects, we see that SMTs use affects TKCs more than the total effect of SMTs use on OL. TKCs are related to OL and affect it directly (β_{21} = 0.58, $p < 0.001$), supporting *H3*. Comparing the magnitudes of these effects, we observe that the total effect of SMTs on OL is larger than the effect of TKCs on OL.

Finally, we find a significant relationship of OL to OP (β_{32} = 0.65, $p < 0.001$), supporting *H4*. Table 4 presents other indirect relationships. Comparing the magnitudes of these effects, we observe that the total effect of OL on OP is larger than the effect of either SMTs or TKCs on OP. As to the control variables, the relationship between size and OP is not significant (0.05, $p > 0.05$). Globally, the results confirm that the model explains TKCs (R^2 = 0.37), OL (R^2 = 0.57) and OP (R^2 = 0.44) well.

Finally, we compared alternative models to confirm that the hypothesized model best represents the data (Hair *et al.*, 2016). Comparison of the proposed structural model (Model 1) to alternative models shows that Model 1 is the most parsimonious, preferable, and acceptable model, supporting relationships among the constructs analyzed (Table 7). For example, Model 3 had a worse RMSEA (Δ = 0.03), ECVI (Δ = 0.16), AIC (Δ = 31.58) and NCP (Δ = 32.58). The results thus confirm that Model 1 is preferred to Model 3 ($\Delta\chi^2$ = 33.58) and to the other models.

5. Conclusions: discussion, implications and limitations and future lines of research

5.1 Discussions

SMTs act as a motor force of information systems in contemporary society. They enable interaction with numerous agents (Blanchard, 2011) and provide many other possibilities for business management (Aral *et al.*, 2013; Castronovo and Huang, 2012; Owyang, 2007). This is the case because they contribute – in their interrelation with dynamic capability and

Table 6 Proposed structural model results (direct, indirect and total effects)

Effect from		*to*	*Direct effects*	t	*Indirect effects*	t	*Total effects*	t
Social Media Technologies	→	Technological Knowledge Competences	0.61***	9.80			0.61***	9.80
Social Media Technologies	→	Organizational Learning	0.25***	3.37	0.35***	6.63	0.60***	9.32
Social Media Technologies	→	Organizational Performance			0.39***	6.79	0.39***	6.79
Technological Knowledge Competences	→	Organizational Learning	0.58***	8.27			0.58***	8.27
Technological Knowledge Competences	→	Organizational Performance			0.37***	6.73	0.37***	6.73
Organizational Learning	→	Organizational Performance	0.65***	11.21			0.65***	11.21
Size	→	Organizational Performance	0.05	0.46			0.05	0.46
Sector	→	Organizational Performance	−0.02	−0.33			−0.02	−0.33
Goodness of Fit Statistics		χ^2_{370} = 763.08 ($P > 0.01$); GFI = 0.59; AGFI = 0.52; ECVI = 4.56; AIC = 893.08; CAIC = 1,171.48; NFI = 0.97; NNFI = 0.98; IFI = 0.98; PGFI = 0.50; PNFI = 0.88; NCP = 393.08; RFI = 0.97; CFI = 0.98; RMSEA = 0.07						

Figure 2 Structural result of proposed model

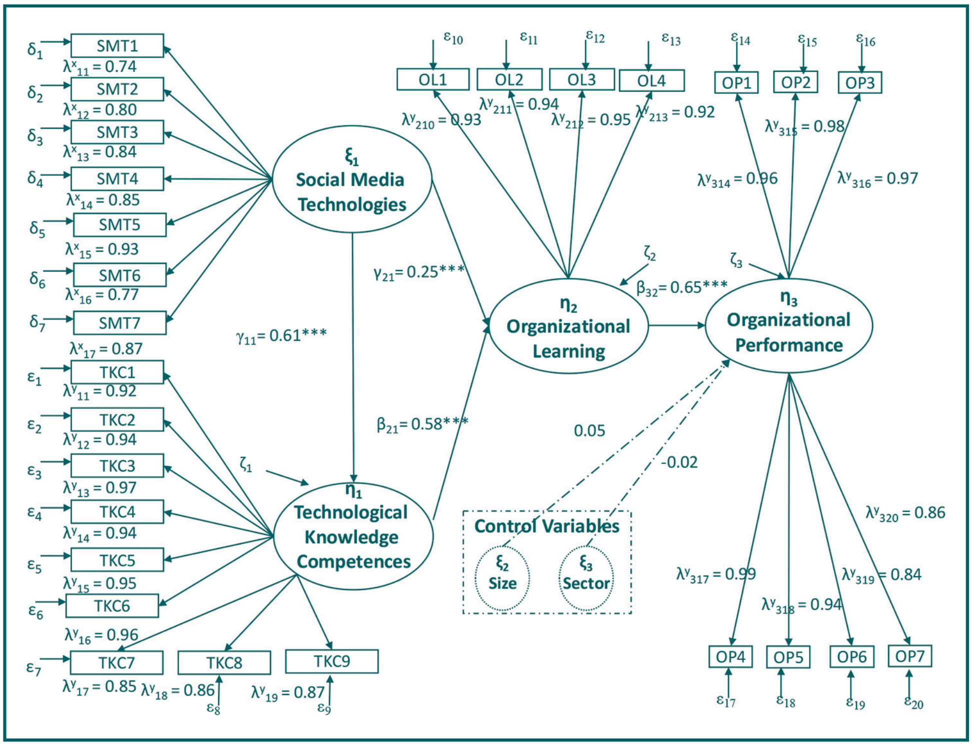


Table 7 Proposed structural model against alternative statistical model

Model description	χ^2	$\Delta\chi^2$	*RMSEA*	*ECVI*	*AIC*	*NCP*
1. Proposed Structural Model	763.08		0.074	4.56	893.08	393.08
2. W.R. Social Media Technologies to Organizational Learning	767.54	4.46	0.074	4.57	895.54	396.54
3. W.R. Technological Knowledge Competences to Organizational Learning	796.66	33.58	0.077	4.72	924.66	425.66
4. W.R. Organizational Learning to Organizational Performance	793.41	30.33	0.076	4.70	921.44	422.41

Note: W.R. = without relationship

TKCs – not only to creating value but also to firms' value capture (Helfat and Raubitschek, 2018), increasing OL. Today, acquisition of new knowledge inevitably involves the use of technological components (Hansen *et al.*, 1999; Joshi *et al.*, 2010).

Our study makes novel contributions to a topic that has not received sufficient study – construction of SMTs to improve OL and develop dynamic capabilities. We find no prior studies that relate SMTs use to OL and TKCs development or examine the latter's effects on OP. Our study is also novel because it has conceptualized SMTs use by measuring frequency of use, as proposed by Garrido-Moreno *et al.* (2015).

Our findings thus show the potential of SMTs use for firms since SMTs provide access to more diverse contacts, improving the quality of ideas that users generate (Parise *et al.*, 2015) and facilitating improvement not only in OL but also in TKCs acquisition processes. Our study also demonstrates that increase in TKCs positively strengthens OL and thus OP. Numerous implications can be deduced from these findings; and these implications – of interest to both researchers and managers – contribute to improving innovation capability, business strategies, relationships with customers and other agents in the ecosystem, and thus OP.

The activities through which managers engage their capabilities and their ecosystems thus coevolve. SMTs as a digital technology, OL processes and TKCs linked at a point in time and over time drive the ecosystems to a stronger position to address future challenges.

5.2 Implications for researchers

Among the theoretical implications for researchers, our study is framed conceptually by the RBV (Barney, 1991; Wernerfelt, 1984), complemented by dynamic capabilities theory (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Firms today are aware that they must operate in competitive environments with high uncertainty and turbulence, where competition is very strong and requires them to develop new capabilities to maintain competitive advantage (García-Sánchez *et al.*, 2018).

The digital revolution we are undergoing is opening new opportunities for SMEs to innovate and flourish (Chaudhuri *et al.*, 2022), especially in the field of intangible resources. We focused on the RBV and dynamic capabilities theories because these SMTs or digital technologies are very valuable intangible resources when they enable a firm to implement strategies to improve efficiency and effectiveness. They are also rare when not possessed by many competing or potentially competing firms (Chaudbury *et al.*, 2022) and thus difficult to imitate and easily exploited by organizations.

We also showed that SMTs encourage learning capability in a digital ecosystem and TKCs in the current organizations, enabling organizations to generate competitive advantages and to increase their performance by implementing digital technologies (SMTs). Furthermore, this paper applies dynamic capabilities theory because dynamic capabilities enable firms to create, extend and modify how they make a living, including through alterations in their resources (tangible and intangible assets), operating capabilities, scale and scope of business, products, customers, ecosystems and other features of their external environments (Helfat and Raubitschek, 2018). In fact, because dynamic capabilities drive patterns of change, we study them from a process perspective (Schilke *et al.*, 2018) and show how interactions contribute to dynamic change.

According to these interactions, we also stress our use of complexity theory, as in other studies (Chiva *et al.*, 2010; Gnyawali *et al.*, 2010; Jonsson *et al.*, 2018; McElroy, 2000; McKelvey, 2016; Ransbotham *et al.*, 2016; Salmador and Bueno, 2005), to develop a conceptual framework. Complexity theory is appropriate because we explain how SMTs constitute a motor force of information systems in contemporary society because they drive a new form of OL, "experiential learning" (Jennings and Wargnier, 2010). Due to experiential learning, the organization's knowledge not only increases but creates routines that become new TKCs – or "generative learning," as experiential learning leads the organization to question its mission, strategy, capabilities, etc., and generate changes in its practices and strategies (García-Morales *et al.*, 2012). Based on this theory, a generative learning research approach makes philosophical assumptions about the emerging world view that include wholeness, perspective observation, nonlinearity, synchronicity, mutual causation, relationship as a unit of analysis, etc. (Chiva *et al.*, 2010). Generative learning is also linked to adaptive learning to enable an OL process that makes it easier for the organization to adapt to the constant dynamic changes to organize and achieve order.

In other words, OL processes dynamically foster the exploitation of digital technologies and knowledge competences to increase OP in organizations, thanks to the adaptation of the different agents throughout the entire supply chain. Indeed, training agents could address the complexities and challenges in supply chain management (Aral *et al.*, 2013; Chaudhuri *et al.*, 2022; Martín-Rojas *et al.*, 2021).

Based on the foregoing, our study deepens understanding of the connections by which new experiential learning contributes through SMTs to OL and the improvement and generation of new TKCs, directly improving OP. Both quantity and frequency of SMTs use are positively related to improvement in knowledge processes that lead to employees' creation and acquisition of new metaknowledge (Sigala and Chalkiti, 2015), resulting in the acquisition of TKCs and increased OL (García-Sánchez *et al.*, 2018). Moreover, these connections enhance collaborations between agents (Martín-Rojas *et al.*, 2021) and increase complexity, which includes a combination of managerial skills and strategic orientation in a market. Further, knowledge of operations and technologies demands a greater variety of collaborators and diversification of functional dimensions of knowledge (Audretsch and Belitski, 2021). Increasing complexity may thus drive the firm to better results by enhancing the effect of knowledge on performance.

Academics and practitioners thus increasingly see complexity theory as a holistic way of understanding organizations and promoting organizational change because complexity theory deals with the nature of emergence, innovation, learning and adaptation.

5.3 Implications for managers

We argue that this study strengthens the creation of coevolutionary adaptive business ecosystems (Fischer *et al.*, 2022; Gnyawali *et al.*, 2010; Jonsson *et al.*, 2018; McKelvey, 2016), as well as and social collaborative networks. The results reveal mechanisms to implement firms' performance through TKCs and their interrelation, strengthening firms' strategic positioning. The study's contributions on the importance of adopting digital strategies in firms as a resource that directly impacts OP are thus valuable practical implications for managers.

Adaptive business ecosystems imply digital ecosystems, and designing business models for digital ecosystems presents a difficult challenge for managers. These managers or even policymakers may orchestrate digital ecosystems under conditions of innovate competition characterized by ongoing introduction and alteration of core and complementary products by actors on different sides of the SMTs who are highly interdependent due to cross-side network effects (Helfat and Raubitschek, 2018).

This paper demonstrates these effects, as we have analyzed SMTs use, OL processes and TKCs that form the core enabling managers of digital ecosystem to create and capture value to adapt the organization to the current turbulent environment. As managers modify their ecosystems over time, they are also likely to learn and develop their dynamic capabilities further (Helfat and Raubitschek, 2018). Dynamic capabilities are essential for a strategic change due to three functions:

1. sensing new opportunities and threats;
2. seizing new opportunities through business model design and strategic investments; and
3. transforming or reconfiguring existing business models and strategies (Helfat and Raubitschek, 2018; Teece *et al.*, 2007).

Digital ecosystems also enhance organizations' capability to innovate and redesign their business models continuously to enable value creation and capture, as well as adaptability.

Increasing digitization also provides opportunities for companies by leveraging both employees' and customers' relationships and increasing cross-selling opportunities (Weill and Woerner, 2015). And it establishes an ecosystem by creating relationships with other agents that offer complementary services (Aral *et al.*, 2013). Moreover, SMTs allow entrepreneurs to establish relationships and partnerships, increase their communications with several stakeholders and improve their business performance (Troise *et al.*, 2022). Such results show SMTs' potential to give different agents access to more suitable and larger networks to increase interactions and information exchange.

Having the most suitable SMTs as a digital technology is not sufficient, however, as many implementation challenges may arise due to people's lack of training or skills or lack of network connectivity. Solutions are thus needed to incentivize TKCs and OL processes in the organization through development of SMTs to increase collaboration between different agents and to make the supply chain more resource-efficient (Chaudhuri *et al.*, 2022). To this end, collaboration with heterogeneous agents helps to develop dynamic capabilities and digital ecosystems (Aral *et al.*, 2013; Martín-Rojas *et al.*, 2021).

Applying the digital technology solutions to digital ecosystems also requires training (Chaudhuri *et al.*, 2022) to exploit the technological competences of employees in companies. And the better the training the organization encourages, the better the organization's development of digital technologies and innovation (Nambisan *et al.*, 2020). Such exploitation of digital technologies (SMTs) is extremely beneficial for managers and for society in general, as it can enhance progress toward the sustainable development goals (Montes *et al.*, 2021). Connections or synergies between strategic managerial and operational agents are important to facilitating firm sales and productivity and consequently increasing performance. These linkages drive change management, innovate business models, use interdisciplinary staff and knowledge to influence external stakeholders, and innovate new mobility and other digital technologies beyond SMTs to achieve better performance (Audretsch and Belitski, 2021).

5.4 Limitations and future lines of research

Although the research results prove the hypotheses proposed and have useful implications, this study has limitations. The sample size does not permit generalization of the results to the full business market. It would also be interesting for future studies to consider other elements to conceptualize and measure SMTs, including (among others) significance of the various tools used and strategic integration (Garrido-Moreno *et al.*, 2015). Further, the model analyzes the relationship between SMTs and OP through SMTs and improvement in TKCs in technology firms. Other sectors might be analyzed, and other variables studied (Parise *et al.*, 2015; Sigala and Chalkiti, 2015).

Second, the data collected are based on answers subject to the respondents' individual interpretations (Podsakoff and Organ, 1986). To reduce the social desirability bias of this self-reported data, the study questionnaires were anonymous, which minimized this bias even on sensitive topics (Konrad and Linnehan, 1995). Additional tests, such as Harman's one-factor test (among others), were also performed and detected no variations from the common method (Podsakoff and Organ, 1986). However, we recommend that future studies use measures of independent and dependent variables obtained from different sources to reduce any effects of response bias (Bou-Llusar *et al.*, 2009; Konrad and Linnehan, 1995; Podsakoff *et al.*, 2003; Podsakoff and Organ, 1986). Similarly, although the use of a single method does not necessarily imply systematic bias (Spector, 2006), it would be interesting for future studies to enrich the way the variables are measured.

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Further reading

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